Congressional Research Service
Informing the legislative debate since 1914

An Analysis of STEM Education Funding at the NSF: Trends and Policy Discussion

name redacted
Specialist in Science and Technology Policy

January 31, 2014

Congressional Research Service
7-....
www.crs.gov
R42470

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

Federal policy makers have a long-standing interest in science, technology, engineering, and mathematics (STEM) education that dates to at least the 1st Congress. This interest is largely driven by concerns about the national science and engineering workforce, which is widely believed to play a central role in U.S. global economic competitiveness and national security.

The National Science Foundation (NSF) is a key component of the federal STEM education effort. Several inventories of the federal STEM education portfolio have highlighted NSF's important role—both in terms of funding and in the number and breadth of NSF programs. The NSF is also the only federal agency whose primary mission includes supporting education across all fields of science and engineering. As such, funding for STEM education at the NSF impacts not only the agency, but also the entire federal STEM education effort.

Congress reduced enacted funding levels (from the prior year) for NSF's main education account in both FY2011 and FY2012. Those year-over-year reductions followed several years of varying funding, as well as changes in the overall distribution of the foundation budget that reduced funding for the main education account as a percentage of the total NSF budget. For the most part, these changes appear to result from a combination of holding the main education account more or less constant while applying most of the foundation's FY2003-FY2012 budget growth to the main research account. However, in constant dollar terms, it appears at least some of the increase in funding for research activities during the observed period may have come at the expense of education activities.

It is not clear if these funding changes reflect evolving congressional and Administration policy priorities and an intentional prioritization of research over educational activities at the NSF, or if they reflect the cumulative impact of funding decisions made in response to specific conditions in specific fiscal years that happen to have had this effect. Further, the significance of these changes for NSF's STEM education and research missions—and for the overall federal STEM effort—depends, in part, on how they fit within the broader policy context. In particular, it depends (among other things) on how policy makers perceive and assess the policy rationale behind STEM education funding at the NSF; the character of NSF's STEM education activities; the foundation's role in the federal STEM education portfolio; and the impact of changes in NSF's education account on the foundation's other primary mission, research.

This report analyzes NSF funding trends and selected closely related STEM education policy issues in order to place conversations about NSF's budget in a broader fiscal and policy context. It concludes with an analysis of potential policy options.

Contents

Figures

Tables

Appendixes

Contacts

Introduction

Federal policy makers have a long-standing interest in science, technology, engineering, and mathematics (STEM) education. This interest is largely driven by concerns about the national science and engineering workforce, which is widely believed to play a central role in U.S. global economic competitiveness and national security. The U.S. STEM education system is a primary source of scientists and engineers in the United States.[1] Approximately 6% of the U.S. workforce was employed in a STEM field in 2011. About 70% of those workers had at least a bachelor's degree. Further, of college graduates who were employed in a STEM field, 73% had a science or engineering major.[2]

Given the oft-cited connection between STEM education and key national priorities, federal policy makers have historically paid close attention to the U.S. STEM education system. The federal STEM education effort is wide-ranging. Analysts have identified between 105 and 252 STEM education programs and activities at 13 to 15 federal agencies. Annual federal appropriations for STEM education are typically in the range of $2.8 billion to $3.4 billion. Published inventories of the federal STEM education effort identify the Department of Education (ED), National Science Foundation (NSF), and Department of Health and Human Services (HHS) as key agencies in the federal effort. Of these, the NSF has the most STEM education funding and largest number of programs (typically). The foundation is also the only federal agency whose primary mission includes supporting education across all fields of science and engineering. As such, the NSF is a key component of the federal STEM education portfolio.[3]

Funding for STEM education decreased as a percentage of the total NSF budget between FY2003 and FY2012.[4] Further, funding levels for the foundation's main education account were lower than the previous year in both FY2011 and FY2012. FY2013 current plan funding for the main education account appears to be close to FY2012 levels.[5] The significance of these funding trends for NSF's education and research missions, as well as for the federal STEM education effort overall, depends in part on how these changes fit within historical funding trends at the NSF. This report analyzes those trends—and addresses selected STEM education policy issues—in order to

[1] Another source of STEM labor in the United States is immigration. For more information about foreign STEM workers, see CRS Report R42530, *Immigration of Foreign Nationals with Science, Technology, Engineering, and Mathematics (STEM) Degrees*, by (name redacted).

[2] Liana Christin Landivar, "The Relationship Between Science and Engineering Education and Employment in STEM Occupations," *American Community Survey Reports* (ACS-23), U.S. Census Bureau, Economics and Statistics Administration, U.S. Department of Commerce, September 2013. See also CRS Report R43061, *The U.S. Science and Engineering Workforce: Recent, Current, and Projected Employment, Wages, and Unemployment*, by (name redacted)

[3] For more information about federal STEM education activities, see CRS Report R42642, *Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer*, by (name redacted) and (name redacted).

[4] Funding at the NSF is distributed between accounts that primarily support research and accounts that primarily support STEM education. However, these missions are highly interrelated. STEM education ultimately enables the conduct of research, which by its very nature is often educational. Nevertheless, funding for these two missions supports different activities.

[5] The post-sequestration, post-rescission FY2013 current plan funding level for NSF's main education account is $833.3 million. This is slightly higher than the FY2012 actual funding level of $830.5 million. The FY2013 current plan funding level may differ from the final, FY2013 actual funding level. Current plan funding levels are typically estimated.

place the conversation about federal funding for STEM education at NSF in broader fiscal and policy context.

Methodology, Sources, Data, and Notes

This report examines actual funding for the NSF from FY2003 to FY2012 in current and constant (2005) dollars. Congress provides appropriations in current dollars, so current dollar funding data align with annual appropriations measures and congressional actions, while constant dollar data adjust for the effects of inflation and provide insight into purchasing power. This report also analyzes the distribution of total NSF funding by appropriations account and by character class. The character class analysis adjusts for programs that draw from more than one appropriations account but serve the same program or activity. Over time, changes in the distribution of funding may reflect changing policy priorities.

Several other introductory points should be noted.

- This report uses the following terms for the major appropriations accounts at NSF: "R&RA" or "main research account" for Research and Related Activities, "E&HR" or "main education account" for Education and Human Resources, "MREFC" or "main construction account" for Major Research Equipment and Facilities Construction, "AOAM" for Agency Operations and Awards Management, "NSB" for National Science Board, and "OIG" for Office of the Inspector General.
- This report uses the following terms for major activities: "R&D" or "research activities" for research and development-related activities, "E&T" or "education activities" for education and training-related activities, and "NIA" for non-investment activities. Non-investment activities are primarily administrative activities (e.g., travel and compensation costs for proposal review panelists).
- The analysis in this report is based on budgetary data from the NSF's annual budget requests to Congress from FY2005 to FY2014 and from information provided to CRS by NSF. Appropriations account data come from the "Overview" sections of the NSF budget requests; funding data by character class come from the "Quantitative Data Table" sections.
- CRS adjusted the appropriations account data for FY2003 to FY2005 to reflect the transfer of the Experimental Program to Stimulate Competitive Research (EPSCoR) between major accounts. This analysis treats EPSCoR as a research account program for all years in the data set.
- NSF adopted its current appropriations account structure in 2003. FY2003-FY2012 are the most recent years for which actual funding data are available and comparable.
- NSF programs are often co-funded (e.g., funded by two or more appropriations accounts). Budgetary data that are broken down by character class adjust for co-funding and provide insight into what NSF actually spends on a given activity.
- Funding levels for FY2009 and FY2010 do not include funding from the American Recovery and Reinvestment Act (AR&RA, P.L. 111-5) because NSF treated these funds as supplemental in its budget calculations.

- To generate constant dollar (e.g., inflation-adjusted) data in FY2005 dollars CRS used the Office of Management and Budget (OMB) deflator published in Table 10.1 of the OMB's *Historical Tables* and accessed on December 23, 2013.
- Data used in this report may be found in **Appendix A** and **Appendix B**.

Historical Funding Trends at NSF

By Character Class

The NSF's budget can be broken down by character class.[6] According to the NSF, its two primary activities are research and development (R&D) and education and training (E&T). The NSF also has a category for what it calls "non-investment activities," or NIA, which pays for items such as proposal review panel travel and compensation costs, invitational travel, and other administrative activities.[7] Unlike appropriations accounts, which show how Congress provides funding to the foundation, the character class perspective adjusts for co-funding (i.e., when programs are supported by more than one appropriations account) and provides insight into total funding for the foundation's two primary missions (e.g., research and STEM education).

