United States Government Accountability Office

GAO

Report to the Chairman, Committee on Rules, House of Representatives

October 2005

HIGHER EDUCATION

Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends

GAO

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GAO-06-114

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Highlights

Highlights of GAO-06-114, a report to the Chairman, Committee on Rules, House of Representatives

Why GAO Did This Study

The United States has long been known as a world leader in scientific and technological innovation. To help maintain this advantage, the federal government has spent billions of dollars on education programs in the science, technology, engineering, and mathematics (STEM) fields for many years. However, concerns have been raised about the nation's ability to maintain its global technological competitive advantage in the future.

This report presents information on (1) the number of federal programs funded in fiscal year 2004 that were designed to increase the number of students and graduates pursuing STEM degrees and occupations or improve educational programs in STEM fields, and what agencies report about their effectiveness; (2) how the numbers, percentages, and characteristics of students, graduates, and employees in STEM fields have changed over the years; and (3) factors cited by educators and others as affecting students' decisions about pursuing STEM degrees and occupations, and suggestions that have been made to encourage more participation.

GAO received written and/or technical comments from several agencies. While one agency, the National Science Foundation, raised several questions about the findings, the others generally agreed with the findings and conclusion and several agencies commended GAO for this work.

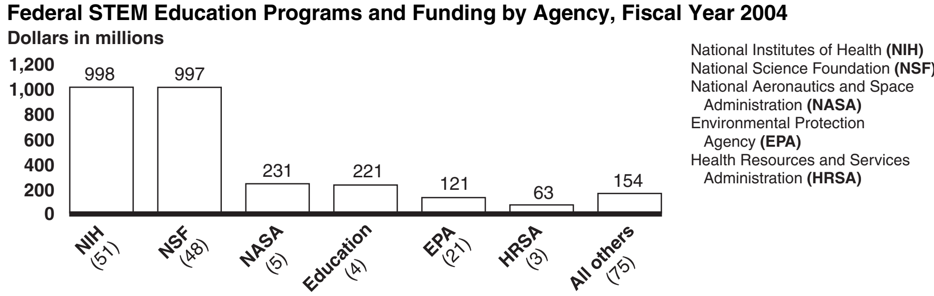
www.gao.gov/cgi-bin/getrpt?GAO-06-114.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Cornelia M. Ashby at (202) 512-7215 or ashbyc@gao.gov.

What GAO Found

Officials from 13 federal civilian agencies reported spending about $2.8 billion in fiscal year 2004 for 207 education programs designed to increase the numbers of students and graduates or improve educational programs in STEM fields, but agencies reported little about their effectiveness. The National Institutes of Health and the National Science Foundation had most of the programs and spent most of the funds. Officials also reported that evaluations were completed or under way for about half of the programs.

Federal STEM Education Programs and Funding by Agency, Fiscal Year 2004



Source: GAO survey responses from 13 federal agencies.

While the total numbers of students, graduates, and employees in STEM fields increased, changes in the numbers and percentages of women, minorities, and international students varied during the periods reviewed. From academic year 1995-1996 to 2003-2004, the percentage of students in STEM fields increased from 21 to 23 percent. Changes in the percentages of domestic minority students varied by group. From academic year 1994-1995 to 2002-2003, the number of graduates in STEM fields increased 8 percent, but this was less than the 30 percent increase in graduates in non-STEM fields. International graduates continued to earn about one-third or more of the advanced degrees in three STEM fields. Between calendar years 1994 and 2003, employment in STEM fields increased 23 percent compared to 17 percent in non-STEM fields, and there was no statistically significant change in the percentage of women employees.

Educators and others cited several factors that affected students' decisions about pursuing STEM degrees and occupations, and made suggestions to encourage more participation. They said teacher quality at the kindergarten to 12th grades, the mathematics and science courses completed in high school, and a mentor, especially for women and minorities, influenced domestic students' decisions. Also, these sources said that opportunities outside the United States and the visa process affected international students' decisions. To encourage more participation in STEM fields, educators and others made several suggestions. But before adopting any of them, it is important to know the extent to which existing STEM education programs are appropriately targeted and making the best use of available federal resources.

