United States Government Accountability Office

Report to Congressional Requesters

March 2018

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION

Actions Needed to Better Assess the Federal Investment

GAO-18-290

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GAO Highlights

Highlights of GAO-18-290, a report to congressional requesters

Why GAO Did This Study

Education programs in STEM fields are intended to enhance the nation's global competitiveness. GAO reported in 2012 that there were more than 200 federal STEM education programs in fiscal year 2010. Since then, this portfolio of programs has changed. GAO was asked to review the landscape of federal STEM education programs.

This report examines (1) how the federal investment in STEM education programs changed from 2010 to 2016, and (2) the extent to which the STEM education portfolio has been assessed. To answer these questions, GAO administered a web-based questionnaire to all federal STEM education programs funded in fiscal year 2016 and analyzed the results. GAO also reviewed relevant federal laws and agency documents, examined the implementation of relevant assessment requirements, and interviewed officials from relevant federal agencies.

What GAO Recommends

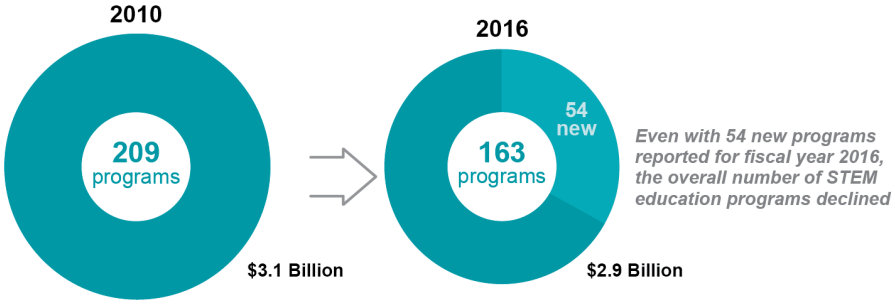
GAO is making four recommendations, including three to the Committee on STEM Education to review performance assessments of STEM education programs, document those assessments, and report programs' participation rates of underrepresented groups. The Committee on STEM Education agreed with GAO's recommendations.

View GAO-18-290. For more information, contact Melissa Emrey-Arras at (617) 788-0534 or EmreyArrasM@gao.gov.

What GAO Found

The federal investment in science, technology, engineering, and mathematics (STEM) education programs remained relatively stable from fiscal years 2010 to 2016, although the number of programs declined from 209 to 163 (see figure). While agencies reported that many of the same STEM education programs existed during this time period, the portfolio underwent various changes, including program consolidations, creations, and terminations. Nearly all STEM education programs in fiscal year 2016 overlapped to some degree with at least one other program in that they offered similar services to similar groups in similar STEM fields to achieve similar objectives. The Committee on STEM Education, an interagency body responsible for implementing the federal STEM education strategic plan, reported it managed this overlap through coordination with agencies administering these programs.

Number of Federal Science, Technology, Engineering, and Mathematics (STEM) Education Programs Reported in Fiscal Years 2010 and 2016



Source: GAO analysis of information reported by agency officials on STEM education programs. | GAO-18-290

The Committee on STEM Education has not fully met its responsibilities to assess the federal STEM education portfolio. Specifically, the Committee has not reviewed programs' performance assessments, as required by its authorizing charter, nor has it documented those assessments in its inventory, as required by law. Such efforts could encourage the use of evidenced-based practices across the portfolio—a key national goal of the STEM education strategic plan. These efforts could also enhance public awareness of the administering agencies' efforts to assess programs' performance. In addition, the Committee has not reported the participation rates of underrepresented groups in federal STEM education programs, as required by law. By reporting this information, the Committee could better assess whether programs are broadening access to groups historically underrepresented in STEM fields—another key goal of the strategic plan.

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Abbreviations

STEM	Science, Technology, Engineering, and Mathematics

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
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March 23, 2018

The Honorable Trey Gowdy
Chairman
The Honorable Elijah E. Cummings
Ranking Member
Committee on Oversight and Government Reform
House of Representatives

The Honorable Robert C. Scott
Ranking Member
Committee on Education and the Workforce
House of Representatives

Education programs in science, technology, engineering, and mathematics (STEM) play an important role by preparing students for careers in STEM fields and are intended to enhance the nation's global competitiveness. Various levels of government foster STEM education, as do other stakeholders, including institutions of higher education, professional and scientific societies, and private industries. In 2012, we reported that more than 200 federal STEM education programs across 13 different agencies spent more than $3 billion in fiscal year 2010.[1] We also found a high degree of overlap among those programs and made several recommendations to improve their coordination and management. You asked us to review the current landscape of federal STEM education programs. This report examines: 1) how the federal investment in STEM education programs changed from 2010 to 2016, and 2) to what extent the STEM education portfolio has been assessed.

To gather information on how the federal investment in STEM education changed from 2010 to 2016, we administered a web-based questionnaire to STEM education programs funded in fiscal year 2016. We identified these programs based on input from the 13 agencies that administered the STEM education programs we previously reported for fiscal year 2010.[2] Program officials provided information on all 163 programs funded

[1] GAO, *Science, Technology, Engineering, And Mathematics Education: Strategic Planning Needed to Better Manage Overlapping Programs across Multiple Agencies*, GAO-12-108 (Washington, D.C.: Jan. 20, 2012).

[2] GAO-12-108

in fiscal year 2016 that we determined met our definition of a STEM education program. For more information on our definition, program identification, and data collection, see appendix I. The questionnaire solicited information on the programs' objectives, groups served, services provided, and spending, among other things, and we analyzed program officials' responses. We used this information to gauge the level of overlap among programs funded in fiscal year 2016. We also compared the results to similar data previously collected for programs funded in fiscal year 2010.

To understand the extent to which the federal programs within the STEM education portfolio had been assessed, we reviewed the requirements in the America COMPETES Reauthorization Act of 2010 (COMPETES Act)[3] regarding federal STEM education program assessment.[4] Subsequently, we examined the information produced to fulfill these requirements, including a strategic plan and annual progress reports. We sent our initial determination of whether these COMPETES Act requirements had been fulfilled to the entities responsible for implementing them and solicited their views. We obtained a response from the Office of Science and Technology Policy as to whether the requirements had been fulfilled and considered any additional information the agencies provided in finalizing our analysis. In addition, we reviewed the assessment responsibilities of the Committee on STEM Education as specified in its authorizing charter and examined its efforts to meet those responsibilities. Further, we conducted a limited review to test whether program assessment

[3] Pub. L. No. 111-358, 124 Stat. 3982.

[4] For the purposes of our report, we use the term performance assessment to refer to agencies' efforts to assess the effectiveness of their programs. We have previously reported that performance assessment is an important way to obtain evaluative information that can help demonstrate whether and why a program is working well. Agencies may use different methods to assess the performance of their programs. For example, performance measurement focuses on whether a program has achieved its objectives, expressed as measureable standards, while program evaluations typically examine a broader range of information on program performance and its context. See, GAO, *Managing for Results: Enhancing Agency Use of Performance Information for Management Decision Making*, GAO-05-927 (Washington, D.C.: Sept. 9, 2005); *Performance Measurement and Evaluation: Definitions and Relationships*, GAO-11-646SP (Washington, D.C.: May 2011); and *Program Evaluation: Strategies to Facilitate Agencies' Use of Evaluation in Program Management and Policy Making*, GAO-13-570 (Washington, D.C.: June 26, 2013).

information was routinely contained within agency budget documents.[5] In response to our questionnaire, program officials reported that 73 of the 163 STEM education programs had been evaluated since fiscal year 2010. From those 73, we randomly selected a nongeneralizable sample of 10 STEM education programs—one from each agency that reported it had evaluated at least one of its STEM education programs recently. We then searched for supporting information within the agencies' budget documents.

In addition, we interviewed officials responsible for coordinating federal STEM education efforts from the National Science Foundation and the Office of Science and Technology Policy. We also interviewed officials from the Office of Management and Budget and other federal agencies leading strategic interagency efforts on STEM education, including the National Aeronautics and Space Administration, the Departments of Education, Energy, Health and Human Services, and the Smithsonian Institution. Further, to inform both of our objectives, we reviewed relevant federal laws and regulations as well as reports on STEM education.

We conducted this performance audit from October 2016 to March 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

STEM Education

The term "STEM education" includes educational activities across all grade levels—from preschool to graduate school. STEM education programs have a variety of primary objectives, which include preparing students for STEM coursework, providing postsecondary students with grants or fellowships in STEM fields, and improving STEM teacher training (see appendix I for our definition of STEM education programs).[6]

[5] For this review, we used the definition of performance assessment found in GAO-11-646SP. Therefore, if an entry referenced an evaluation or contained performance information, we included it in our total.

[6] This definition is consistent with the definition of STEM education used in GAO-12-108.

Federal STEM education programs have been created in two ways—either by law or by federal agencies under their statutory authorities.

We previously reported that most federal STEM education programs overlapped to some degree with at least one other program, in that they offered similar services to similar groups in similar STEM fields to achieve similar objectives (see sidebar for definition of overlap).[7]

Although those programs may not be duplicative, we reported that they were similar enough that they needed to be well coordinated and guided by a robust strategic plan. And, through its strategic planning and other coordination efforts, the Office of Science and Technology Policy and the National Science and Technology Council implemented our recommendations to work with agencies to better align their activities with a government-wide strategy; develop a plan for sustained coordination; identify programs for potential consolidation or elimination; and assist agencies in determining how to better evaluate their programs.[8]

GAO's Work on Duplication, Overlap, and Fragmentation

This report, like GAO's prior work, uses standard definitions to describe duplication, overlap, and fragmentation, among government programs:

- **Duplication** occurs when two or more agencies or programs are engaged in the same activities or provide the same services to the same beneficiaries.
- **Overlap** occurs when multiple agencies or programs have similar goals, engage in similar activities or strategies to achieve their goals, or aim to serve similar beneficiaries.
- **Fragmentation** refers to those circumstances in which more than one federal agency (or more than one organization within an agency) is involved in the same broad area of national need and opportunities exist to improve service delivery.