Figure 1 shows how NSF current dollar funding for E&T and R&D activities changed between FY2003 and FY2012. (See **Appendix A** for data.) The total current dollar increase in NSF funding between FY2003 and FY2012 was $1.735 billion, or 32% more than the FY2003 baseline of $5.369 billion. During this period, current dollar funding for R&D increased by $1.762 billion while current dollar funding for E&T decreased by $95 million. Funding for R&D increased more or less steadily, while funding for E&T fluctuated. E&T funding levels ranged from a high of $941 million in FY2004 to a low of $783 million in FY2006. The median funding level for E&T during the observed period was $840 million. FY2012 funding for E&T was below the FY2003 level.

When expressed in constant (2005) dollars, funding for R&D experienced a relatively flat period from FY2005 through FY2008. (See **Figure 2**.) The sharp increase in constant dollar R&D funding between FY2009 and FY2010 coincides with the second year of funding under the America COMPETES Act (P.L. 110-69).[8] R&D funding levels have stayed about the same since then. Constant dollar funding for E&T generally trended downward between FY2003 and FY2012—ranging from a high of $972 million in FY2004 to a low of $696 million in FY2012. Median constant dollar funding for E&T activities during the observed period was $797 million.

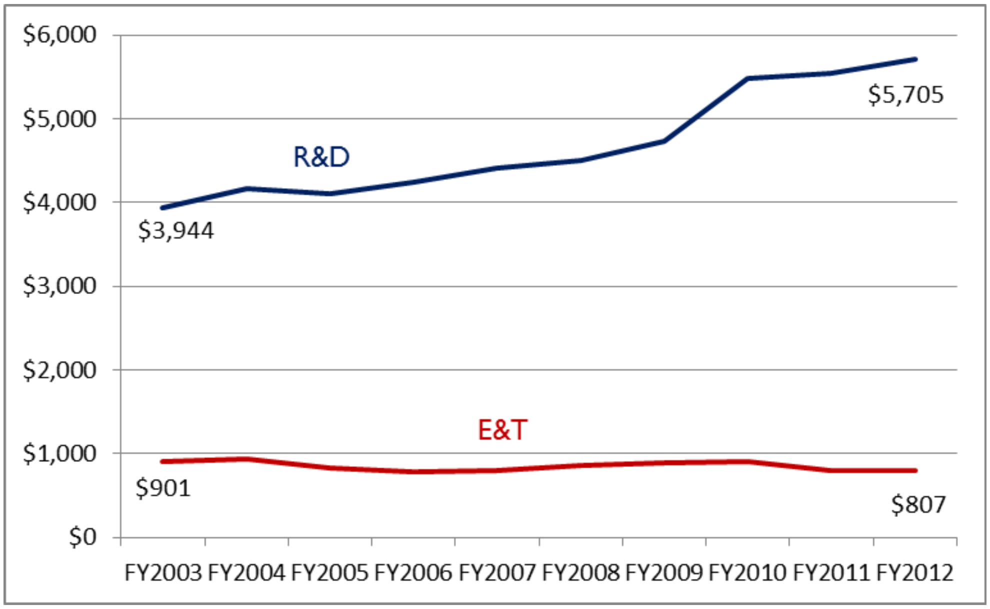
[6] NSF adheres to Office of Management and Budget, *OMB Circular A-11*, for its character class definitions. For more information, see http://www.whitehouse.gov/omb/circulars_a11_current_year_a11_toc.

[7] As the purpose of this report is to examine NSF's investment activities, it excludes NIA trends.

[8] The America COMPETES Act (P.L. 110-69) increased authorized funding levels for targeted accounts at the NSF, National Institutes of Standards and Technology laboratories and construction, and the Department of Energy's Office of Science. For more information see CRS Report R41819, *Reauthorization of the America COMPETES Act: Selected Policy Provisions, Funding, and Implementation Issues*, by (name redacted); and CRS Report R41951, *An Analysis of Efforts to Double Federal Funding for Physical Sciences and Engineering Research*, by (name redacted)

Figure 1. NSF Funding by Character Class (Current)

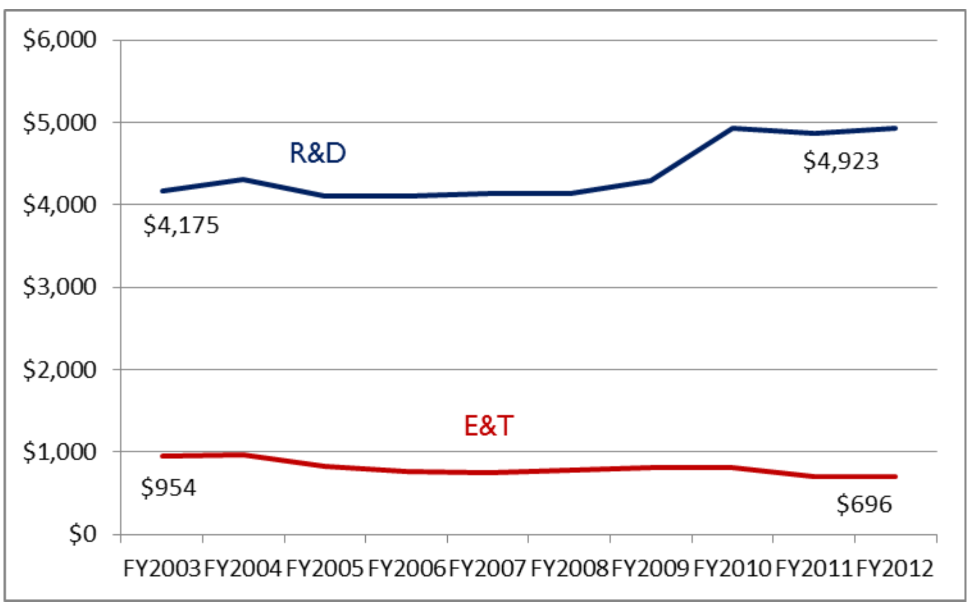
FY2003 to FY2012 Actual, In Millions, Rounded



Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

Figure 2. NSF Funding by Character Class (2005 Constant)

FY2003 to FY2012 Actual, In Millions, Rounded

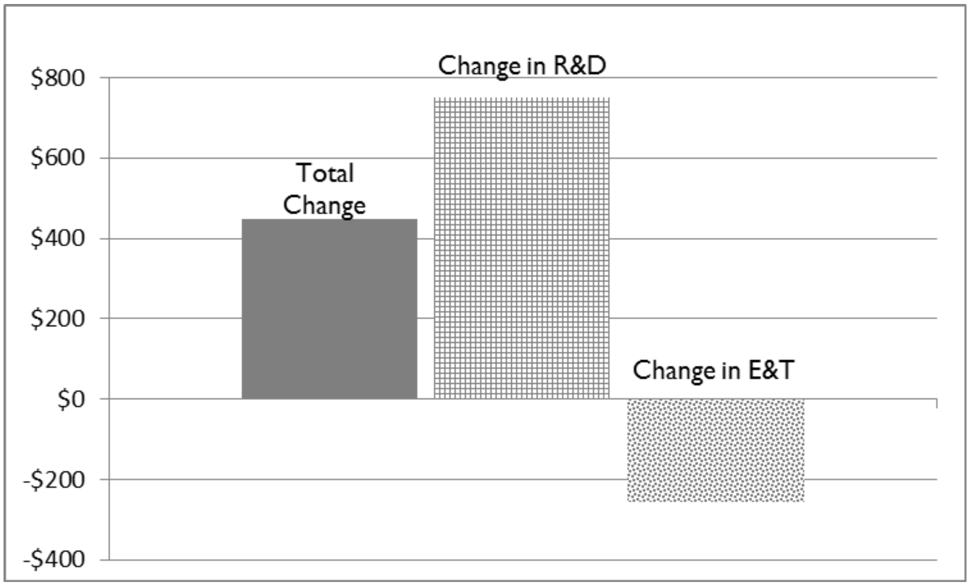


Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

In constant (2005) dollars, total NSF funding increased by $447 million—from $5.684 billion to $6.131 billion—between FY2003 and FY2012. Funding for R&D increased by $748 million while funding for E&T decreased by $258 million during this same period. (See **Figure 3**.) Given that funding for R&D grew in excess of the total NSF increase, and that funding for E&T experienced negative growth, at least some of the growth in funding for R&D between FY2003 and FY2012 appears to have come from E&T.