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Abbreviations

BEST	Building Engineering and Science Talent
BLS	Bureau of Labor Statistics
CGS	Council of Graduate Schools
CLF	civilian labor force
COS	Committee on Science
CPS	Current Population Survey
DHS	Department of Homeland Security
EPA	Environmental Protection Agency
HHS	Health and Human Services
HRSA	Health Resources and Services Administration
IPEDS	Integrated Postsecondary Education Data System
NASA	National Aeronautics and Space Administration
NCES	National Center for Education Statistics
NCLBA	No Child Left Behind Act
NIH	National Institutes of Health
NPSAS	National Postsecondary Student Aid Study
NSF	National Science Foundation
NSTC	National Science and Technology Council
SAO	Security Advisory Opinion
SEVIS	Student and Exchange Visitor Information System
STEM	science, technology, engineering, and mathematics

United States Government Accountability Office
Washington, DC 20548

October 12, 2005

The Honorable David Dreier
Chairman, Committee on Rules
House of Representatives

Dear Mr. Chairman:

The United States has long been known as a world leader in scientific and technological innovation. To help maintain this advantage, the federal government has spent billions of dollars on education programs in the science, technology, engineering, and mathematics (STEM) fields for many years. Some of these programs were designed to increase the numbers of women and minorities pursuing degrees in STEM fields. In addition, for many years, thousands of international students came to the United States to study and work in STEM fields. However, concerns have been raised about the nation's ability to maintain its global technological competitive advantage in the future. In spite of the billions of dollars spent to encourage students and graduates to pursue studies in STEM fields or improve STEM educational programs, the percentage of United States students earning bachelor's degrees in STEM fields has been relatively constant—about a third of bachelor's degrees—since 1977. Furthermore, after the events of September 11, 2001, the United States established several new systems and processes to help enhance border security. In some cases, implementation of these new systems and processes, which established requirements for several federal agencies, higher education institutions, and potential students, made it more difficult for international students to enter this country to study and work.

In the last few years, many reports and news articles have been published, and several bills have been introduced in Congress that address issues related to STEM education and occupations. This report presents information on (1) the number of federal civilian education programs funded in fiscal year 2004 that were designed to increase the numbers of students and graduates pursuing STEM degrees and occupations or improve educational programs in STEM fields and what agencies report about their effectiveness; (2) how the numbers, percentages, and characteristics of students, graduates, and employees in STEM fields have changed over the years; and (3) factors cited by educators and others as influencing people's decisions about pursuing STEM degrees and occupations, and suggestions that have been made to encourage greater participation in STEM fields. To determine the number of programs designed to increase the numbers of students and graduates pursuing STEM degrees and occupations, we identified 15 federal departments and agencies as having STEM programs, and we developed and conducted a survey asking each department or agency to provide information on its education programs, including information about their effectiveness.[1] We received responses from 14 of them, the Department of Defense did not participate, and we determined that at least 13 agencies had STEM education programs during fiscal year 2004 that met our criteria.

To describe how the numbers of students, graduates, and employees in STEM fields have changed, we analyzed and reported data from the Department of Education's (Education) National Center for Education Statistics (NCES) and the Department of Labor's (Labor) Bureau of Labor Statistics (BLS). Specifically, as shown in table 1, we used the National Postsecondary Student Aid Study (NPSAS) and the Integrated Postsecondary Education Data System (IPEDS) from NCES and the Current Population Survey (CPS) data from BLS. We assessed the data for reliability and reasonableness and found them to be sufficiently reliable for the purposes of this report.