Source: GAO, *Fragmentation, Overlap, and Duplication: An Evaluation and Management Guide,* GAO-15-49SP (Washington, D.C.: April 14, 2015). | GAO-18-290

America COMPETES Reauthorization Act of 2010

Enacted in 2007, the America COMPETES Act authorized several programs to promote STEM education.[9] The America COMPETES Reauthorization Act of 2010 (COMPETES Act) reauthorized the America COMPETES Act and addresses coordination and oversight issues, including those associated with the coordination and potential duplication of federal STEM education efforts.[10] The COMPETES Act required the Director of the Office of Science and Technology Policy to establish, under the National Science and Technology Council, the Committee on

[7] GAO-12-108.

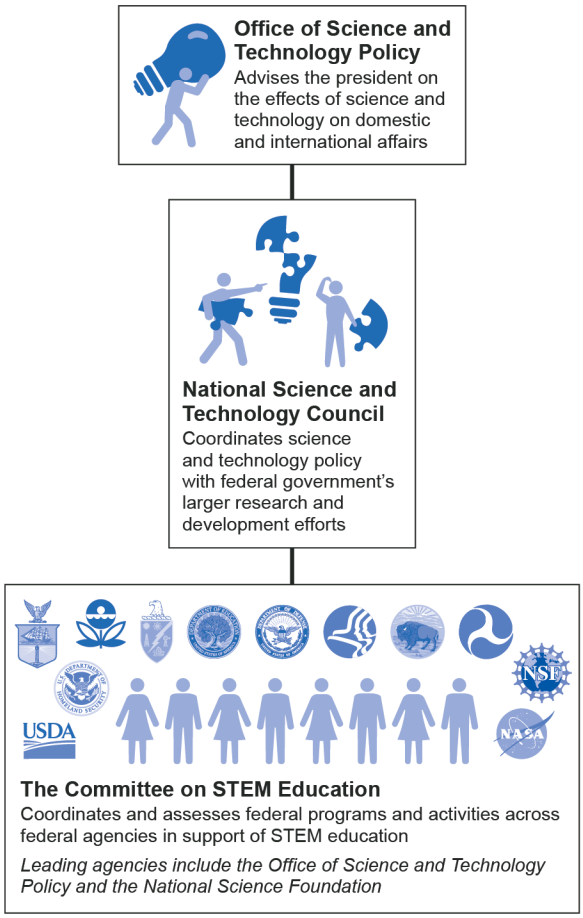
[8] The National Science and Technology Council is the principal body within the executive branch that coordinates science and technology policy across the federal government's research and development efforts.

[9] Pub. L. No. 110-69, 121 Stat. 572 (2007).

[10] Pub. L. No. 111-358, 124 Stat. 3982. For ease of reference, for purposes of this report we refer to the America COMPETES Reauthorization Act of 2010 as the COMPETES Act.

STEM Education to serve as the interagency coordination body for STEM education in the federal government (see fig. 1).[11]

Figure 1: Leadership Structure for Policy on Science, Technology, Engineering, and Mathematics (STEM) Education

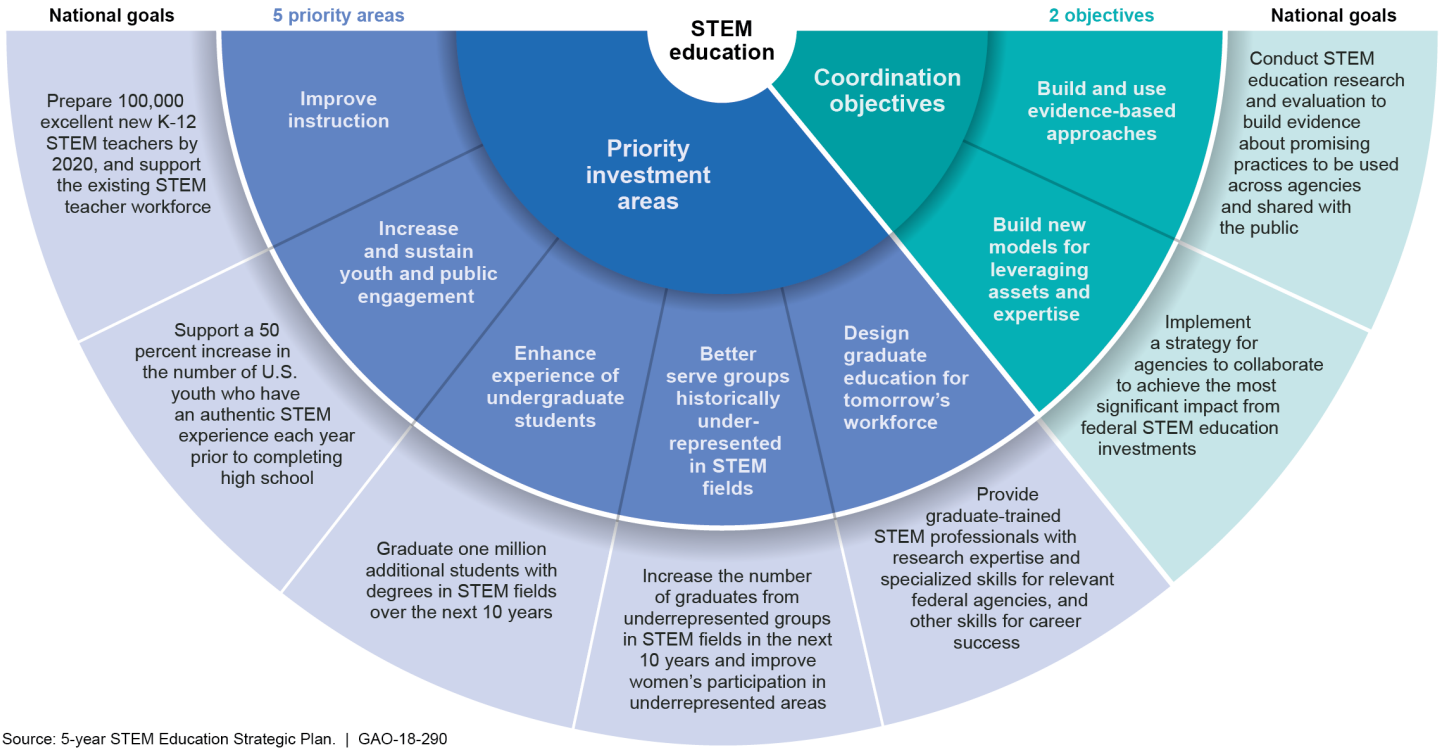


Source: GAO. | GAO-18-290

In May 2013, the Committee on STEM Education issued a 5-year Strategic Plan for federal STEM education efforts, as required by the COMPETES Act. To improve collaboration across the portfolio, the Strategic Plan identified five priority investment areas and two coordination objectives, specifying national goals for each (see fig. 2).

[11] Pub. L. No. 111-358, § 101(a), 124 Stat. 3982, 3984 (codified at 42 U.S.C. § 6621(a)).

Figure 2: Science, Technology, Engineering, and Mathematics (STEM) Education National Goals, Priority Investment Areas, and Coordination Objectives



Source: 5-year STEM Education Strategic Plan. | GAO-18-290

Note: The Strategic Plan defines historically underrepresented groups as Hispanics and Latinos, African Americans, American Indians, Alaska Natives, Native Hawaiians and Pacific Islanders, the economically disadvantaged, people with disabilities, and women and girls.

The COMPETES Act also requires that the Committee create, and periodically update, an inventory of federal STEM education programs that includes documentation of program assessments and the participation rates of women, underrepresented minorities, and persons in rural areas.[12]

[12] 42 U.S.C. § 6621(b)(6).

In addition, the COMPETES Act requires that the Office of Science and Technology Policy publish annual reports on coordinating federal STEM education efforts. The law mandates that these reports include specific information, such as:

- a description of each federal agency's STEM education programs funded in the previous and current fiscal years, as well as those proposed under the President's budget request;
- the levels of funding for each participating federal agency's programs described above;
- an evaluation of the levels of duplication and fragmentation of the programs described above; and
- a description of the progress made implementing the Strategic Plan, including a description of the outcome of any program assessments completed in the previous year, and any changes made to the Strategic Plan since the previous annual report.[13]

In January 2017, the President signed into law the American Innovation and Competitiveness Act, which, among other things, amended certain provisions of the COMPETES Act.[14] The Act added some requirements for both the Office of Science and Technology Policy and the Committee on STEM Education. For example, it created new mandates for the Committee to:

- review the measures federal agencies use to evaluate their STEM education programs, and
- make recommendations for reforming, terminating, or consolidating the federal STEM portfolio.[15]

[13] 42 U.S.C. § 6621(d).

[14] Pub. L. No. 114-329, 130 Stat. 2969 (2017).

[15] Pub. L. No. 114-329, § 304(a)(3), 130 Stat. 2969, 3006 (2017) (codified at 42 U.S.C. § 6621(b)(8), (10)).

Any such recommendations for an upcoming fiscal year are to be included in the Office of Science and Technology Policy's annual report.[16]

Cross-agency Priority Goal on STEM Education

In 2014, the Office of Management and Budget, in consultation with the federal agencies that administer STEM education programs, established STEM education as a cross-agency priority goal.[17] The Office of Science and Technology Policy and the National Science Foundation led the oversight and management of this goal, and as part of this work, goal leaders from these agencies identified milestones that aligned with the Strategic Plan's priority investment areas and coordination objectives (see fig. 2). For example, goal leaders reported progress toward meeting key milestones associated with improving STEM instruction. In 2017, to ensure alignment with the current administration's priorities, the Office of Management and Budget removed the priority status of all cross-agency priority goals, including STEM education; this ended the required public issuance of quarterly priority goal reports.[18] The STEM Education goal's final quarterly progress report was issued at the end of fiscal year 2016.

Other Data and Transparency Requirements

Other government-wide efforts are underway to improve the transparency around federal programs in general. These efforts are not directed at the STEM education programs specifically, but may assist in managing the STEM education portfolio. The GPRA Modernization Act of 2010 requires the Office of Management and Budget to present a coherent inventory of all federal programs by making information about each federal program available on a website.[19] However, we previously reported that, because agencies used different approaches to define their programs, comparability of programs within and across agencies on this inventory

[16] The Office of Science and Technology Policy's annual report is mandated to be sent to Congress at the time of the President's budget request, which is required by law to be submitted no later than the first Monday in February. 42 U.S.C. § 6621(c), 31 U.S.C. § 1105(a).

[17] Cross-agency priority goals are 4-year outcome-oriented goals covering a number of complex or high-risk management and mission issues.