Figure 3. Change in NSF Funding from FY2003 to FY2012, by Character Class

Total Change, Change in R&D, and Change in E&T
In Millions of Constant (2005) Dollars, Rounded



Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

The distribution of NSF funding by character class also changed between FY2003 and FY2012. As **Table 1** shows, the percentage of the NSF budget dedicated to E&T activities generally decreased while the percentage dedicated to R&D activities generally increased. This is consistent with the previous finding that most of the total increase in NSF funding during the observed period went to R&D. Some of the increase in the percentage of the NSF budget dedicated to R&D may have come from NIA. (See "Note," **Table 1**.)

Table 1. Distribution of NSF Obligations by Character Class (% of Total)

FY2003 to FY2012 Actual and FY2003 to FY2012 Average

Class	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	Ave. '03-'12
R&D	73.5%	73.7%	74.8%	75.1%	74.9%	74.1%	73.1%	78.7%	80.1%	80.3%	75.8%
NIA	9.8%	9.6%	10.2%	11.0%	11.5%	11.9%	13.0%	8.4%	8.3%	8.3%	10.2%
E&T	16.8%	16.7%	15.0%	13.9%	13.6%	14.1%	13.9%	12.9%	11.6%	11.4%	14.0%

Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

Note: In response to direction from the Office of Management and Budget, NSF reclassified certain NIA obligations as R&D in FY2010. It is likely that pre-FY2010 R&D levels are higher than represented here, but the amount of the difference is unknown. NSF indicates that there may be a coding problem in the FY2008 E&T numbers, such that some R&D activities may be improperly assigned to the E&T account.

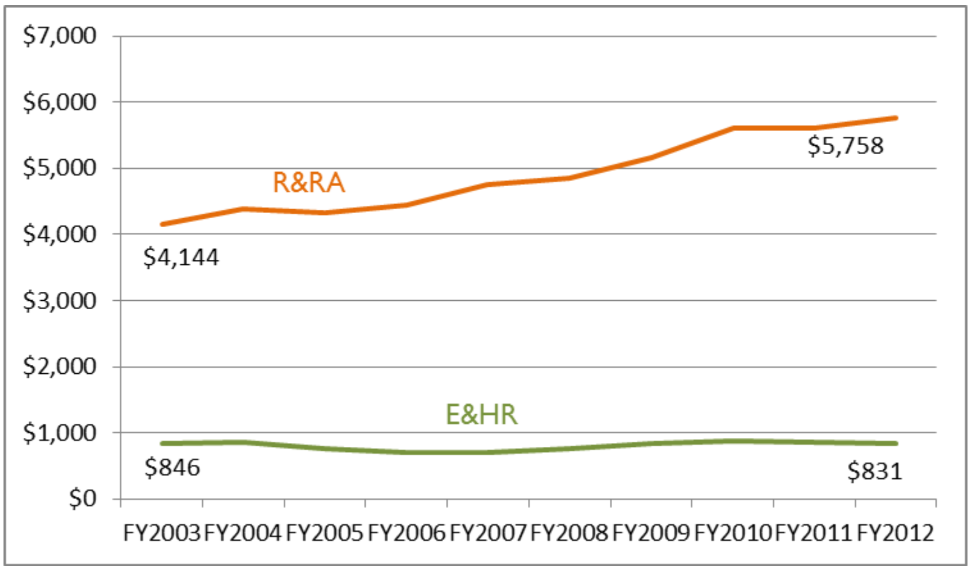
By Appropriations Account

Congress provides funding to the NSF via appropriations accounts, not by character class. Analysis of appropriations account trends, therefore, aligns more closely with congressional action than analysis by character class. This section focuses on changes in congressional appropriations for the R&RA and E&HR accounts because these accounts are the primary sources of support for NSF mission activities. As with the previous analysis of character class trends, this section examines both current and constant (2005) trends in funding for these accounts.

Total current dollar appropriations to NSF increased from $5.369 billion to $7.105 billion between FY2003 and FY2012. Of this $1.735 billion increase, 93.0% or $1.615 billion went to R&RA. Current dollar appropriations for E&HR decreased by $15.2 million (-1.8%) during the same period. **Figure 4** shows the current dollar trends in R&RA and E&HR from FY2003 to FY2012. (See **Appendix B** for data.)

Figure 4. NSF Funding for R&RA and E&HR (Current)

FY2003 to FY2012 Actual, In Millions, Rounded



Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

Both R&RA and E&HR experienced current dollar reductions from the prior year in FY2005 and FY2011. However, other than in these years, R&RA funding levels increased over the prior year for each year in the observed period. E&HR funding varied. It received four year-over-year increases and five year-over-year reductions between FY2003 and FY2012. Further, reductions to the E&HR account appeared to be steeper, and took longer to return to pre-reduction levels, than did reductions to R&RA.[9]

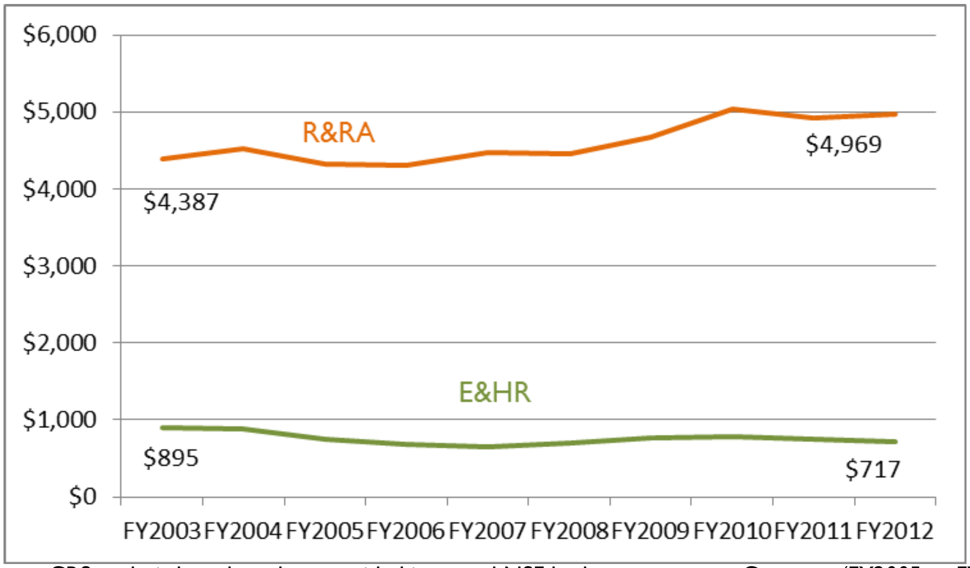
In constant (2005) dollars, NSF funding increased by $447 million between FY2003 and FY2012. As shown in **Figure 5**, constant dollar funding for R&RA increased by $583 million (13%) while

[9] For example, in FY2005, both R&RA and E&HR experienced reductions. The decrease in R&RA was $59.4 million, or 1.4% percent below the FY2004 level of $4.388 billion. The following year (FY2006) Congress returned the R&RA account to the FY2004 level and increased beyond it. By contrast, the FY2005 decrease to E&HR was $99.7 million, or 11.7% of the FY2004 level ($849.9 million). Congress did not return E&HR funding to FY2004 levels until FY2009.

constant dollar funding for E&HR decreased by $179 million (-20%). These trends suggest that most of the total constant dollar growth at the NSF—and at least some of the constant dollar value of E&HR—accrued to R&RA during the observed period.

Figure 5. NSF Funding for R&RA and E&HR (2005 Constant)

FY2003 to FY2012 Actual, In Millions, Rounded



Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

As **Table 2** shows, the percentage of the NSF budget dedicated to R&RA activities has generally increased and the percentage of the budget dedicated to E&HR has generally decreased since FY2003.

Table 2. Distribution of NSF Funding by Appropriations Account (% of Total)

FY2003 to FY2012 Actual and FY2003 to FY2012 Average

Account	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	Ave. '03-'12
R&RA	77.2%	77.6%	79.0%	78.8%	80.9%	79.8%	79.7%	80.5%	81.1%	81.0%	79.6%
E&HR	15.7%	15.0%	13.7%	12.4%	11.8%	12.6%	13.1%	12.5%	12.5%	11.7%	13.1%
MREFC	3.3%	3.3%	3.0%	4.1%	2.8%	2.7%	2.5%	2.4%	1.8%	2.8%	2.9%
AOAM	3.5%	3.9%	4.1%	4.4%	4.2%	4.6%	4.5%	4.3%	4.3%	4.2%	4.2%
NSB	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
OIG	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%

Source: CRS analysis based on data provided in annual NSF budget requests to Congress (FY2005 to FY2014).