Table 1: Sources of Data, Data Obtained, Time Span of Data, and Years Analyzed

Department	Agency	Database	Data obtained	Time span of data	Years analyzed
Education	NCES	NPSAS	College student enrollment	9 years	Academic years 1995-1996 and 2003-2004
Education	NCES	IPEDS	Graduation/degrees	9 years	Academic years 1994-1995 and 2002-2003
Labor	BLS	CPS	Employment	10 years	Calendar years 1994 through 2003

Sources: NCES's National Postsecondary Student Aid Study (NPSAS) and Integrated Postsecondary Education Data System (IPEDS) and BLS's Current Population Survey (CPS) data.

Note: Enrollment and employment information are based on sample data and are subject to sampling error. The 95-percent confidence intervals for student enrollment estimates are contained in appendix V of this report. Percentage estimates for STEM employment have 95-percent confidence intervals of within +/- 6 percentage points and other employment estimates (such as wages and salaries) have confidence intervals of within +/- 10 percent of the estimate, unless otherwise noted. See appendixes I, V, and VI for additional information.

[1] For the purposes of this report, we will use the term "agency" when referring to any of the 13 federal departments and agencies that responded to our survey.

To obtain perspectives on the factors that influence people's decisions about pursuing STEM degrees and occupations, and to obtain suggestions for encouraging greater participation in STEM fields, we interviewed educators and administrators in eight colleges and universities (the University of California Los Angeles and the University of Southern California in California; Clark Atlanta University, Georgia Institute of Technology, and Spelman College in Georgia; the University of Illinois; Purdue University in Indiana; and Pennsylvania State University). We selected these colleges and universities to include a mix of public and private institutions, provide geographic diversity, and include a few minority-serving institutions, including one (Spelman College) that serves only women students. In addition, most of the institutions had large total numbers of students, including international students, enrolled in STEM fields. We also asked officials from the eight universities to identify current students to whom we could send an e-mail survey. We received responses from 31 students from five of these institutions. In addition, we interviewed federal agency officials and representatives from associations and education organizations, and analyzed reports on various topics related to STEM education and occupations. Appendix I contains a more detailed discussion of our scope and methodology. We conducted our work between October 2004 and October 2005 in accordance with generally accepted government auditing standards.

Results in Brief

Officials from 13 federal civilian agencies reported having 207 education programs funded in fiscal year 2004 that were designed to increase the numbers of students and graduates pursuing STEM degrees and occupations or improve educational programs in STEM fields, but they reported little about the effectiveness of these programs. The 13 agencies reported spending about $2.8 billion in fiscal year 2004 for these programs. According to the survey responses, the National Institutes of Health (NIH) and the National Science Foundation (NSF) sponsored 99 of the 207 programs and spent about $2 billion of the approximate $2.8 billion. The program costs ranged from $4,000 for a national scholars program sponsored by the Department of Agriculture (USDA) to about $547 million for an NIH program that is designed to develop and enhance research training opportunities for individuals in biomedical, behavioral, and clinical research by supporting training programs at institutions of higher learning. Officials reported that most of the 207 programs had multiple goals, and many were targeted to multiple groups. For example, 2 programs were identified as having one goal of attracting and preparing students at any education level to pursue coursework in STEM areas, while 112 programs had this as one of multiple goals. Agency officials also reported that evaluations were completed or under way for about half of the programs, and most of the completed evaluations reported that the programs had been effective and achieved established goals. However, some programs that have not been evaluated have operated for many years.