[18] GAO, *Managing for Results: Further Progress Made in Implementing the GPRA Modernization Act, but Additional Actions Needed to Address Pressing Governance Challenges,* GAO-17-775 (Washington, D.C.: Sept. 29, 2017).

[19] Pub. L. No. 111-352, § 7, 124 Stat. 3866, 3876 (2011), *codified at* 31 U.S.C. § 1122. The GPRA Modernization Act of 2010 enhanced the Government Performance and Results Act of 1993 (GPRA) (Pub. L. No. 103-62, 107 Stat. 285 (1993)).

was limited.[20] We recently identified a potential framework for the development of a useful federal program inventory.[21] The Office of Management and Budget decided to postpone further development of the inventory in order to coordinate with the implementation of related requirements of the Digital Accountability and Transparency Act of 2014.[22] Once fully implemented, this act is expected to expand the types and transparency of public information on federal spending to make it easier to track it to specific federal programs. The act requires government-wide reporting on a greater variety of data related to federal spending, such as budget and financial information, as well as tracking of these data at multiple points in the federal spending lifecycle.[23]

From 2010 to 2016, the Number of STEM Education Programs Decreased While Spending Remained Stable, and Most Programs Continued to Overlap

[20] GAO, *Government Efficiency and Effectiveness: Inconsistent Definitions and Information Limit the Usefulness of Federal Program Inventories*, GAO-15-83, (Washington D.C.: Oct. 31, 2014).

[21] GAO, *Federal Programs: Information Architecture Offers a Potential Approach for Development of an Inventory,* GAO-17-739 (Washington, D.C.: Sept. 28, 2017).

[22] Pub. L. No. 113-101, 128 Stat. 1146.

[23] We recently reported on implementation of the Act. GAO, *DATA Act: OMB, Treasury, and Agencies Need to Improve Completeness and Accuracy of Spending Data and Disclose Limitations*, GAO-18-138 (Washington, D.C.: Nov. 8, 2017).

Agencies Reported Fewer STEM Education Programs and Relatively Stable Levels of Spending in Fiscal Year 2016 Compared to Fiscal Year 2010

Program officials from the 13 federal agencies that administer STEM education programs reported a total of 163 STEM education programs in fiscal year 2016, compared to 209 programs in fiscal year 2010. Three agencies—the Department of Energy, the Department of Health and Human Services, and the National Science Foundation—administered more than half of all STEM education programs in fiscal years 2010 and 2016.

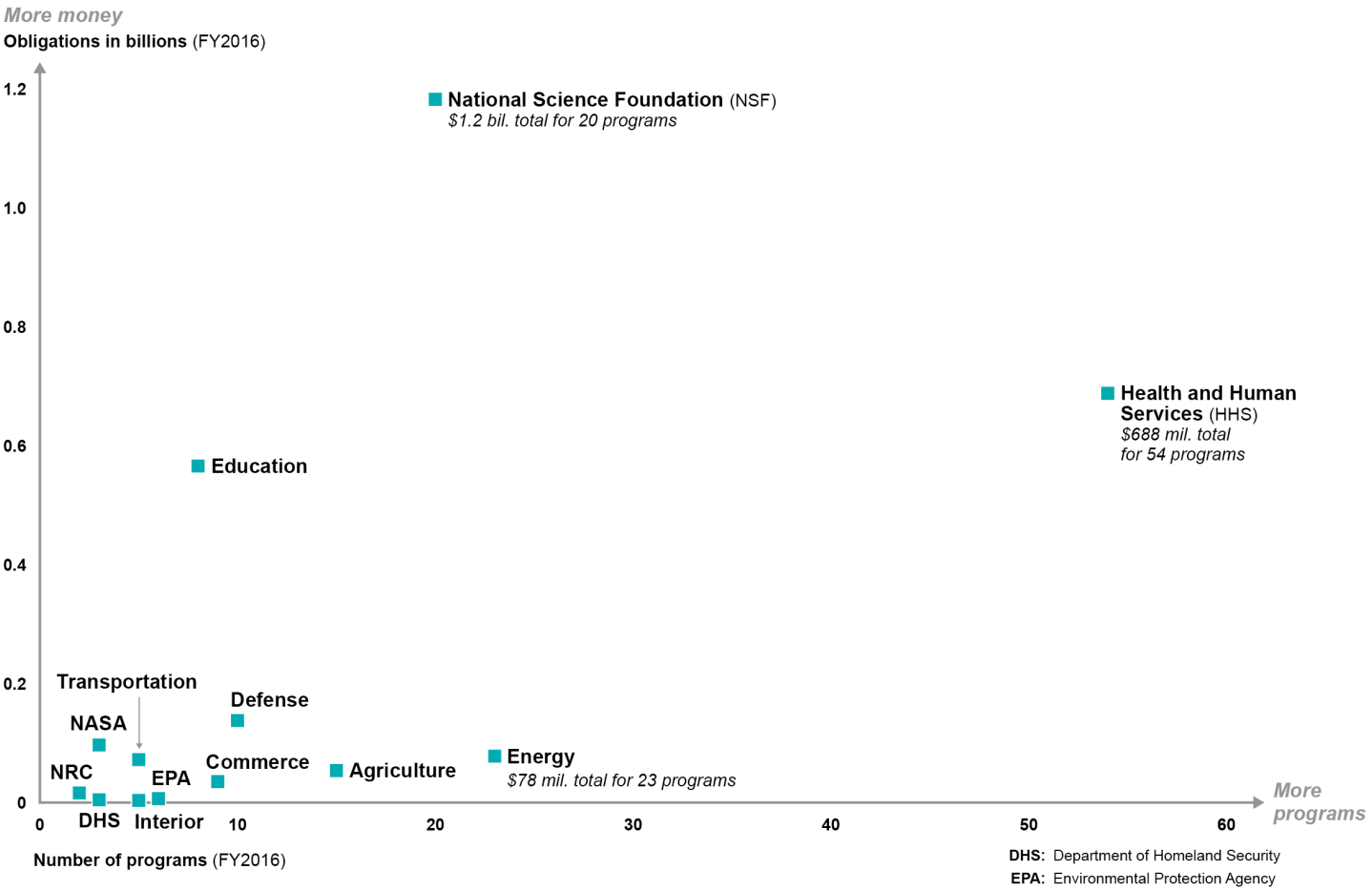
Despite collectively reporting fewer STEM education programs, program officials responding to our questionnaire reported spending about the same amount in fiscal year 2016 as they did in fiscal year 2010. In fiscal year 2016, program officials reported spending about $2.9 billion on the 163 programs.[24] Spending by individual programs ranged from about $14,000 annually to hundreds of millions of dollars.[25] The National Science Foundation and the Department of Health and Human Services programs account for about 60 percent of this spending. Figure 3 provides an agency-level summary of the number of programs and their reported spending. Appendix II contains a complete list of the 163 STEM education programs and their reported spending for fiscal year 2016.[26]

[24] Fiscal year 2010 obligations for STEM education programs were $3.1 billion. When adjusted for inflation, these program obligations are approximately $3.4 billion in 2016 dollars.

[25] The Department of Agriculture's 1890 National Scholars Program has not obligated any funds to the public. It is a share-cost program supported by Department of Agriculture agencies.

[26] Federal agencies also carried out other activities related to STEM education; however, as we previously reported, these activities did not fit our definition of a STEM education program because STEM education was not the primary objective. These efforts include broad-based programs with STEM components, programs that enhance the general public's knowledge of STEM, and research programs that may hire students. For example, grant programs may offer competitive preference to applicants that propose activities in alignment with the administration's priority of advancing STEM education, without making it a requirement for funding.

Figure 3: Number of Science, Technology, Engineering, and Mathematics (STEM) Education Programs by Agency and Total Reported Spending, Fiscal Year 2016



Source: GAO analysis of fiscal year 2016 data as reported by department and agency officials. | GAO-18-290

Note: GAO asked program officials to report on obligations—defined as definite commitments that create a legal liability of the government for the payment of goods and services ordered or received, or a legal duty on the part of the United States that could mature into a legal liability. Payment may be made immediately or in the future. An agency incurs an obligation, for example, when it places an order, signs a contract, awards a grant, purchases a service, or takes other actions that require the government to make payments to the public or from one government account to another. In this report, we generally refer to obligations as spending.

While agencies reported many of the same STEM education programs in fiscal years 2010 and 2016, the federal portfolio evolved in various ways. About half of the 209 programs previously reported for fiscal year 2010 were reported again for fiscal year 2016—accounting for about two-thirds (109 programs) of the fiscal year 2016 portfolio. The remaining third (54

programs) were newly reported for fiscal year 2016. (See appendix I for more information on changes to the STEM portfolio between fiscal years 2010 and 2016.)

The portfolio underwent various changes from fiscal years 2010 to 2016, including program consolidations, creations, and terminations.[27] According to leadership of the Committee on STEM Education, these changes were due to many factors. One key factor is the STEM Education Strategic Plan, which, among other things, calls for greater efficiency and cohesion across federal STEM education programs. Other factors include agencies' individual priorities, including their mission and budget, and congressional interest in specific programs. For example, agencies reported:

- **Consolidations.** Starting in 2014, for greater efficiency and cohesion, the National Science Foundation consolidated a number of related undergraduate STEM education programs, including STEM Talent Expansion Programs, Transforming Undergrad Education in STEM, and Nanotechnology Undergraduate Education in Engineering.
- **Creations.** Department of Health and Human Services officials reported administering 28 new STEM education programs. These programs are housed in the Department's National Institutes of Health, which generally bases its funding decisions on scientific opportunities and its own peer review process. One new program is the Building Infrastructure Leading to Diversity Initiative. This program supports undergraduate institutions in implementing and studying approaches to engaging and retaining students from diverse backgrounds in biomedical research.
- **Terminations.** Department of Education officials reported that four STEM education programs funded in fiscal year 2010 were terminated before fiscal year 2016. One such program was the Women's Educational Equity program. Congress last funded this program in fiscal year 2010.

[27] In addition, 20 programs previously identified as STEM education for fiscal year 2010 were not recognized by their administering agency as STEM education programs in fiscal year 2016. (See appendix I for more information about the criteria and methodology we used to exclude a program from our inventory.)