Policy Issues and Observations

As the previous section's analysis of historical funding trends at NSF shows, Congress reduced funding for NSF's main education account in both FY2011 and FY2012. Those year-over-year reductions followed several years of fluctuating funding for E&HR. In addition, changes in the distribution of the foundation budget reduced funding for the main education account as a percentage of the total NSF budget. These changes generally appear to result from a combination of holding the main education account more or less constant while applying most of the foundation's FY2003-FY2012 budget growth to R&RA. However, in constant (2005) dollars, at least some of the growth in NSF research funding appears to come from the foundation's education-related activities.

It is not clear if these funding changes reflect evolving congressional and Administration policy priorities and an intentional prioritization of research over educational activities at the NSF. They may simply reflect the cumulative impact of funding decisions made in response to specific conditions in specific fiscal years. Further, methodological and research limitations can impede the types of economic analyses that might otherwise be used to assess optimal funding levels for NSF accounts. The period of time for which comparable budgetary account data exist, for example, is limited to 10 years. It can also be difficult to definitively link federal investments in research and education *writ large* with social, scientific, or economic outcomes.

However, historical funding trends at the NSF raise several questions for Congress as it considers funding for the foundation, as well as for the federal STEM education effort overall. These questions include

- What is the policy rationale behind funding for STEM education at NSF?
- What are NSF's STEM education activities?
- What is NSF's role within the federal STEM education portfolio?
- What impact might changes in the NSF STEM education account have on research activities at NSF?
- What are the policy options for Congress as it considers future NSF budgets?

What Policy Rationale Drives Funding for STEM Education at NSF?

One of the main reasons that advocates support increased funding for STEM education programs at NSF is because of their perceived contribution to the U.S. science and engineering (S&E) workforce. A broad consensus of business, academic, and policy leaders holds that U.S. STEM education weaknesses have or will soon contribute to national S&E workforce shortages and that this labor supply problem has or will diminish U.S. global economic competitiveness and threaten national security.[10] Analysts who hold this view typically contend that the federal government should increase funding across, or within specific parts of, the so-called STEM education "pipeline" (pre-kindergarten to post-graduate education). These investments, advocates assert, will improve U.S. student performance in STEM subjects and increase both the quantity and quality of U.S. students graduating with degrees in STEM fields. Programs designed to improve teaching and learning in STEM fields or to attract and retain students in STEM degree programs through scholarships and financial aid are examples of this policy approach.

[10] One influential example of this argument is laid out in National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, Committee on Prospering in the Global Economy of the 21st Century: An Agenda for America Science and Technology, and Committee on Science, Engineering, and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies Press, 2007, http://www.nap.edu/catalog/11463.html.

Other observers counter that U.S. students are not underperforming in mathematics and science; that shortage claims are overstated, misunderstood, or do not call for supply side interventions;[11] and that demand, not supply, may be the bigger policy challenge.[12] These analysts assert that the United States graduates more science and engineering students than there are science and engineering jobs[13] and that classic signs of labor shortages (e.g., rapidly increasing wages) are not broadly evident in the U.S. STEM labor supply. These analysts typically acknowledge that there may be reasons to seek improved student STEM performance, but they argue that the current policy debate is based on misperceptions, obscures root causes of poor performance (e.g., poverty effects in education), and results in ineffective policy responses.[14] Analysts who hold this view suggest demand-side policies (e.g., increased funding for R&D, tax credits for privately funded research, or more and better jobs for scientists), improved labor market signaling, and addressing the root problems of low-performing students (e.g., poverty) as possible policy alternatives.

A third view of the shortage issue asserts that the disagreement about the adequacy of the supply of STEM workers "can be resolved by the fact that large numbers of people with STEM talent or degrees divert from STEM occupations either in school or later in their careers."[15] Analysts who hold this view contend that the economy increasingly values and demands STEM competencies—for example, the knowledge, skills, and abilities typically associated with education in STEM fields—even in non-STEM occupations. These analysts assert that workforce shortages become more evident if demand from *both* STEM *and* non-STEM fields is compared to the supply of STEM-educated workers. (In other words, they assert that analysts who argue that there are no shortages are missing part of the equation.) Those who hold this view typically agree that a supply response is appropriate, and recommend paying more attention to the role of personal interest in career choices, nurturing students with a personal interest in STEM "even if they do not look like traditional STEM workers,"[16] and integrating STEM competencies into a broader array of academic disciplines.

What Are NSF's STEM Education Activities?

Funding for STEM education at NSF serves a variety of objectives. However, a 2011 report found that 66% of NSF's STEM education budget provided for programs designed either to support postsecondary students (primarily through scholarships and other forms of financial support) or for research on teaching and learning in STEM fields. Most of the postsecondary student funding

[11] Richard Freeman, "The Market for Scientists and Engineers," *NBER Reporter*, no. 3 (Summer 2007), pp. 6-8, http://www.nber.org/reporter/2007number3/freeman.html.

[12] Ron Hira, "U.S. Policy and the STEM Workforce System," *American Behavioral Scientist*, v. 53, no. 7 (March 2010), pp. 949-961.

[13] Testimony of Institute for the Study of International Migration Director of Policy Studies B. Lindsay Lowell, in U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *"STEM" the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees?*, hearings, 112th Cong., 1st sess., Serial No. 112-64, October 5, 2011, http://judiciary.house.gov/hearings/hear_10052011_2.html.

[14] B. Lindsay Lowell and Harold Salzman, *Into the Eye of the Storm: Assessing the Evidence on Science and Engineering Education, Quality, and Workforce Demand*, Urban Institute, October 2007, http://www.urban.org/publications/411562.html.

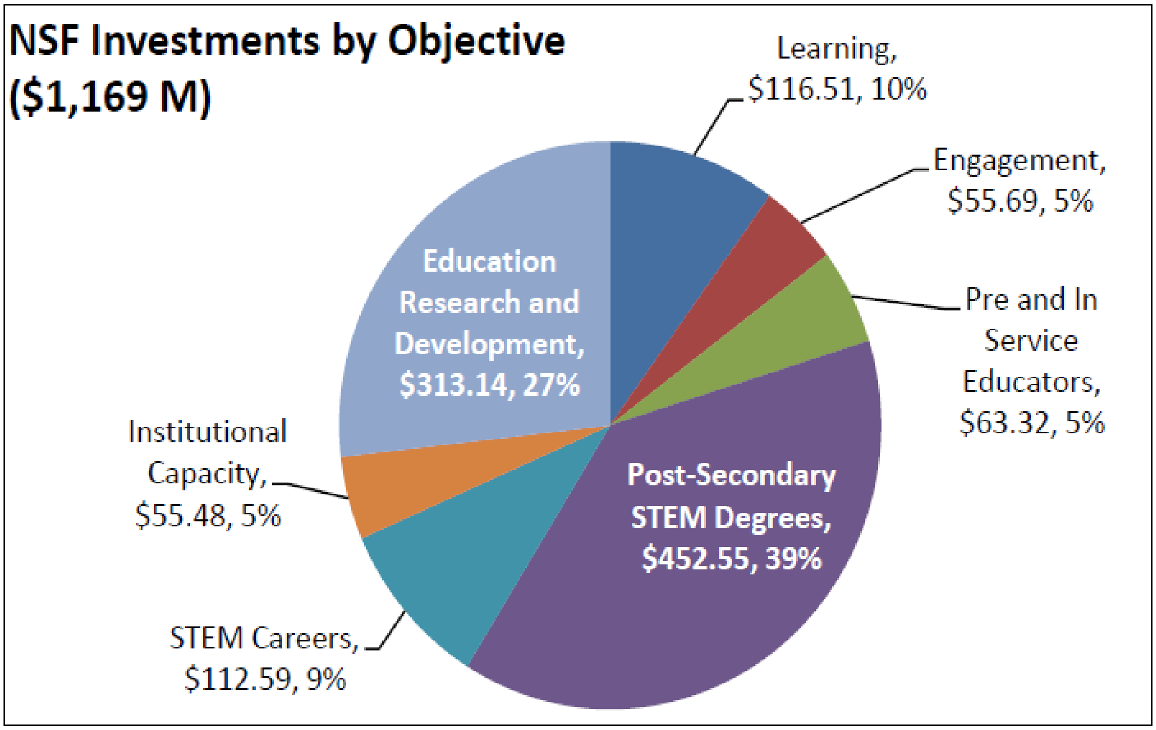
[15] Anthony P. Carnevale, Nicole Smith, and Michelle Melton, *STEM: Science, Technology, Engineering, and Mathematics*, Georgetown University Center on Education and the Workforce, October 20, 2011, p. 7, http://cew.georgetown.edu/STEM/.