While the total numbers of students, graduates, and employees have increased in STEM fields, changes in the numbers and percentages of women, minorities and international students varied during the periods reviewed. From the 1995-1996 academic year to the 2003-2004 academic year, the number of students increased in STEM fields by 21 percent—more than the 11 percent increase in non-STEM fields. Also, students enrolled in STEM fields increased from 21 percent to 23 percent of all students. Changes in the numbers and percentages of domestic minority students varied by group. For example, the number of African American students increased 69 percent and the number of Hispanic students increased 33 percent. The total number of graduates in STEM fields increased by 8 percent from the 1994-1995 academic year to the 2002-2003 academic year, while graduates in non-STEM fields increased 30 percent. Further, the numbers of graduates decreased in at least four of eight STEM fields at each education level. The total number of domestic minority graduates in STEM fields increased, and international graduates continued to earn about one-third or more of the master's and doctoral degrees in three fields. Moreover, from 1994 to 2003, employment increased by 23 percent in STEM fields as compared with 17 percent in non-STEM fields. African American employees continued to be less than 10 percent of all STEM employees, and there was no statistically significant change in the percentage of women employees.

Educators and others cited several factors as influencing students' decisions about pursuing STEM degrees and occupations, and they suggested many ways to encourage more participation in STEM fields. Studies, education experts, university officials, and others cited teacher quality at the kindergarten through 12th grade levels and students' high school preparation in mathematics and science courses as major factors that influence domestic students' decisions about pursuing STEM degrees and occupations. In addition, university officials, students, and studies identified mentoring as a key factor for women and minorities. Also, according to university officials, education experts, and reports, international students' decisions about pursuing STEM degrees and occupations in the United States are influenced by yet other factors, including more stringent visa requirements and increased educational opportunities outside the United States. We have reported that several aspects of the visa process have been improved, but further steps could be taken. In order to promote participation in the STEM fields, officials at most of the eight universities visited and current students offered suggestions that focused on four areas: teacher quality, mathematics and science preparation and courses, outreach to underrepresented groups, and the federal role in STEM education. The students who responded to our e-mail survey generally agreed with most of the suggestions and expressed their desires for better mathematics and science preparation for college. However, before adopting such suggestions, it is important to know the extent to which existing STEM education programs are appropriately targeted and making the best use of available federal resources.

We received written comments on a draft of this report from the Department of Commerce, the Department of Health and Human Services, and the National Science and Technology Council. These agencies generally agreed with our findings and conclusions. We also received written comments from the National Science Foundation which questioned our findings related to program evaluations, interagency collaboration, and the methodology we used to support our findings on the factors that influenced decisions about pursing STEM fields. Also, the National Science Foundation provided information to clarify examples cited in the report, stated that the data categories were not clear, and commented on the graduate level enrollment data we used. We revised the report to acknowledge that the National Science Foundation uses a variety of mechanisms to evaluate its programs and we added a bibliography that identifies the reports and research used during the course of this review to address the comment about our methodology related to the factors that influenced decisions about pursuing STEM fields. We also revised the report to clarify the examples and the data categories and to explain the reasons for selecting the enrollment data we used. However, we did not make changes to address the comment related to interagency collaboration for the reason explained in the agency comments section of this report. The written comments are reprinted in appendixes VII, VIII, IX, and X. In addition, we received technical comments from the Departments of Commerce, Health and Human Services, Homeland Security, Labor, and Transportation, and the Environmental Protection Agency and National Aeronautics and Space Administration, which we incorporated when appropriate.

Background

STEM includes many fields of study and occupations. Based on the National Science Foundations' categorization of STEM fields, we developed STEM fields of study from NCES's National Postsecondary Student Aid Study (NPSAS) and Integrated Postsecondary Education Data System (IPEDS), and identified occupations from BLS's Current Population Survey (CPS). Using these data sources, we developed nine STEM fields for students, eight STEM fields for graduates, and four broad STEM fields for occupations. Table 2 lists these STEM fields and occupations and examples of subfields. Additional information on STEM occupations is provided in appendix I.