Significant Overlap Continued to Exist Among STEM Education Programs, Although Programs May Differ in Meaningful Ways

Based on our analysis of questionnaire responses, nearly all STEM education programs in fiscal year 2016 overlapped with at least one other STEM education program, in that they offered at least one similar service to at least one similar group in at least one similar STEM field to achieve at least one similar objective (see text box). Similar levels of overlap occurred among programs funded in fiscal year 2010.

Similarities Among Overlapping Federal Science, Technology, Engineering, and Mathematics (STEM) Education Programs

Similar Services

Many of the 163 STEM education programs provided similar services. To support students, most programs (143) provided research opportunities, internships, mentorships, or career guidance. In addition, 110 programs supported short-term experiential learning activities, and 99 programs supported long-term experiential learning activities. Short-term experiential learning activities include field trips, guest speakers, workshops, and summer camps. Long-term experiential learning activities last throughout a semester in length or longer. To support teachers, 77 programs provided curriculum development and 45 programs supported teacher in-service training, professional development, or retention activities.

Similar Groups Intended to be Served

Many programs also provided services to similar groups, such as K-12 students, postsecondary students, K-12 teachers, and college faculty. A majority of STEM programs reported primarily benefiting postsecondary students; specifically, 103 programs intended to serve 4-year undergraduate students, 76 intended to serve Master's degree students, and 83 intended to serve doctoral students. Most programs also intended to serve multiple groups; 137 of the 163 programs served two or more groups.

Similar STEM Fields

More than 75 percent of programs focused on specific STEM academic fields of study. The most common fields were biology (85 programs), technology (75 programs), engineering (72 programs), and computer science (71 programs). Of those programs that focused on specific STEM fields of study, about 55 percent (68 programs) focused on 5 or more different fields.

Similar Objectives

Many STEM education programs had similar objectives. An objective of a majority of programs (115) was to provide training opportunities for undergraduate or graduate students in STEM fields. Most programs (139) also reported having multiple primary STEM objectives.

Source: GAO analysis of questionnaire responses provided by agency officials on STEM education programs.| GAO-18-290

Despite these similarities, overlapping programs may differ in meaningful ways, such as their specific field of focus and those programs' stated goals. For example, a primary objective of the Department of Health and Human Services' Cancer Education Grants program and the National Aeronautics and Space Administration's National Space Grant College and Fellowship Project is to provide training opportunities for undergraduate or graduate students in biological sciences, among other fields. However, these programs have different program goals:

- The Cancer Education Grants program aims to develop innovative cancer education programs and cancer research dissemination projects.
- The National Space Grant College and Fellowship Project encourages interdisciplinary education, research, and public service programs related to aerospace.

Although many STEM education programs are designed to provide similar services to similar groups, some programs serve distinct populations within those broader groups, such as minority, disadvantaged, or underrepresented groups.[28] Within the broad group—middle and high school students, an individual program may focus on serving only minority, disadvantaged, or underrepresented students. For example, the Department of Transportation's Garrett A. Morgan Technology and Transportation Education program focuses services on students who are girls and minorities, whereas the Department of Education's Upward Bound Math-Science program aims to serve students who are economically disadvantaged.

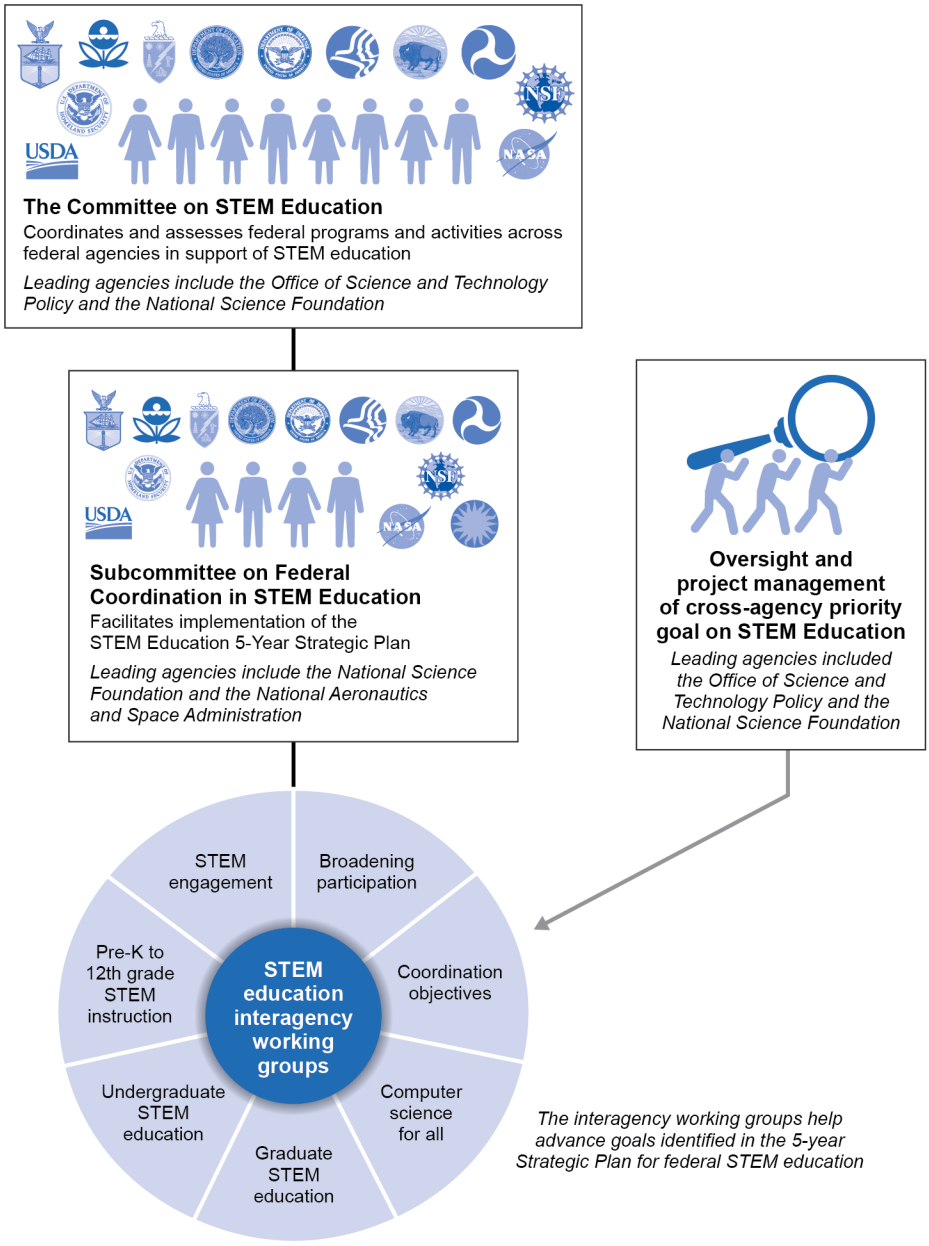
The Committee on STEM Education and the Office of Science and Technology Policy reported managing overlap in the portfolio by coordinating with other agencies through a:

- **Cross-agency priority goal.** Project management and oversight of this goal provided an additional mechanism to facilitate coordination. Goal leaders published quarterly progress reports describing their efforts to achieve each of the five priority investment areas and two coordination objectives.[29]
- **Federal coordination subcommittee.** Creating a federal coordination subcommittee and various interagency working groups helped to advance goals identified in the Strategic Plan. Committee leadership structured working groups to connect agencies with similar programs (see fig. 4).

[28] In response to our questionnaire, program officials reported that 64 of the 163 (39 percent) programs administered in fiscal year 2016 were primarily intended to serve minority, disadvantaged, or underrepresented groups.

[29] GAO has previously reported that the governance structure around cross-agency priority goals has been effective in improving coordination around those goals. GAO, *Managing for Results: OMB Improved Implementation of Cross-Agency Priority Goals, but Could Be More Transparent About Measuring Progress,* GAO-16-509 (Washington, D.C.: May 20, 2016).

Figure 4: Federal Oversight and Working Groups on Science, Technology, Engineering, and Mathematics (STEM) Education



Source: GAO analysis of information reported by agency officials on STEM education programs. | GAO-18-290

Note: The cross-agency priority goal on STEM education ended in May 2017. Also, in August of 2016, subsequent to the issuance of the Strategic Plan, the Committee on STEM Education initiated the Computer Science for All working group.

Efforts to Assess Programs' Performance and Participation Rates of Underrepresented Minorities Are Limited

Performance Assessments of STEM Education Programs Are Not Reviewed or Documented

The Committee on STEM Education and Office of Science and Technology Policy have not fully met their responsibilities to assess the STEM education portfolio.[30] Specifically, the Committee on STEM Education has not reviewed performance assessments of STEM education programs to ensure effectiveness—a primary function of its authorizing charter.[31] Committee leadership acknowledged that they have not conducted such reviews. Overall, the Committee made limited progress advancing its strategic goal of increasing the use of evidence-based approaches because, according to Committee leadership, they focused on achieving other strategic goals. By reviewing programs' performance assessments, the Committee could leverage existing performance information to identify and share promising practices that agencies could use in designing or revising their programs. Moreover, in doing so, the Committee could further its strategic goal of increasing the use of evidence-based approaches across the portfolio of STEM education programs. We previously have reported that managers can use performance information to identify and increase the use of program approaches that are working well.[32] Additionally, such a review could help the Committee meet its new responsibilities under the 2017 American Innovation and Competitiveness Act, including reviewing the measures federal agencies use to evaluate their STEM education programs and making recommendations for terminating, consolidating, and reforming programs in the federal STEM education portfolio.

[30] See appendix III for the implementation status of selected COMPETES Act provisions.

[31] In 2011, the National Science and Technology Council issued a charter establishing the Committee on STEM Education. The charter describes the Committee's purpose and scope, functions, and membership. One of its three functions is to review STEM education activities and programs, and the respective assessments of each, throughout federal agencies to ensure effectiveness.

[32] GAO, Managing for Results: Enhancing Agency Use of Performance Information for Management Decision Making, GAO-05-927 (Washington, D.C.: Sept. 9, 2005).

COMPETES Act Requirement of the Committee on Science, Technology, Engineering, and Mathematics Education

- Create, periodically update, and maintain an inventory of federal STEM education programs that includes documentation of program assessments.

Source: 42 U.S.C. § 6621(b)(6). | GAO-18-290

Further, the Committee on STEM Education has not met the COMPETES Act requirement to document the performance assessments of STEM education programs in its federal STEM inventory (see sidebar).