[16] Ibid., p. 75.

went to the Graduate Research Fellowship (GRF) and Integrative Graduate Education and Research Traineeship (IGERT) programs, which provide stipends and support to STEM graduate students. Most of the funding for research in STEM education went to the Discovery Research K-12 and Mathematics and Science Partnership programs, which seek to improve kindergarten-through-Grade 12 (K-12) STEM education. Smaller portions of NSF's STEM education budget provided for a number of other objectives.[17] (See **Figure 6**.)

Figure 6. STEM Education Funding at NSF, by Objective

FY2010 actual, millions of current dollars



Source: Executive Office of the President, National Science and Technology Council, Committee on STEM Education, Fast-Track Action Committee on Federal Investments in STEM Education, *The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio*, December 2011, p. 68.

Notes: The NSTC calculation for STEM education funding at the NSF in FY2010 (actual) uses a different methodology than either the E&HR or E&T estimates used in other parts of this report.

Several reports on the federal STEM education effort have noted a general dearth of STEM education program evaluations and have recommended that federal agencies increase their program evaluation rates. This challenge is not broadly applicable to the NSF, which has conducted evaluations of many of its STEM education programs. However, in a January 2012 Government Accountability Office (GAO) review of federal STEM education programs, GAO found that federal STEM education program evaluations—including NSF evaluations—could be improved. In particular, GAO recommended improved survey response rates, better alignment of

[17] Executive Office of the President, National Science and Technology Council, Committee on STEM Education, Fast-Track Action Committee on Federal Investments in STEM Education, *The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio*, December 2011, p. 68, http://www.whitehouse.gov/sites/default/files/microsites/ostp/costem__federal_stem_education_portfolio_report.pdf.

methods with other components of the evaluation, and robust use of criteria to measure outcomes.[18]

What Is NSF's Role in the Federal STEM Education Portfolio?

The NSF plays a key role in the federal STEM education portfolio. For example, the National Science and Technology Council (NSTC) estimates that total federal STEM education investments were $3.4 billion in FY2010.[19] The NSF portion of that total was $1.2 billion (rounded). The NSF is also the only federal agency whose primary mission includes education across all fields of science and engineering. This key position means changes at the NSF may disproportionally affect the entire federal STEM education effort (both funding and character).

In terms of the character of its contribution to the federal STEM education portfolio, NSF highlights its STEM education research and development (R&D) functions. The foundation states that it focuses on identifying effective STEM education practices through research and small-scale testing, but that it is not well-positioned to bring these practices to scale.[20]

NSF is also an important source of scholarships, fellowships, and financial support to STEM students as well as institutions of higher education. For example, since the establishment of the Graduate Research Fellowship (GRF) program in 1952—two years after NSF's own founding in 1950—NSF has supported researchers and students in STEM fields. This funding serves integrated research and education purposes. It seeks to support the national research effort through support of the STEM workforce and it seeks to support the national STEM education effort by providing financial and educational incentives for students to go into STEM and STEM-related fields (such as K-12 science teaching). NSF estimates that it provides financial support to about 5% of the science and engineering graduate students in the United States.[21]

In addition to NSF's role as a funder of STEM education R&D and STEM student support, the foundation also operates smaller (measured by funding levels) programs that seek to advance other federal STEM education policy priorities. These include programs designed to increase the participation of historically under-represented groups in STEM fields and programs that provide funding for out-of-school or informal STEM education. Some NSF STEM education programs are also integrated with similar programs at other agencies, such as the Mathematics and Science Partnership program, which has a sister program at ED.

Although NSF is a major contributor to the federal STEM education portfolio, some analysts may argue that national STEM education objectives could be met without some (or all) NSF STEM education programs.

---

[18] U.S. Government Accountability Office, Science, Technology, Engineering, and Mathematics Education: Strategic Planning Needed to Better Manage Overlapping Programs Across Multiple Agencies, GAO-12-108, January 2012, pp. 27-29, http://gao.gov/products/GAO-12-108.

[19] Executive Office of the President, National Science and Technology Council, Committee on STEM Education, Fast-Track Action Committee on Federal Investments in STEM Education, *The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio*, December 2011, http://www.whitehouse.gov/sites/default/files/microsites/ostp/costem__federal_stem_education_portfolio_report.pdf.

[20] Based on NSF briefing of CRS and GAO staff, January 21, 2011.

[21] See National Science Foundation, *FY2013 Budget Request to Congress*, February 13, 2012, p. Summary Tables-5, http://www.nsf.gov/about/budget/fy2013/index.jsp.

The Federal STEM Education Portfolio: Selected Governance Concerns

The specific debate about funding for STEM education programs at the NSF is taking place within a broader conversation about governance of the federal STEM education portfolio. This conversation has focused on the potential for duplication in the federal effort and on the perception that the federal effort lacks both coordination and an overarching strategy. The Obama Administration proposed a reorganization of the federal STEM education portfolio as part of the FY2014 budget request. The proposed reorganization envisions a prominent role for NSF in the federal STEM education portfolio. Policy makers have also expressed ongoing concern about the dissemination of NSF-funded STEM education research. These issues are discussed in greater detail in the following sections.

Duplication and Consolidation

The scope, scale, and perceived lack of coordination in the federal STEM education portfolio have some analysts concerned that federal agencies are duplicating effort. In response to these concerns, some policy makers have proposed consolidating or eliminating some or all of NSF's STEM education programs.[22]

Published assessments of duplication in the federal STEM education portfolio are somewhat contradictory. Preliminary findings from an April 2011 GAO report appeared to suggest the potential for duplication in federal teacher quality programs, including teacher quality programs at the NSF.[23] However, the December 2011 NSTC comprehensive inventory of federal STEM education programs specifically examined the duplication question within the federal STEM education portfolio and found "little overlap and no duplication."[24] A January 2012 GAO report on the federal STEM education effort concluded that 83% of federal STEM education programs overlapped "to some degree," but stated that this overlap would "not necessarily be duplicative."[25]

Federal program consolidation is a widely debated option that policy makers may employ to reduce duplication and potentially affect savings. Some policy makers see program consolidation as a means to increase program flexibility and improve program responsiveness, because federal program managers would have greater authority to shift priorities without having to modify federal law.[26] However, other policy makers may object to this change, because it can transfer

---

[22] For example, see Senator Tom Coburn, *The National Science Foundation: Under the Microscope*, April 2011, p. 54, http://coburn.senate.gov/public//index.cfm?a=Files.Serve&File_id=2dccf06d-65fe-4087-b58d-b43ff68987fa.

[23] The GAO found a total of 82 potentially duplicative teacher quality programs at 10 federal agencies. The auditing agency indicates that nine of these programs were at the NSF. See, U.S. Government Accountability Office, *Opportunities to Reduce Duplication in Federal Teacher Quality Programs* (GAO-11-510T), April 13, 2011, http://www.gao.gov/products/GAO-11-510.

[24] Executive Office of the President, National Science and Technology Council, Committee on STEM Education, Fast-Track Action Committee on Federal Investments in STEM Education, *The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio*, December 2011, p. 37, http://www.whitehouse.gov/sites/default/files/microsites/ostp/costem__federal_stem_education_portfolio_report.pdf.

[25] U.S. Government Accountability Office, *Science, Technology, Engineering, and Mathematics Education: Strategic Planning Needed to Better Manage Overlapping Programs Across Multiple Agencies*, GAO-12-108, January 2012, pp. 20-21, http://gao.gov/products/GAO-12-108.