Table 2: List of STEM Fields Based on NCES's NPSAS and IPEDS Data and BLS's CPS Data

<table>
<tr><th>Enrollment–NCES' NPSAS data</th><th>Degrees–NCES' IPEDS data</th><th>Occupations–BLS' CPS data</th></tr>
<tr><td>Agricultural sciences</td><td rowspan="2">Biological/agricultural sciences
• Botany
• Zoology
• Dairy
• Forestry
• Poultry
• Wildlife management</td><td rowspan="6">Science
• Agricultural and food scientists
• Astronomers and physicists
• Atmospheric and space scientists
• Biological scientists
• Chemists and materials scientists
• Environmental scientists and geoscientists
• Nurses
• Psychologists
• Sociologists
• Urban and regional planners</td></tr>
<tr><td rowspan="2">Biological sciences</td></tr>
<tr><td>Earth, atmospheric, and ocean sciences
• Geology
• Geophysics and seismology</td></tr>
<tr><td>Physical sciences</td><td>Physical sciences
• Chemistry
• Physics</td></tr>
<tr><td>Psychology</td><td>Psychology
• Clinical
• Social</td></tr>
<tr><td>Social sciences</td><td>Social sciences
• Political science
• Sociology</td></tr>
<tr><td>Technology</td><td>Technology
• Solar
• Automotive engineering</td><td>Technology
• Clinical laboratory technologists and technicians
• Diagnostic-related technologists and technicians
• Medical, dental, and ophthalmic laboratory technicians</td></tr>
</table>

Enrollment–NCES' NPSAS data	Degrees–NCES' IPEDS data	Occupations–BLS' CPS data
Engineering	**Engineering** • Aerospace, aeronautical, and astronautical • Architectural • Chemical • Civil • Electrical, electronics, and communication • Nuclear	**Engineering** • Architects, except naval • Aerospace engineers • Chemical engineers • Civil engineers • Electrical and electronic engineers • Nuclear engineers
Computer sciences	**Mathematics/computer sciences**	**Mathematics and computer sciences**
Mathematics	• Actuarial science • Applied mathematics • Mathematical statistics • Operations research • Data processing • Programming	• Computer scientists and systems analysts • Computer programmers • Computer software engineers • Actuaries • Mathematicians • Statisticians

Sources: NCES for NPSAS and IPEDS data; CPS for occupations.

Note: This table is not designed to show a direct relationship from enrollment to occupation, but to provide examples of majors, degrees, and occupations in STEM fields from the three sources of data.

Many of the STEM fields require completion of advanced courses in mathematics or science, subjects that are introduced and developed at the kindergarten through 12th grade level, and the federal government has taken steps to help improve achievement in these and other subjects. Enacted in 2002, the No Child Left Behind Act (NCLBA) seeks to improve the academic achievement of all of the nation's school-aged children. NCLBA requires that states develop and implement academic content and achievement standards in mathematics, science and the reading or language arts. All students are required to participate in statewide assessments during their elementary and secondary school years. Improving teacher quality is another goal of NCLBA as a strategy to raise student academic achievement. Specifically, all teachers teaching core academic subjects must be highly qualified by the end of the 2005-2006 school year.[2] NCLBA generally defines highly qualified teachers as those that have (1) a bachelor's degree, (2) state certification, and (3) subject area knowledge for each academic subject they teach.

[2]Core subjects include English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography.

The federal government also plays a role in coordinating federal science and technology issues. The National Science and Technology Council (NSTC) was established in 1993 and is the principal means for the Administration to coordinate science and technology among the diverse parts of the federal research and development areas. One objective of NSTC is to establish clear national goals for federal science and technology investments in areas ranging from information technologies and health research to improving transportation systems and strengthening fundamental research. NSTC is responsible for preparing research and development strategies that are coordinated across federal agencies in order to accomplish these multiple national goals.

In addition, the federal government, universities and colleges, and others have developed programs to provide opportunities for all students to pursue STEM education and occupations.[3] Additional steps have been taken to increase the numbers of women, minorities, and students with disadvantaged backgrounds in the STEM fields, such as providing additional academic and research opportunities. According to the 2000 Census, 52 percent of the total U.S. population 18 and over were women; in 2003, members of racial or ethnic groups constituted from 0.5 percent to 12.6 percent of the civilian labor force (CLF), as shown in table 3.