In 2011, the Committee on STEM Education reported summary information on programs' performance assessments, including the total number of programs funded in fiscal year 2010 that had been evaluated since 2005.[33] However, the information provided was not program-specific; therefore, it is unclear which programs were assessed for effectiveness. Further, that information is outdated, as the STEM education portfolio has changed considerably since 2010, as we have discussed in this report. Committee leadership said they do not have plans to update the summary information provided in 2011, noting that agency budget justifications include program performance assessments. However, we reviewed the budget justifications for 10 STEM education programs that program officials reported had been recently evaluated and found that 8 had no information on performance assessments. By periodically documenting in its federal STEM education inventory whether programs have been assessed for effectiveness, the Committee can enhance communication of performance information among agency officials and stakeholders. This could facilitate the use of performance information by agency managers and lead to greater public awareness regarding the effectiveness of many of the nation's STEM education programs.

COMPETES Act Requirement of the Office of Science and Technology Policy

- Include in its annual report a description of any program assessments completed in the previous year.

Source: 42 U.S.C. § 6621(d)(4). | GAO-18-290

The Office of Science and Technology Policy has not done everything required of it either. It has not described the outcomes of programs' performance assessments completed in the previous year in its annual reports, as required by the COMPETES Act (see sidebar).

[33] According to *The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio*, the 252 STEM education investments reported in fiscal year 2010 were categorized as either broader STEM education or agency-mission specific. Of the 139 broader STEM education investments, 119 had been evaluated since 2005. The 113 agency-mission specific investments were less thoroughly evaluated; 46 of the 113 had collected some outcome data.

Office of Science and Technology Policy officials said that they have not reported on recent program assessments, and added that many STEM education programs were not mature enough to provide sufficient data for a definitive assessment. However, many of the 2016 programs that we identified were at least 7 years old and had been assessed. Specifically, 67 percent (109) of the programs reported by program officials for fiscal year 2016 had also been reported for fiscal year 2010. Of the programs in existence since 2010, 49 percent (53) have been assessed, according to program officials' questionnaire responses. By reporting information on the outcomes of performance assessments completed in the previous year, the Office of Science and Technology Policy could enhance awareness of promising practices in federal STEM education programs.

Program Participation Rates of Underrepresented Groups Are Not Reported

The Committee on STEM Education has not reported STEM education programs' participation rates of groups historically underrepresented in STEM fields, although broadening participation of those groups is one of the Committee's strategic goals.[34] Moreover, the COMPETES Act requires that the Committee report the participation rates of women, underrepresented minorities, and persons in rural areas in its inventory of federal programs (see sidebar).

COMPETES Act Requirement of the Committee on Science, Technology, Engineering, and Mathematics Education

- Create, periodically update, and maintain an inventory of federal STEM education programs that includes documentation of participation rates of women, underrepresented minorities, and persons in rural areas.

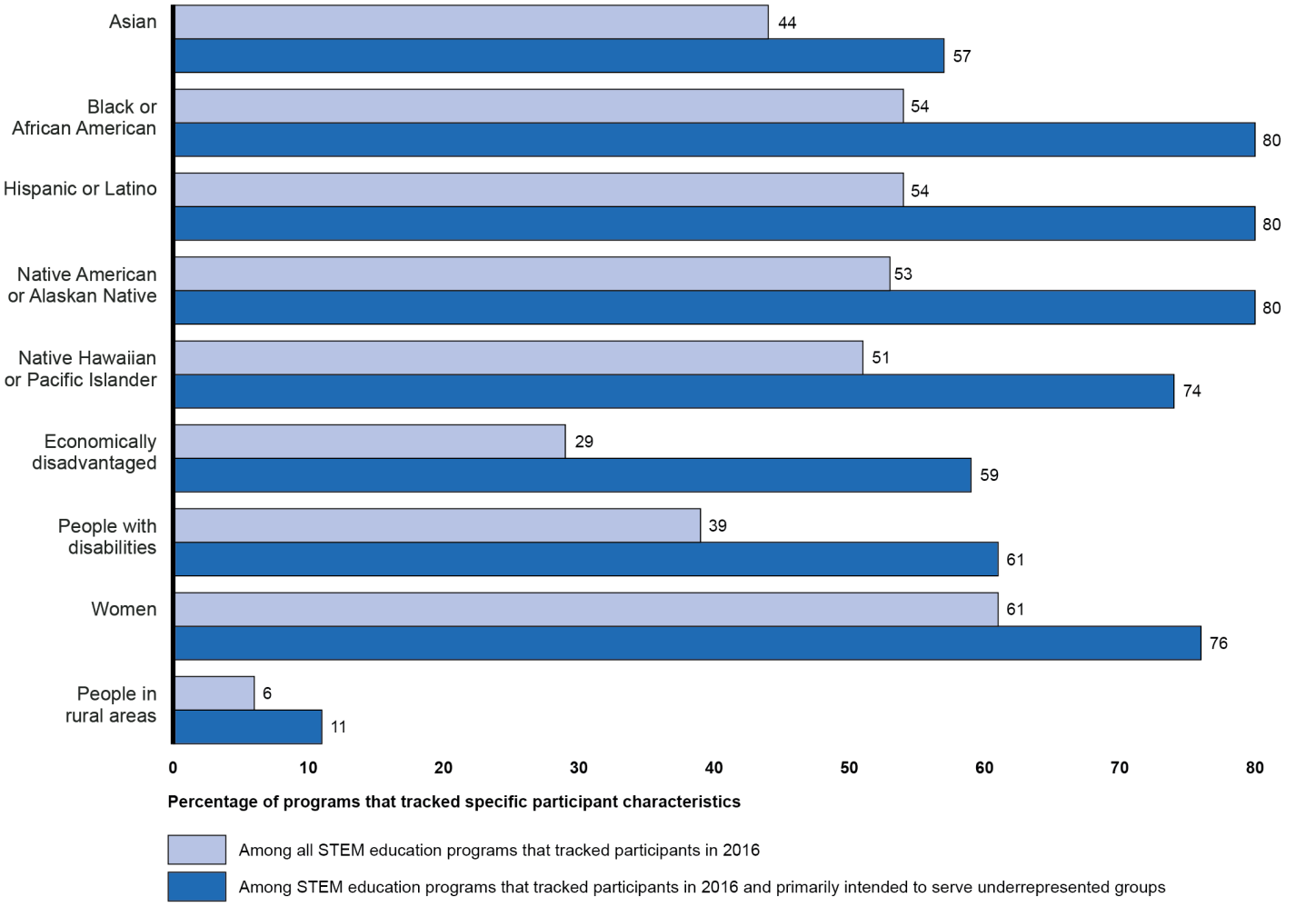
Source: 42 U.S.C. § 6621(b)(6). | GAO-18-290

Committee leadership acknowledged they have not reported these data, and added that such participation data are not fully available across all STEM education programs. However, we found that such participation data were generally available.

In response to our questionnaire, nearly three-quarters of STEM education programs (120 of 163) reported tracking participants in fiscal year 2016. Of those programs, many also tracked specific participant characteristics. For example, 61 percent (73) of programs that tracked participants also captured whether their participants were women and 54 percent (65) documented those who were African American. Programs primarily intended to serve minority, disadvantaged, or underrepresented groups tracked participant characteristics at higher rates than programs that intended to serve broader groups of beneficiaries (see fig. 5).

[34] One priority investment area specified in the Strategic Plan is to better serve groups historically underrepresented in STEM fields. It defines groups underrepresented in STEM fields as Hispanics and Latinos, African Americans, American Indians, Alaska Natives, Native Hawaiians and Pacific Islanders, the economically disadvantaged, people with disabilities, and women and girls.

Figure 5: Percentage of Science, Technology, Engineering, and Mathematics (STEM) Education Programs That Tracked Certain Participant Characteristics in Fiscal Year 2016



Source: GAO analysis of questionnaire responses provided by agency officials on STEM education programs. | GAO-18-290

In addition, 7 of the 13 administering agencies, such as the Department of Health and Human Services, reported that they tracked participation in fiscal year 2016 for at least two-thirds of their STEM education programs.[35] Officials from the Department of Health and Human Services

[35] The seven agencies that reported via our questionnaire that they tracked the number of participants for at least two-thirds of their programs are the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, and Interior, and the Environmental Protection Agency.

said that the department maintains data for many of its STEM education programs in a database that captures individual participants' demographic data, including race and gender, and aggregates such information for internal reporting. Officials also said they use this information to evaluate whether individual programs are meeting their goals of serving particular groups. Although we found that many agencies reported collecting data on participants in their STEM education programs, the Committee on STEM Education has not reported such information in its inventory, as required.

Reporting information on the participation rates of women, underrepresented minorities, and persons in rural areas could help the Committee assess whether STEM education programs have broadened participation to groups historically underrepresented in STEM fields—a key goal of the Strategic Plan. Committee leadership said they measured progress toward this goal with general performance indicators, such as the number of women who earned STEM degrees, regardless of participation in federal programs, because such data were readily available. However, those performance indicators are influenced by various factors, including some external to federal STEM education efforts. For example, the number of women earning STEM degrees could be affected by broader economic factors or college enrollment trends, rather than the activities of the agencies.

Conclusions

The federal government continues to invest billions of dollars annually in STEM education programs to enhance the nation's economic and educational competitiveness. Since 2010, the federal portfolio of STEM education programs has evolved considerably. The Committee on STEM Education reported that, through its leadership and strategic planning efforts, it fostered coordination among agencies administering STEM education programs, which helped them implement the STEM Education Strategic Plan. Such efforts to encourage interagency coordination can help ensure efficient use of resources, particularly given the overlap of programs in the STEM education portfolio.

The Committee on STEM Education and the Office of Science and Technology Policy have not fulfilled their responsibilities to review, document, and report performance information on STEM education programs. Reviewing performance assessments of the many programs in the federal STEM education portfolio is a vital management responsibility that could, for example, improve the Committee's ability to disseminate information on promising practices or make recommendations that

agencies can use to make well-informed decisions about designing or revising their programs. Further, documenting programs' performance assessments in the Committee's federal STEM education inventory and reporting the outcomes of recent assessments in the Office of Science and Technology Policy's annual reports could enhance the availability of performance information.