[26] This is, for example, part of the rationale for Administration-proposed program consolidations at the Department of Education. For more information about the Administration's planned changes at ED, see CRS Report R41355, *Administration's Proposal to Reauthorize the Elementary and Secondary Education Act: Comparison to Current Law*, (continued...)

program control from the legislative to the executive branch, potentially shifting the balance of power between the branches. Consolidation (particularly in the form of block grants) has also been proposed as a strategy to transfer control to the states and as a means to reduce program costs. Such a shift could increase the ability of states to respond to local conditions and needs, but might make it more difficult for federal policy makers to implement a national STEM education agenda,[27] or to leverage the unique assets that federal science agencies bring to the STEM education effort.[28] On the issue of cost and consolidation, the GAO has found that program consolidation can be more expensive in the short term and may not result in long-term savings if program workloads are not reduced.[29] Consolidation opponents raise general concerns about the potential impact of merging programs, arguing that certain programs (such as STEM education programs) need specified funding streams to avoid being passed over in favor of competing educational priorities.

The impact of federal STEM education program consolidation efforts on STEM education at the NSF will depend on what programs are consolidated, how the consolidation is accomplished, how funding streams are affected, and the degree to which NSF programs are strictly duplicative of other federal STEM education efforts.[30] Congress could, for example, seek either a full or partial consolidation of STEM education programs at either the NSF or across the entire federal STEM education portfolio. Savings and program impacts would vary, depending on which of these strategies policy makers pursue.

A Federal STEM Education Strategy

A second policy issue raised in the current federal STEM education governance debate relates to the perceived lack of coordination or an overarching strategy in the portfolio. Until recently, the federal STEM education effort was largely unknown and primarily undertaken in a distributed fashion that responded to the specific needs of agencies and STEM constituencies. Programs were typically not part of a defined, overarching federal STEM education strategy or well-coordinated approach across federal agencies. Although some analysts may view the distributed method as particularly responsive to the unique workforce needs or STEM education assets of federal science agencies, other observers have suggested that an overarching cross-agency strategy may improve the efficiency of federal STEM education investments.[31]

(...continued)

by (name redacted) et al.

[27] This would depend on how the grants to states were structured. Federal policy makers could still attempt to establish a national STEM education agenda by making receipt of consolidated program funds contingent on meeting certain defined national goals. However, some states may reject such efforts as overly prescriptive.

[28] For example, the National Aeronautics and Space Administration (NASA) has both unique workforce needs (e.g., astrobiologists) and unique assets that it can bring to the national STEM education effort (e.g., teaching from space).

[29] GAO states that "over 90% of STEM education programs that reported administrative costs estimated having administrative costs lower than 10% of their total program costs." U.S. Government Accountability Office, *Science, Technology, Engineering, and Mathematics Education: Strategic Planning Needed to Better Manage Overlapping Programs Across Multiple Agencies*, GAO-12-108, January 2012, p. 22, http://gao.gov/products/GAO-12-108.

[30] For example, programs that appear duplicative by some measures (e.g., target group), may have different intangible assets that could impact program implementation and outcomes.

[31] For example, the December 2011 NSTC inventory of federal STEM education programs suggested that there was room for improvement in their management and stated that "the primary issue [instead of duplication] is how to strategically focus the limited federal dollars available within the vast landscape of opportunity so they will have the most significant impacts possible in areas of national priority." (See, NSTC report, p. 37.) The GAO concluded (continued...)

Both Congress and the Administration have moved to develop a federal STEM education strategy. Section 101 of the America COMPETES Reauthorization Act of 2010 (P.L. 111-358) directed the NSTC to develop and implement a five-year federal STEM education strategy. (NSF co-chairs the NTSC subcommittee on STEM education, colloquially known as "CoSTEM," that was formed in response to Section 101.) The NSTC issued a report on the status of the strategy in February 2012 (hereinafter referred to as the "status report").[32] The status report identified two STEM education goals—STEM workforce development and STEM literacy—as well as policy and administrative strategies designed to accomplish these goals. Further, the status report identified four priority policy areas for the federal effort: "effective K-12 teacher education, engagement, undergraduate STEM education, and serving groups traditionally underrepresented in STEM fields."[33] Noting that strong arguments can be made for other STEM education policy areas, the report states that these priority areas were chosen because they represent the convergence of "national needs, Presidential priorities, and federal assets."[34] Agencies would retain the authority to establish their own STEM education priorities as well.

The NSTC published its five-year strategic plan for federal STEM education investments (hereinafter referred to as the "strategic plan") in May 2013. The strategic plan envisions a future where

> The United States has a well-qualified and increasingly diverse STEM workforce able to lead innovation in STEM-related industries and to fulfill CoSTEM agency workforce needs; American students have access to excellent P-12, postsecondary, and informal STEM education and learning opportunities; and Federal STEM education programs are based on evidence and coordinated for maximum impact in priority areas.[35]

To achieve this vision, the strategic plan identifies five priority areas for federal STEM education investment: improve STEM instruction, increase and sustain youth and public engagement in STEM, enhance STEM experiences of undergraduate students, better serve groups historically underrepresented in STEM fields, and design graduate education for tomorrow's STEM workforce. Within each of these priority areas, the strategic plan identifies specific goals, such as preparing 100,000 excellent new K-12 teachers by 2020 and supporting a 50% increase in the

---

(...continued)

similarly in its January 2012 report and recommended that the NSTC draft a federal STEM education strategy plan, and that NSTC should also develop policies to ensure agencies comply with the national plan. In particular, the GAO recommended that NSTC should develop (1) guidance for agencies on how to incorporate STEM education efforts into agency performance plans; (2) a framework for how agencies will be monitored to ensure they collect and report on strategic plan goals; and (3) guidance to help agencies determine the types of evaluations that may be feasible and appropriate for different types of STEM education programs. Additionally, GAO recommended that NSTC should work with agencies to identify programs that might be candidates for consolidation or elimination. (See, GAO-12-108, p. 31).

[32] Executive Office of the President, National Science and Technology Council, Committee on STEM Education, Federal Coordination in STEM Education Task Force, *Coordinating Federal Science, Technology, Engineering, and Mathematics (STEM) Education Investments: Progress Report*, February 2012, http://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc_federal_stem_education_coordination_report.pdf.

[33] Ibid., p. 13.

[34] Ibid., p. 17.

[35] Executive Office of the President, National Science and Technology Council, Committee on STEM education, *Federal Science, Technology, Engineering, and Mathematics (STEM) Education: 5-Year Strategic Plan*, May 2013, p. 8, http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf.

number of U.S. youth who have a STEM experience each year. The strategic plan includes an outline for implementation, but notes that "detailed roadmaps" would need to be developed.[36]

Congressional response to the strategic plan has, to some degree, become part of a broader conversation about the FY2014 Administration budget request. In April 2013, prior to the publication of the strategic plan, the Obama Administration released its FY2014 budget request. Integrated into the request was a proposal to reorganize the federal STEM education effort.[37] The Administration asserts that the proposed reorganization was informed by drafts of the strategic plan.[38] However, some policy makers assert that the strategic plan "appears to have been modified at the last minute to bring it into conformance with the Administration's STEM education budget proposal," and argue that in so doing, "key elements of the progress report were lost or diluted."[39] On the other hand, some policy makers who object to the proposed reorganization offered the strategic plan as "a new starting point for discussion" about any potential changes to the federal STEM education effort.[40]

The adoption and implementation of an overarching federal STEM education strategy could have many implications for STEM education at the NSF, depending on the type of strategy policy makers adopt and the STEM education goals they pursue. The America COMPETES Reauthorization Act of 2010 gave the executive branch the authority to both develop and implement a federal STEM education strategy. However, implementation depends on appropriations and related congressional decisions. If the 113th Congress adopts the NSTC strategy or proposed FY2014 reorganization in its appropriations and authorization actions, NSF will likely continue its large role in the national STEM education strategy. If legislators pursue similar goals, but undertake a different strategy—such as increasing funding for Advanced Placement course-taking or providing more funding for early childhood education at ED—then the NSF may play a different role. Alternatively, legislators may adopt different national STEM education goals or strategies.

Obama Administration Proposal to Reorganize the Federal STEM Education Effort in FY2014

The Obama Administration's FY2014 budget request includes a proposal to reduce the number of federal STEM education investments by about half while increasing total funding for federal STEM education activities by about 6% over FY2012 funding levels (hereinafter referred to as the "proposed reorganization"). Under the proposed reorganization, approximately 78 programs at nine federal agencies would lose funding for certain STEM education activities. Some STEM education activities within agencies would also be consolidated. Funding for certain priority

---

[36] Ibid., p. 16.