Table 3: Percentage of the U.S. Population for Selected Racial or Ethnic Groups in the Civilian Labor Force, Calendar Years 1994 and 2003

Race or ethnicity	Percentage of U.S. population in the CLF, 1994	Percentage of U.S. population in the CLF, 2003
Hispanic or Latino origin	8.9	12.6
Black or African American	10.8	10.7
Asian	2.8	4.4
American Indian or Alaska Native	0.5	0.5

Source: GAO calculations based upon March 1994 and March 2003 CPS data.

In addition to domestic students, international students have pursued STEM degrees and worked in STEM occupations in the United States. To

[3]Other federal programs that are not specifically designed to attract students to STEM education and occupations, such as Pell Grants, may provide financial assistance to students who obtain degrees in STEM fields.

do so, international students and scholars must obtain visas.[4] International students who wish to study in the United States must first apply to a Student and Exchange Visitor Information System (SEVIS) certified school. In order to enroll students from other nations, U.S. colleges and universities must be certified by the Student and Exchange Visitor Program within the Department of Homeland Security's Immigration and Customs Enforcement organization. As of February 2004, nearly 9,000 technical schools and colleges and universities had been certified. SEVIS, is an Internet-based system that maintains data on international students and exchange visitors before and during their stay in the United States. Upon admitting a student, the school enters the student's name and other information into the SEVIS database. At this time the student may apply for a student visa. In some cases, a Security Advisory Opinion (SAO) from the Department of State (State) may be needed to determine whether or not to issue a visa to the student. SAOs are required for a number of reasons, including concerns that a visa applicant may engage in the illegal transfer of sensitive technology. An SAO based on technology transfer concerns is known as Visas Mantis and, according to State officials, is the most common type of SAO applied to science applicants.[5] In April 2004, the Congressional Research Service reported that State maintains a technology alert list that includes 16 sensitive areas of study. The list was produced in an effort to help the United States prevent the illegal transfer of controlled technology and includes chemical and biotechnology engineering, missile technology, nuclear technology, robotics, and advanced computer technology.[6]

Many foreign workers enter the United States annually through the H-1B visa program, which assists U.S. employers in temporarily filling specialty

[4]There are several types of visas that authorize people to study and work in the United States. F, or student, visas, are for study at 2- and 4-year colleges and universities and other academic institutions; the exchange visitor, or J, visas are for people who will be participating in a cultural exchange program; and M visas are for nonacademic study at institutions, such as vocational and technical schools. In addition, H-1B visas allow non-citizens to work in the United States.

[5]GAO, *Border Security: Streamlined Visas Mantis Program Has Lowered Burden on Foreign Science Students and Scholars, but Further Refinements Needed*, GAO-05-198 (Washington, D.C.: Feb. 18, 2005).

[6]Congressional Research Service, *Science, Engineering, and Mathematics Education: Status and Issues*, 98-871 STM, April 27, 2004, Washington, D.C.

occupations.[7] Employed workers may stay in the United States on an H-1B visa for up to 6 years. The current cap on the number of H-1B visas that can be granted is 65,000. The law exempts certain workers, however, from this cap, including those who are employed or have accepted employment in specified positions. Moreover, up to 20,000 exemptions are allowed for those holding a master's degree or higher.