In addition, the Committee falls short in reporting required information on programs' participation rates of women, underrepresented minorities, and persons from rural areas. Without such information, it is unclear whether the federal investment in STEM education is ultimately supporting its strategic goal of broadening participation to groups historically underrepresented in STEM fields.

Moreover, as the Committee on STEM Education begins to implement its new responsibilities prescribed by the American Innovation and Competitiveness Act, its efforts to review programs' performance assessments could improve its capacity to make well-informed recommendations to further enhance the portfolio of STEM education programs.

Recommendations for Executive Action

We are making a total of four recommendations, including three to the Committee on STEM Education and one to the Office of Science and Technology Policy. Specifically:

> The leadership of the Committee on STEM Education should review performance assessments of federal STEM education programs and then take appropriate steps to enhance effectiveness of the portfolio, such as by sharing promising practices that agencies could use in designing or revising their programs. (Recommendation 1)
>
> The leadership of the Committee on STEM Education should improve public awareness of information on programs' performance assessments by documenting program-level information on performance assessments in its federal STEM education inventory. (Recommendation 2)
>
> The leadership of the Committee on STEM Education should report required information on the participation rates of women, underrepresented minorities, and persons from rural areas in

federal STEM education programs that collect this information. (Recommendation 3)

The Director of the Office of Science and Technology Policy should report the outcomes of programs' performance assessments completed in the previous year in its annual report. (Recommendation 4)

Agency Comments and Our Evaluation

We provided a draft of this report to the National Science and Technology Council's Committee on STEM Education and the Office of Science and Technology Policy for review and comment. These entities jointly provided written comments, which are reproduced in appendix IV, and technical comments, which we incorporated, as appropriate. They agreed with all four of our recommendations and noted initial strategies for how they would implement three of them. Regarding implementation of the fourth recommendation to report on participation rates of underrepresented groups in federal STEM education programs, they noted plans to examine confounding factors inhibiting the reporting of the information required under the COMPETES Act. Gaining insight on the challenges agencies face collecting this information is an important first step. However, to comply with the requirement of the COMPETES Act and help ensure programs reach populations historically underrepresented in STEM fields, we continue to believe that the Committee should report the participation rates of women, underrepresented minorities, and persons from rural areas in federal STEM education programs that collect this information. To do so, the Committee may also need to develop strategies to help agencies overcome some of these confounding factors.

We are sending copies of this report to leadership of the Committee on STEM Education, and the Assistant Director of STEM Education at the Office of Science and Technology Policy, and the appropriate congressional committees. In addition, the report will be available at no charge on GAO's website at http://www.gao.gov.

If you or your staff should have any questions about this report, please contact me at (617) 788-0534 or emreyarrasm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.

Melissa Emrey-Arras
Director, Education, Workforce, and Income Security Issues

Appendix I: GAO's Methodology for Program Identification and Data Collection

How GAO Identified Federal Education Programs on Science, Technology, Engineering, and Mathematics

To identify the programs that should receive our questionnaire, we sought input from the 13 agencies that administer federal science, technology, engineering, and mathematics (STEM) education programs. We provided each of the agencies with our definition of a STEM education program and asked agency officials to identify programs funded in fiscal year 2016 that met this definition (see text box). We also asked agency officials to provide information on the status of the 209 STEM education programs we included in our previous report on STEM education programs.[1] Specifically, we asked whether the programs were funded in fiscal year 2016 and, if not, whether they were consolidated or terminated.

[1] GAO, *Science, Technology, Engineering, And Mathematics Education: Strategic Planning Needed to Better Manage Overlapping Programs across Multiple Agencies*, GAO-12-108 (Washington, D.C.: Jan. 20, 2012).

Definition of Science, Technology, Engineering, and Mathematics (STEM) Education Program

GAO defined "STEM education program" as a program funded by allocation or congressional appropriation. An organized set of activities was considered a single program even when its funds were also allocated to other programs. A STEM education program that met the definition had one or more of the following as a primary objective:

- attract or prepare students to pursue classes or coursework in STEM areas through formal or informal education activities (informal education programs provide support for activities that offer students learning opportunities outside of formal schooling through contests, science fairs, summer programs, and other means; outreach programs aimed at the general public were not included);
- attract students to pursue degrees (2-year, 4-year, graduate, or doctoral degrees) in STEM fields through formal or informal education activities;
- provide training opportunities for undergraduate or graduate students in STEM fields (this can include grants, fellowships, internships, and traineeships that are intended for students; general research grants that involve hiring a student for lab work were not considered a STEM education program);
- attract graduates to pursue careers in STEM fields;
- improve teacher (preservice or in-service) education in STEM fields;
- improve or expand the capacity of K-12 schools or postsecondary institutions to promote or foster education in STEM fields; and
- conduct research to enhance the quality of STEM education programs provided to students.

Programs designed to retain current employees in STEM fields were not included. Programs that fund retraining of workers to pursue a degree in a STEM field were included because these programs help increase the number of students and professionals in STEM fields by helping retrain non-STEM workers to work in STEM fields. Also included were health care programs that train students for careers that are primarily in scientific research, but not those that train students for careers that are primarily in patient care (e.g. those that trained nurses, doctors, dentists, psychologists, or veterinarians).

Lastly, GAO considered STEM fields to include any of the following broad disciplines: agricultural sciences; astronomy; biological sciences; chemistry; computer science; earth, atmospheric, and ocean sciences; engineering; material science; mathematical sciences; physics; social sciences (e.g., psychology, sociology, anthropology, cognitive science, economics, behavioral sciences); and technology.

GAO used this same definition of STEM education program in its 2012 report. However, in the current report, GAO explicitly specified astronomy and material science as STEM fields and also revised "mathematics" to be "mathematical sciences" based on feedback from agency officials.

Source: GAO | GAO-18-290

We reviewed the information agencies submitted and took steps to corroborate it, such as by reviewing program descriptions and budget documents. Based on our analysis of this information, we sent a web-based questionnaire to 198 programs (see table 1).

Table 1: Changes Agencies Reported in the Federal Portfolio of Science, Technology, Engineering, and Mathematics (STEM) Education Programs between Fiscal Years 2010 and 2016

Agency reported portfolio changes	Number of programs
Previously reported for fiscal year 2010	**209**
Programs removed from the 2016 portfolio	
Terminated or consolidated	77
No longer reported as STEM education[a]	11
Programs added to the 2016 portfolio	
Newly created	74
Newly reported as STEM education[b]	3
Identified for fiscal year 2016 and sent a questionnaire	**198**

Source: GAO analysis of agency submissions on their STEM education programs. | GAO-18-290

[a] We previously reported these 11 programs as STEM education for fiscal year 2010 because their administering agencies reported them as STEM education programs in fiscal year 2010. For this report, the administering agencies for these 11 programs did not report them as meeting the STEM education definition in fiscal year 2016.

[b] Officials from the Department of Agriculture reported 2 programs as STEM education for 2016 that they had not reported previously for 2010, despite being funded then. Officials from the National Aeronautics and Space Administration reported 2 programs separately for fiscal year 2016 that they had previously reported together as one program for fiscal year 2010. Thus, we sent questionnaires to 3 programs newly reported as STEM education for 2016.

To develop the questionnaire and collect the data, we used recognized survey design practices to enhance data quality. For instance, we ordered the questionnaire appropriately and ensured the questions were clearly stated and easy to understand. The questionnaire solicited information on federal STEM education programs, including programs' objectives, intended groups served, services provided, STEM fields, and obligations. We did not conduct pretests because most of the questions were included in our prior questionnaire and had already been pretested.[2]

On May 8, 2017, we sent an email announcing the online questionnaire to the officials responsible for programs identified as STEM education and also notifying them that the questionnaire would be activated that week. On May 10, 2017, we sent a second message to officials informing them that the questionnaire was activated and providing them with unique usernames and passwords. As necessary, we followed-up with program

[2] We administered a similar questionnaire for our 2012 report on STEM education programs (GAO-12-108).

officials by telephone and email. We collected responses through August 31, 2017.

Based on our analysis of the questionnaire responses and other information we received from program officials, we excluded 35 programs from our inventory. (See table 2 for a summary of those 35 programs and the reasons we excluded them.)

Table 2: Programs Excluded from our Federal Science, Technology, Engineering, and Mathematics (STEM) Education Inventory

Reason	Number of programs
Program did not have STEM education as a primary objective	20
Program did not receive congressional allocation or appropriation in fiscal year 2016	13
Program was reported twice by the agency	2
Total	**35**

Source: GAO analysis of information on federal STEM education activities. | GAO-18-290

Nine of the 35 excluded programs had been reported by agency officials as STEM education programs in our previous report. In most cases (8 of 9), we excluded these programs in this report because the programs did not include STEM education as a primary objective in fiscal year 2016. In the remaining case, we excluded the program because it was a component of another fiscal year 2016 STEM education program, and thus would be duplicative. We confirmed this information and the programs' exclusion with the administering agencies.

After we completed our analysis, we identified 163 programs as STEM education for fiscal year 2016. Programs officials responsible for all 163 of these programs completed our questionnaire. We used standard descriptive statistics to analyze responses to these completed questionnaires. We also used recognized survey design practices to process and analyze data collected via the questionnaire. For instance, we performed automated checks to review the data and identify inappropriate answers. We also reviewed the data for missing or ambiguous responses and followed up with program officials when necessary to clarify their responses. We did not verify all responses since we had applied recognized survey design practices and follow-up procedures, and had determined that the data used in this report were of sufficient quality for the purposes of our reporting objectives.