[37] This proposal is discussed more fully in the section titled, "Obama Administration Proposal to Reorganize the Federal STEM Education Effort in FY2014."

[38] Testimony of Office of Science and Technology Policy Director John Holdren, in U.S. Congress, Senate Committee on the Budget, *Silo Busting: Effective Strategies for Government Reorganization*, hearings, 113th Cong., 1st sess., May 16, 2013.

[39] H.Rept. 113-171, p. 59.

[40] House Committee on Science, Space, and Technology, Ranking Member Eddie Bernice Johnson, "Committee Discusses Proposed Reorganization of STEM Education Programs," press release, June 4, 2013, http://democrats.science.house.gov/press-release/committee-discusses-proposed-reorganization-stem-education-programs.

programs at three "lead" agencies (NSF, ED, and the Smithsonian Institution) would increase. Under the proposal, NSF would focus on improving undergraduate STEM education as well as creating a more coherent system of federal graduate fellowships.

The Administration asserts that the proposed reorganization would "cut back lower-priority or narrow-purpose programs to make room for targeted increases."[41] The Administration further argues that the proposed reorganization would decrease fragmentation in the federal STEM education effort, "allowing potential for easier coordination and strong evaluations of what's working."[42] Some policy makers share the Administration's broad concerns about fragmentation—and perceive a similar lack of coordination—in the federal STEM education effort. Other policy makers also express support for consolidation, generally, as a response to perceived duplication in the federal STEM education effort. The proposed reorganization, which includes both a coordinated approach and a program consolidation, potentially addresses those concerns for some policy makers.

The proposed reorganization has received a mixed response from Congress—some policy makers accept certain proposed changes, while others seek to prevent implementation.[43] Objection to the proposed reorganization stems from a variety of factors, most of which relate to the process by which the proposal was developed (or perceived to have been developed) and its timing.

For example, some policy makers assert that the proposed reorganization was developed outside of, or with insufficient insight from, the process for coordinating federal STEM education programs that Congress established in Section 101 of the America COMPETES Reauthorization Act of 2010 (P.L. 111-358). In a June 2013 House Committee on Science, Space, and Technology hearing, several legislators expressed concern about the release of the proposed reorganization prior to the publication of the strategic plan for federal STEM education as mandated by Section 101.[44] Similarly, the Senate Appropriations Committee report on FY2014 funding for Commerce, Justice, Science, and Related Agencies

> defers action on the [proposed reorganization] until such time that [the Office of Science and Technology Policy] … finalizes the STEM program assessments as required by America COMPETES.[45]

Other stakeholders argue that the Administration's process for developing the proposed reorganization was insufficiently transparent—the proposal is reported to have surprised many in the scientific community—and that too few stakeholders were consulted in its development. Further, although the Administration asserts that the proposed reorganization will facilitate better

[41] Testimony of Office of Science and Technology Policy Director John Holdren, in U.S. Congress, Senate Committee on the Budget, *Silo Busting: Effective Strategies for Government Reorganization*, hearings, 113th Cong., 1st sess., May 16, 2013.

[42] Ibid.

[43] The House report on Energy and Water Development Appropriations for FY2014 accepts some of the proposed changes. (See H.Rept. 113-135, p. 86.) However, both the House and Senate Appropriations Committee reports on Commerce, Justice, Science, and Related Agencies Appropriations reject the proposed reorganization in FY2014, except in specific instances. (See H.Rept. 113-171, p. 8, and S.Rept. 113-78, pp. 102-103.)

[44] House Committee on Science, Space, and Technology, "STEM Education: The Administration's Proposed Reorganization," hearings, 113th Cong., 1st sess., June 4, 2013, http://science.house.gov/hearing/full-committee-hearing-stem-education-administration%E2%80%99s-proposed-re-organization.

[45] S.Rept. 113-78, p.103.

program evaluation, news reports state that that "previous evaluations of STEM programs were not the driving force in selecting winners and losers."[46] Additionally, some policy makers question the capacity of lead agencies to take on their new roles or express support for programs at ceding agencies, like the National Aeronautics and Space Administration.

The effect of the Administration's proposed reorganization of federal STEM education activities on STEM education programs at the NSF is unclear. A change of this magnitude—approximately half the federal effort—could result in a wide range of intended and unintended consequences. The Administration has not provided Congress with a detailed implementation plan or impact analysis. Further, many of the proposed changes require either tacit or specific approval from multiple congressional committees, as well as from Congress as a whole.

Dissemination

The dissemination of NSF's STEM education research—including research evaluating the effectiveness of NSF STEM education programs—to other federal agencies and education stakeholders is an ongoing policy challenge.

Some policy makers have responded to the dissemination challenge by seeking improved collaboration between federal agencies at both the portfolio and program levels. At the portfolio level, for example, the NSTC's federal STEM education strategy proposes sharing evidence-based approaches (e.g., established by research) as a primary strategy toward accomplishing federal STEM education goals.[47] At the program level, the Administration's FY2014 budget request seeks funding for at least two STEM education collaborations between NSF and ED.[48] Whether these collaborations (if funded) will prove successful depends on program managers' willingness to collaborate, on executive branch leadership support for collaboration, and on the institutional cultures of the respective agencies, among other things.

Other strategies to address the dissemination challenge include policies directing NSF to independently distribute STEM education research to stakeholders. For example, the House Appropriations Committee report on Commerce, Justice, Science, and Related Agencies Bill, 2012 (H.Rept. 112-169) directed NSF to independently distribute research on best practices in STEM education to stakeholders. H.Rept. 112-169 also directed the NSF to develop methods to track and evaluate stakeholders' implementation of that research and to report to Congress on progress.[49] In response to these and related congressional directives, NSF funded a National

---

[46] Jeffrey Mervis, "An Invisible Hand Behind Plan to Realign U.S. Science Education," *Science*, vol. 341 (July 26, 2013), pp. 338-341. See also, "Science Education Overhaul," *Chemical & Engineering News* (June 17, 2013), pp. 25-28.

[47] For more information on the effort to establish a federal STEM education strategy, see the section of this report titled, "A Federal STEM Education Strategy."

[48] In addition to the Mathematics and Science Partnership program, NSF's *FY2014 Budget Request to Congress* includes funding for the K-16 Mathematics Initiative. The K-16 Mathematics Initiative is a joint NSF-ED project focused on student learning of mathematics at the K-16 levels.

[49] U.S. Congress, House Committee on Appropriations, *Commerce, Justice, Science, and Related Agencies Bill, 2012*, report together with minority views to accompany H.R. 2596, 112th Cong., 1st Sess., H.Rept. 112-169, July 20, 2011 (Washington, DC:GPO 2011), pp. 84-85.

Research Council study on successful STEM education and held a series of workshops around the country on promising practices in STEM education.[50]

What Impact Might Changes in the NSF STEM Education Account Have on Research Activities at NSF?

Although this report focuses on NSF STEM education programs, many of those programs are co-funded (e.g., they receive funding from other foundation accounts, principally R&RA). As such, changes in the main NSF education account may impact the main research account.

For example, the R&RA contribution to E&T activities increased by 85% (from $143 million to $264 million) between FY2003 and FY2012. Some of this increase may be attributable to policy changes made by Congress and the President. Section 510 of the America COMPETES Reauthorization Act of 2010 (P.L. 111-358) requires NSF to fund the GRF program with equal contributions from both R&RA and E&HR. NSF has increased the R&RA contribution to the GRF program in accordance with Section 510. Further, because the GRF program is typically classified as an E&T activity, this change may account for some of the increase in R&RA funding for E&T activities. However, R&RA funding for E&T activities was increasing prior to the enactment of Section 510.

The impact of these funding dynamics on NSF's research capacity is unclear. FY2012 R&RA funding for E&T was $264 million, which was high compared to the historic average for E&T funding in the R&RA account, but was still less than 5% of the total R&RA budget that year ($5.758 billion). One interpretation of these changes in R&RA is that they represent a deeper integration of the foundation's complementary research and education missions. The research experience is sometimes perceived as serving educational purposes,[51] just as support for education may ultimately benefit the research enterprise. However, an alternative explanation might be that budgetary fluctuations or stagnation in the main education account put pressure on the main research account. Congress may wish to consider whether and to what extent the R&RA account should serve education and training purposes and whether the main education account is sufficient for congressional priorities in these areas.