Appendix II: Federal Science, Technology, Engineering, and Mathematics (STEM) Education Programs and Reported Fiscal Year 2016 Obligations

Table 3: Federal STEM Education Programs and Reported Fiscal Year 2016 Obligations

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
National Aeronautics and Space Administration	Minority University Research and Education Project (MUREP)	31,995,826
	National Space Grant College and Fellowship Project (Space Grant)	39,999,988
	STEM Education and Accountability Project (SEAP)	24,844,939
National Science Foundation	Advanced Technological Education (ATE)	66,040,000
	Advancing Informal STEM Learning (AISL)	62,500,000
	Alliances for Graduate Education and the Professoriate (AGEP)	8,000,000
	Cultivating Cultures for Ethical STEM (CCE STEM)	2,670,000
	CyberCorps(R): Scholarship for Service (SFS)	49,980,000
	Discovery Research PreK-12 (DRK-12)	84,300,000
	East Asia & Pacific Summer Institutes for U.S. Graduate Students (EAPSI)	1,380,000
	Education and Human Resources Core Research (ECR)	67,570,000
	Graduate Research Fellowship (GRF) Program	332,340,000
	Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)	35,010,000
	Improving Undergraduate STEM Education (IUSE)	104,770,000
	Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)	13,970,000
	International Research Experiences for Students (IRES)	5,930,000
	Louis Stokes Alliances for Minority Participation (LSAMP)	46,010,000
	National Science Foundation Research Traineeship (NRT)	55,980,000
	Research Experiences for Teachers (RET) in Engineering and Computer Science	6,140,000
	Research Experiences for Undergraduates (REU)	97,720,000
	Robert Noyce Teacher Scholarship Program	64,500,000
	STEM + Computing (STEM+C) Partnerships	64,370,000
	Tribal Colleges and Universities Program (TCUP)	14,010,000
Nuclear Regulatory Commission	Integrated University Program (IUP)	15,102,000
	Minority Serving Institutions Program (MSIP)	1,008,285
Department of Agriculture		
Animal and Plant Health Inspection Service	AgDiscovery Program	907,034
	1890 National Scholars Program	0[a]

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
National Institute of Food and Agriculture	1890 Institution Teaching, Research and Extension Capacity Building Grants (CBG) Program	17,457,425
	Agriculture and Food Research Initiative Education and Literacy Initiative Research and Extension Experiences for Undergraduate Fellowships	4,101,236
	Agriculture and Food Research Initiative Education and Literacy Initiative Professional Development for Secondary School Teacher and Education Professionals	2,000,000
	Agriculture and Food Research Initiative Fellowships (Predoctoral and Postdoctoral)[b]	11,417,025
	Agriculture in the Classroom	398,028
	Distance Education Grants Program for Institutions of Higher Education in Insular Areas	800,000
	Higher Education Challenge Grants Program	4,378,970
	Hispanic Education Partnership Grants	8,840,842
	Multicultural Scholars	936,873
	National Needs Fellowships	336,203
	Secondary Education, Two-Year Postsecondary Education and Agriculture in the K-12 Classroom Grants	852,300
	Resident Instruction Grants Program for Institutions of Higher Education in Insular Areas	1,000,000
	Women and Minorities in Science, Technology, Engineering and Mathematics Fields Grant Program (WAMS)[b]	382,650
Department of Commerce		
National Institute of Standards and Technology (NIST)	NIST Summer Institute for Middle School Science Teachers	200,000
	NIST Graduate Student Measurement Science & Engineering (GMSE) Fellowship Program	640,000
	NIST Summer Undergraduate Research Fellowship (SURF) Program	1,700,000
National Oceanic and Atmospheric Administration (NOAA)	Bay Watershed Education and Training (B-WET) Program	7,952,700
	Environmental Literacy Program	3,000,000
	Educational Partnership Program with Minority Serving Institutions	14,431,000
	Ernest F. Hollings Scholarship Program	5,830,000
	National Sea Grant College Program (National Sea Grant College Program-Education Component)	904,061
	Teacher at Sea Program	600,000
Department of Defense		
Air Force	Air Force K-12 STEM Outreach (AFSTEM)	3,995,000
	National Defense Science and Engineering Graduate (NDSEG) Fellowship	43,905,926

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
Army	Army Educational Outreach Program (AEOP)	10,220,356
Navy	Science and Engineering Apprentice Program (SEAP)	[c]
	SeaPerch	57,000
	The Naval Research Enterprise Intern Program (NREIP)	[c]
Secretary of Defense	DoD STARBASE Program	25,000,000
	National Defense Education Program (NDEP) Military Child Pilot Program	13,466,982
	National Defense Education Program (NDEP) K-12	5,512,106
	National Defense Education Program (NDEP) Science, Mathematics And Research for Transformation (SMART)	33,602,660
Department of Education	Developing Hispanic-Serving Institutions: STEM and Articulation Programs	92,425,366
	Graduate Assistance in Areas of National Need[d]	29,293,000
	Mathematics and Science Partnerships	152,717,000
	Minority Science and Engineering Improvement Program	9,648,000
	Research in Special Education[d]	44,775,891
	Research, Development, and Dissemination[d]	179,032,382
	Strengthening Predominantly Black Institutions[d]	13,905,000
	Upward Bound Math-Science	44,289,274
Department of Energy	Advanced Vehicle Competitions	2,500,000
	American Chemical Society Summer School in Nuclear and Radiochemistry	561,000
	BioenergizeME	300,000
	Collegiate Wind Competition	750,000
	Community College Internships (CCI)	1,000,000
	Computational Science Graduate Fellowship	11,500,000
	Environmental Management-Minority Serving Institution Partnership Program (MSIPP)	5,615,075
	Environmental Management Traineeship in Robotics	3,000,035
	Hampton University Graduate Studies	50,000
	Industrial Assessment Centers	7,000,000
	Integrated University Program (IUP)	4,980,486
	Mickey Leland Energy Fellowship Program	700,000
	Minority Educational Student Partnership Program (MEISPP) (summer interns)	933,900
	National Nuclear Security Administration-Minority Serving Institutions Partnership Program	16,500,000
	National Science Bowl (NSB)	2,900,000
	Office of Science Graduate Student Research (SCGSR)	2,500,000

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
	Race to Zero Student Design Competition	472,500
	Radiochemistry Summer School	300,000
	Science and Technology Workforce Development Initiative	1,000,000
	Science Undergraduate Laboratory Internships (SULI)	8,300,000
	Solar Decathlon	2,500,000
	Traineeship in Radiochemistry	3,000,000
	Visiting Faculty Program (VFP)	1,700,000
Department of Health and Human Services		
National Institutes of Health	Aging Research Dissertation Awards to Increase Diversity	451,361
	Blueprint Program for Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences	2,333,036
	Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative: Short Courses in Computational Neuroscience	401,280
	Bridges to the Baccalaureate Program	9,549,894
	Bridges to the Doctorate	3,424,610
	Cancer Education Grants Program	10,771,449
	Cancer Research Education Grants Program-Research Experiences	912,361
	Center for Cancer Research Cancer Research Interns (Cancer Research Interns)	182,232
	Center for Cancer Research/John Hopkins University Master of Science in Biotechnology Concentration in Molecular Targets and Drug Discovery Technologies	266,976
	Courses for Skills Development in Biomedical Big Data Science	4,356,583
	Drug Abuse Dissertation Research	413,106
	Enriching the Hematology Research Workforce through Short-term Educational Experiences in Emerging Science Research Education Program Grant	311,644
	Graduate Partnerships Program	10,873,246[e]
	Initiative for Maximizing Student Development	22,442,998
	Initiative to Maximize Research Education in Genomics: Diversity Action Plan	2,995,000
	Innovative Programs to Enhance Research Training (IPERT)	6,761,954
	Intramural National Institute of Allergy and Infectious Diseases Research Opportunities	260,396
	Maximizing Access to Research Careers (MARC) U-STAR	17,484,652
	Medical Informatics Training Program	900,000
	Mental Health Research Dissertation Grant to Increase Diversity	70,725
	National Cancer Institute Predoctoral to Postdoctoral Fellow Transition Award (F99 portion only)	1,366,103

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
	National Institute of Allergy and Infectious Diseases Division of Intramural Research (DIR) Office of Training and Diversity (OTD) Sponsorship Program	561,778
	National Institute of Allergy and Infectious Diseases Division of Intramural Research (DIR) Summer Diversity Program	14,106
	National Institute of Diabetes and Digestive and Kidney Diseases Research Education Program Grants for Summer Research Experiences (R25)	1,200,000
	National Institute of Mental Health Mentoring Networks for Mental Health Research Education	786,789
	National Institute of Mental Health Research Education Mentoring Programs for HIV/AIDS Research	2,812,201
	National Institute of Mental Health Short Courses for Mental Health-Related Research Education	1,416,275
	National Institute of Neurological Disorders and Stroke Neuroscience Development for Advancing the Careers of a Diverse Research Workforce	1,020,046
	National Institute of Nursing Research Summer Genetics Institute	65,000
	National Institute on Aging Medicine, Science, Technology, Engineering and Mathematics: Advancing Diversity in Aging Research (ADAR) through Undergraduate Education	4,248,443
	National Library of Medicine Institutional Training Grants for Research Training in Biomedical Informatics and Data Science	12,672,914
	NIH Big Data to Knowledge (BD2K) Enhancing Diversity in Biomedical Data Science	673,730
	NIH Building Infrastructure Leading to Diversity (BUILD) Initiative (RL5 portion only)	10,480,823
	NIH Building Infrastructure Leading to Diversity (BUILD) Initiative (TL4 portion only)	16,427,440
	Postbaccalaureate Intramural Research Training Award Program	32,642,180[e]
	Postbaccalaureate Research Education Program (PREP)	11,193,892
	Research Education Grants for Statistical Training in the Genetics of Addiction	505,160
	Research Initiative for Scientific Enhancement	27,291,181
	Research Supplements to Promote Diversity in Health-Related Research	35,956,662
	Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants (T32, T35, T90, TL1)	295,884,161
	Ruth L. Kirschstein National Research Service Award for Individual Predoctoral Fellows, including Underrepresented Racial/Ethnic Groups and Students from Disadvantaged Backgrounds	78,108,710
	Science Education Drug Abuse Partnership Award	483,000
	Science Education Partnership Award	18,541,000
	Short Courses on Mathematical, Statistical, and Computational Tools for Studying Biological Systems	2,416,584
	Short-Term Research Education Program to Increase Diversity in Health-Related Research	4,574,028