Options for Congress

Among the several options available to Congress are the following.

- **Maintain NSF budget as it is.** If Congress seeks to preserve NSF's budgetary autonomy, it could maintain the NSF budget as it is, making no significant increases or reductions and without directing the agency to change the distribution of funding between its main research and education accounts. This would provide the foundation its historical discretion, while Congress could continue to guide its activities through the oversight process.

[50] More information about this effort is available at http://successfulstemeducation.org/.

[51] For example, some STEM education advocates argue that early undergraduate research opportunities are critical learning experiences and important to the STEM educational process.

- **Increase funding for STEM education at NSF.** If Congress seeks to increase NSF's STEM education capacity and its role in the federal portfolio, it could provide additional funding for NSF's STEM education activities. It could
    - *Increase funding for E&HR*—Congress could do this by either shifting funding from other appropriations accounts to E&HR or by providing additional funding directly to the main education account. A shift in funding from other accounts to E&HR would not necessarily result in a real increase to NSF's STEM education programs (particularly if the reductions were to R&RA, which could presumably offset such reductions by limiting its contributions to co-funded programs). Further, reductions to other accounts may limit NSF's ability to meet Congress's non-STEM education priorities.
    - *Increase the R&RA contribution to E&T*—Another way to increase overall funding for education at the NSF would be to increase the R&RA contribution to E&T activities through increased contributions to co-funded activities. Congress could do this with or without overall increases to the NSF and R&RA; however, if R&D funding does not also increase at the rate of inflation, purchasing power may be lost. Increasing R&RA contributions to E&T activities may deepen the integration of these complementary NSF missions or may put pressure on research activities.
- **Decrease funding for STEM education at NSF.** If Congress seeks to capture savings from the NSF budget or prioritize STEM education activities at other federal agencies, it could reduce funding for NSF STEM education programs. To this end, Congress has at least two options. It could prioritize certain programs—for example, by either portfolio role or performance—and reduce others. Alternatively, it could reduce topline support for E&HR and limit the percentage of R&RA that may be used for E&T.
    - *Prioritization*—In general, prioritization of certain programs might result in savings, depending on the choices policy makers make about reductions and support for the programs it preserves. However, congressional prioritization of NSF's STEM education programs may challenge the foundation's historical autonomy, which many analysts see as essential to its scientific mission. Congress has at least two options for prioritizing NSF's STEM education programs: portfolio role and performance.
        - *By Portfolio Role*—Instead of treating NSF's education activities as a single function, Congress could separate NSF's STEM education R&D programs from its student and institutional aid programs. Congress could then establish differential funding rates for NSF's STEM education R&D and aid programs. For example, some analysts suggest that research funding is most efficient when provided in predictable incremental increases (as opposed to wide variations, which impose adjustment costs). However, demand for student and institutional aid tends to be affected by factors that vary—such as population size, general economic conditions, and state education budgets, among others.
        - *By Performance*—Congress could direct NSF to develop a framework for evaluating its STEM education programs. That framework could incorporate factors that reflect the importance of the program to NSF's mission, to the federal STEM education portfolio, to the constituencies

served, to the field (e.g., intellectual merit), and to other congressional criteria. Policy makers at NSF and Congress could use this information to prioritize funding for NSF's STEM education programs. A performance approach to reductions could increase the effectiveness of NSF's STEM education programs. However, one of the challenges of the performance approach is that the criteria by which decisions are made may not reflect the full value of the programs and as a result, effective programs may be unintentionally terminated.

  - *Decrease topline funding for E&HR and limit the percentage of R&RA that may be used for E&T.* Given the important role played by federal funding for fundamental research—most of NSF-funded research is basic research—Congress could prioritize NSF's research activities over its education activities and continue assigning most of the foundation's funding growth to the research account. To the extent that NSF's STEM education programs are unique to the federal effort, this may affect the portfolio.

- **Use mechanisms other than the NSF to achieve federal STEM education goals.** Congress could meet federal STEM education goals in any number of ways, depending on what those goals are and the policy strategies policy makers pursue. For example, Congress could increase the number of students who are interested in and prepared to study STEM subjects in college by increasing funding for Advanced Placement or other gifted student programs at ED. Other analysts may seek to increase general federal student aid (e.g., Pell program), which also serves STEM students (along with all others) but does not create incentives for students to pursue degrees in certain fields. Some policy makers may prefer to leave such matters to state and local governments to decide.

- **Decrease funding for STEM education across the portfolio.** If Congress seeks to prioritize other national concerns (e.g., national debt, defense, health care), it may choose to reduce funding for STEM education across the federal enterprise. Federal agencies may respond to reduced funding levels by limiting STEM education activities. Congress may wish to consider providing guidance to federal agencies to ensure that legislative priorities are maintained.

As Congress weighs these various options, it may be useful to consider the short-, medium-, and long-term impact of congressional funding choices on the entire federal STEM education portfolio, on the respective research and education missions of the NSF, and on the general policy purposes (e.g., advancement of the national STEM labor supply) these investments seek to serve.

Appendix A. Character Class Data

Table A-1. NSF Funding by Character Class (Current)

FY2003-FY2012 Actual, In Millions, Rounded

Class	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
R&D	$3,944	$4,166	$4,098	$4,240	$4,407	$4,506	$4,729	$5,488	$5,537	$5,705
NIA	$524	$545	$559	$624	$675	$722	$843	$584	$576	$593
E&T	$901	$941	$824	$783	$803	$856	$897	$900	$800	$807
Total	**$5,369**	**$5,652**	**$5,481**	**$5,646**	**$5,884**	**$6,084**	**$6,469**	**$6,972**	**$6,912**	**$7,105**

Source: CRS calculations based on data provided by the NSF.

Table A-2. NSF Funding by Character Class (2005 Constant)

FY2003-FY2012 Actual, In Millions, Rounded

Class	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
R&D	$4,175	$4,302	$4,098	$4,100	$4,139	$4,137	$4,286	$4,924	$4,866	$4,923
NIA	$555	$562	$559	$603	$634	$662	$764	$524	$506	$512
E&T	$954	$972	$824	$757	$754	$786	$813	$808	$703	$696
Total	**$5,684**	**$5,836**	**$5,481**	**$5,460**	**$5,527**	**$5,585**	**$5,863**	**$6,256**	**$6,075**	**$6,131**

Source: CRS calculations based on data provided by the NSF.

Appendix B. Appropriations Data

Table B-1. NSF Appropriations by Account (Current)

FY2003- FY2012 Actual, In Millions, Rounded

Account	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
R&RA	$4,144	$4,388	$4,328	$4,449	$4,758	$4,853	$5,152	$5,615	$5,608	$5,758
E&HR	$846	$850	$750	$700	$696	$766	$846	$873	$861	$831
MREFC	$179	$184	$165	$234	$166	$167	$161	$166	$125	$198
AOAM	$189	$219	$223	$247	$248	$282	$294	$300	$299	$299
NSB	$3	$2	$4	$4	$4	$4	$4	$4	$4	$4
OIG	$9	$9	$10	$11	$12	$12	$12	$14	$14	$14
Total	**$5,369**	**$5,652**	**$5,481**	**$5,646**	**$5,884**	**$6,084**	**$6,469**	**$6,972**	**$6,913**	**$7,105**

Source: CRS calculations based on data provided by the NSF.

Table B-2. NSF Appropriations by Account (2005 Constant)

FY2003- FY2012 Actual, In Millions, Rounded

Account	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
R&RA	$4,387	$4,530	$4,328	$4,303	$4,470	$4,455	$4,670	$5,038	$4,929	$4,969
E&HR	$895	$878	$750	$677	$653	$703	$766	$783	$757	$717
MREFC	$190	$190	$165	$226	$156	$153	$146	$149	$110	$171
AOAM	$201	$226	$223	$239	$233	$259	$267	$269	$263	$258
NSB	$3	$2	$4	$4	$3	$4	$4	$4	$4	$4
OIG	$9	$10	$10	$11	$11	$11	$11	$13	$12	$12
Total	**$5,684**	**$5,836**	**$5,481**	**$5,460**	**$5,527**	**$5,585**	**$5,863**	**$6,256**	**$6,075**	**$6,131**

Source: CRS calculations based on data provided by the NSF.

Author Contact Information

(name redacted)
Specialist in Science and Technology Policy
[redacted]@crs.loc.gov, 7-....