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
	Short-Term Research Experience for Underrepresented Persons (STEP-UP; R25)	14,588,697
	Student Intramural Research Training Award Program	7,276,883[e]
	Summer Institute for Research Education in Biostatistics	1,470,346
	Summer Research Education Experience Programs	3,620,084
	Team-Based Design in Biomedical Engineering Education	615,518
	Training in Computational Neuroscience: From Biology to Model and Back Again (R90 portion only)	865,048
	Undergraduate Research Education Program (UP) to Enhance Diversity in the Environmental Health Sciences	645,215
	Undergraduate Scholarship Program for Individuals from Disadvantaged Backgrounds	2,249,743
	Undergraduate Summer Institutes in Kidney, Urologic and Hematologic Diseases (R25)	621,600
Department of Homeland Security		
Science and Technology Directorate	Homeland Security STEM Summer Internship Program	500,000
	Minority Service Institutions-Scientific Leadership Awards	3,600,000
	Minority Service Institutions-Summer Research Team	500,000
Department of the Interior		
U.S. Geological Survey	Education Component of the National Cooperative Geologic Mapping Program (EDMAP)	419,438
	National Association of Geoscience Teachers (NAGT)-USGS Cooperative Summer Field Training Program	208,000
	Student Intern in Support of Native American Relations (SISNAR)	68,738
Bureau of Indian Affairs	Bureau of Indian Affairs, Office of Trust Services, Pathways Internship Program	475,082
	Science Post Graduate Scholarship Fund	2,450,000
Department of Transportation		
Office of the Secretary of Transportation	University Transportation Centers Program	67,700,000
Federal Aviation Administration	Joint University Program	250,000
Federal Highway Administration	Garrett A. Morgan Technology and Transportation Education Program	332,150
	National Summer Transportation Institute	2,620,293
	Summer Transportation Internship Program for Diverse Groups	1,300,000

Agency	Program	Reported fiscal year 2016 STEM education program obligations (in dollars)
Environmental Protection Agency	Cooperative Training in Environmental Sciences Research	532,768
	Environmental Education Grants Program	3,306,600
	Environmental Research Training Grant (University of Cincinnati/EPA Research Training Grant)	175,000
	National Environmental Education Program	2,175,500
	People, Prosperity, and Planet Award: National Student Design Competition for Sustainability	223,795
	President's Environmental Youth Award	80,000

Source: GAO questionnaire of STEM education programs. | GAO-18-290

Note: Amounts obligated for each program for fiscal year 2016 were reported to us by program officials in response to our questionnaire. We did not independently verify this information.

[a] This program has not obligated any funds to the public. It is a share-cost program supported by Department of Agriculture agencies.

[b] Department of Agriculture officials reported two programs as STEM education for 2016 that they had not reported previously for 2010, despite being funded then.

[c] Department of Defense officials reported a combined obligation amount for these two programs: $2,216,482

[d] According to Department of Education officials, these programs also support a wide variety of non-STEM related fields and activities.

[e] According to Health and Human Services officials, obligations for these programs are estimates.

Appendix III: Current Implementation Status of Selected COMPETES Act Provisions to Coordinate Federal Science, Technology, Engineering, and Mathematics Education

Table 4: Current Implementation Status of Selected COMPETES Act Provisions to Coordinate Federal Science, Technology, Engineering, and Mathematics (STEM) Education

COMPETES Act provisions	Implementation status
1. The Office of Science and Technology Policy should establish a committee comprised of specified agencies that have STEM education programs and activities.	●
Mandated responsibilities of the Committee:	
2. Coordinate the STEM education activities and programs of the federal agencies.	●
3. Coordinate STEM education activities and programs with the Office of Management and Budget.	●
4. Encourage the teaching of innovation and entrepreneurship as part of STEM education activities.	●
5. Ensure that STEM education activities and programs across the agencies are not duplicative.	●
6. Develop and implement a 5-year STEM education strategic plan, update every 5 years.	●
Elements required in the 5-year strategic plan:	
a. Annual and long-term objectives.	●
b. Common metrics to assess progress toward achieving the objectives.	●
c. Approaches each participating agency will take to assess the effectiveness of its STEM education programs.	●
d. The role of each agency in supporting programs and activities designed to achieve the annual and long-term objectives in the strategic plan.	●
7. Establish, periodically update, and maintain an inventory of federal STEM education programs and activities, including documentation of assessments of program effectiveness and the participation rates of women, underrepresented minorities, and persons in rural areas.	◑
Mandated responsibilities of the Office of Science and Technology Policy:	
8. Encourage and monitor the efforts of the participating agencies to ensure the strategic plan is developed and executed effectively.	●
9. Transmit an annual report to Congress on the 5-year STEM education strategic plan.	●
Elements required in the Office of Science and Technology Policy's annual report:	
10. A description of the STEM education programs and activities for the previous and current fiscal years, and any proposed programs under the President's budget request.	●
11. The funding levels for the STEM education programs and activities for each participating federal agency for the previous fiscal year and under the President's budget request.	●
12. An evaluation of the levels of duplication and fragmentation of federal STEM education programs and activities.	●
13. Progress made in implementing the 5-year plan, including a description of the outcome of any program assessments completed in the previous year and any changes made to that plan since the previous report.	◑

COMPETES Act provisions	Implementation status
14. How the participating federal agencies will disseminate information about federal resources for STEM education practitioners.	●

Legend: ● = Fully implemented: actions taken fully addressed the provision

◑ = Partially implemented: actions taken addressed some, but not all, parts of the provision

Source: GAO analysis of efforts to implement provisions of the COMPETES Act based on document review and agency input. | GAO-18-290

Appendix IV: Comments from the Office of Science and Technology Policy and the Committee on Science, Technology, Engineering, and Mathematics Education

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL
WASHINGTON, D.C. 20502

Thursday, March 1, 2018

Melissa Emrey-Arras
Director, Education, Workforce, and Income Security
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Ms. Emrey-Arras,

On behalf of the leadership of the National Science and Technology Council (NSTC) and its Committee on Science, Technology, Engineering, and Mathematics Education (CoSTEM), I appreciate the opportunity, as Senior Policy Advisor and Assistant Director for STEM Education at the Office of Science and Technology Policy (OSTP), to convey this joint response to the recommendations in the U.S. Government Accountability Office (GAO) draft report, "Science, Technology, Engineering, and Mathematics Education: Actions Needed to Better Assess the Federal Investment" (GAO-18-290). STEM education is an urgent priority for CoSTEM, OSTP, and the Trump Administration. In September, 2017, President Trump signed a Presidential Memorandum to boost investment in STEM education and computer science, which was immediately followed by pledges for matching investment by private industry. We look to continue the momentum.

We are proud of the significant progress achieved in Federal STEM education, programming, coordination, and national leadership since the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Reauthorization Act of 2010. Fragmentation has been reduced and cross-agency partnerships have coalesced. Inter- and intra-agency human and fiscal resources are more focused on Congressional and Administration priorities. Promising practices in student retention, educator professional development, community engagement, broadening participation, and measurement of gains now permeate the Federal STEM education community, improving services, outcomes, and evaluation.

Documentation of these gains has been catalogued annually by the Progress Report on Coordinating Federal Science, Technology, Engineering, and Mathematics Education delivered to Congress in compliance with the COMPETES Act. We appreciate that GAO captured the ongoing progress in Appendix III, designating twelve selected COMPETES Act provisions as "fully implemented" with two provisions designated as "partially implemented."

We are also pleased to highlight four significant developments that underscore important progress in recent months:

- Under the auspices of CoSTEM through FC-STEM, a cross-agency STEM Education Evaluation Working Group, along with STEM education agency evaluators, convened in early 2018 to examine STEM education investment area evaluation plans and highlight promising practices for assessment, of which there are many.

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- Over the course of late 2017 and early 2018, OSTP, in partnership with Federal Coordination in STEM Education Committee (FC-STEM), a subcommittee of CoSTEM, convened each CoSTEM Interagency Working Group around the five Priority Investment Areas of the 2013-2018 Federal STEM Education 5-Year Strategic Plan to intake assessment information and set a course for the future.
- OSTP, in collaboration with the Office of Management and Budget (OMB) and FC-STEM, have designed and distributed a data-gathering instrument to catalogue gains on CoSTEM priorities across the 13 agencies comprising CoSTEM. Alongside OMB's annual CoSTEM Program Inventory, information from this survey will allow comprehensive analyses for continued improvement of Federal STEM education coordination.
- In recent months, the Office of Science and Technology Policy welcomed strong leadership at the executive director position for the National Science and Technology Council and appointed a STEM education expert as senior policy analyst who brings three decades of experience and proven results. OSTP is well positioned to advance the Administration's priorities, assessment and evaluation, inter-agency communication, reporting, and strategic planning for the future, in partnership with the STEM education leadership across the Federal government and with the U.S. Congress.

We have reviewed the "Recommendations for Executive Action" (page 20), and with expanded capacity now in place at OSTP to support CoSTEM, we will move forward to put processes and strategies in place to consider how to address each one in a meaningful way over the coming months. Regarding program effectiveness recommendations:

- CoSTEM, in concert with agency evaluation experts and OMB performance staff, will focus on evaluation of the very diverse portfolio of STEM education investments across agencies and how to best review and report on STEM education assessment.
- CoSTEM will improve public awareness about Federal STEM investments by synthesizing highlights and trends about program-level performance assessment and impacts when possible.
- The Director of OSTP will include reporting on the available outcomes of programs' performance assessments completed in the previous year, subject to reliable availability, in the annual report.

Regarding the reporting of participation rates of underrepresented subpopulations:

- We embrace the imperative to deliver return-on-investment information, especially regarding the engagement of underrepresented groups, to STEM stakeholders across government and beyond. CoSTEM intends to examine confounding factors such as privacy law, self-report reliability, definitional challenges (e.g., "rural" and "Participation") inhibiting the fulfillment of this provision of the COMPETES Act.

The Office of Science and Technology Policy and the Committee on STEM Education of the NSTC appreciate GAO's shared commitment to advancing STEM education programs and better

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preparing the nation's youth. We have an exciting opportunity to make great strides in strengthening and improving Federal STEM activities to ensure future generations of students have the tools they need to succeed in an ever-evolving workforce, and that the United States has the talent necessary to maintain our global leadership in science and technology. It is imperative that our citizens young and old have the opportunity to develop the skills necessary to fill 21st century jobs. We look forward to continued collaboration.

Sincerely,

Jeff Weld, Ph.D.
Senior Policy Advisor and Assistant Director, STEM Education
Office of Science and Technology Policy
Executive Office of the President

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Melissa Emrey-Arras, (617) 788-0534 or EmreyArrasM@gao.gov

Staff Acknowledgments

In addition to the contact named above, Bill J. Keller (Assistant Director), Kathryn O'Dea Lamas (Analyst-in-Charge), Morgan Jones, and Karissa Robie made significant contributions. Also contributing to this report were James Bennett, Deborah Bland, Charles Culverwell, Jill Lacey, Sheila McCoy, James Rebbe, Kathleen van Gelder, and Sarah Veale.