More than 200 Federal Education Programs Are Designed to Increase the Numbers of Students and Graduates or Improve Educational Programs in STEM Fields, but Most Have Not Been Evaluated

Officials from 13 federal civilian agencies reported having 207 education programs funded in fiscal year 2004 that were specifically established to increase the numbers of students and graduates pursuing STEM degrees and occupations, or improve educational programs in STEM fields, but they reported little about the effectiveness of these programs.[8] These 13 federal agencies reported spending about $2.8 billion for their STEM education programs. Taken together, NIH and NSF sponsored nearly half of the programs and spent about 71 percent of the funds. In addition, agencies reported that most of the programs had multiple goals, and many were targeted to multiple groups. Although evaluations have been done or were under way for about half of the programs, little is known about the extent to which most STEM programs are achieving their desired results. Coordination among the federal STEM education programs has been limited. However, in 2003, the National Science and Technology Council formed a subcommittee to address STEM education and workforce policy issues across federal agencies.

[7] A specialty occupation is defined as one that requires the application of a body of highly specialized knowledge, and the attainment of at least a bachelor's degree (or its equivalent), and the possession of a license or other credential to practice the occupation if required.

[8] GAO asked agencies to include STEM and related education programs with one or more of the following as a primary objective: (1) attract and prepare students at any education level to pursue coursework in STEM areas, (2) attract students to pursue degrees (2-year degrees through post doctoral) in STEM fields, (3) provide growth and research opportunities for college and graduate students in STEM fields, such as working with researchers and/or conducting research to further their education, (4) attract graduates to pursue careers in STEM fields, (5) improve teacher (pre-service, in-service, and postsecondary) education in STEM areas, and (6) improve or expand the capacity of institutions to promote or foster STEM fields.

Federal Civilian Agencies Reported Sponsoring over 200 STEM Education Programs and Spending Billions in Fiscal Year 2004

Officials from 13 federal civilian agencies provided information on 207 STEM education programs funded in fiscal year 2004. The numbers of programs ranged from 51 to 1 per agency with two agencies, NIH and NSF, sponsoring nearly half of the programs—99 of 207. Table 4 provides a summary of the numbers of programs by agency, and appendix II contains a list of the 207 STEM education programs and funding levels for fiscal year 2004 by agency.

Table 4: Number of STEM Education Programs Reported by Federal Civilian Agencies

Federal agency	Number of STEM education programs
Department of Health and Human Services/ National Institutes of Health	51
National Science Foundation	48
Department of Energy	26
Environmental Protection Agency	21
Department of Agriculture	16
Department of Commerce	13
Department of the Interior	13
National Aeronautics and Space Administration	5
Department of Education	4
Department of Transportation	4
Department of Health and Human Services/Health Resources and Services Administration	3
Department of Health and Human Services/Indian Health Service	2
Department of Homeland Security	1
Total	**207**

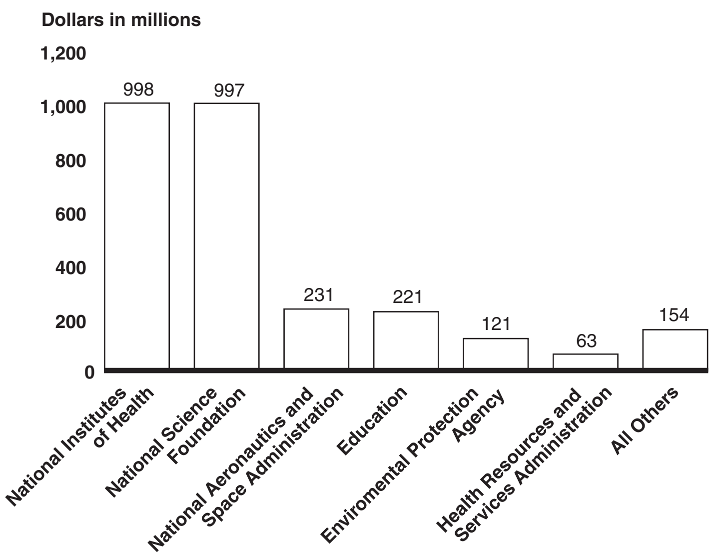
Source: GAO survey responses from 13 federal agencies.

Federal civilian agencies reported that approximately $2.8 billion was spent on STEM education programs in fiscal year 2004.[9] The funding levels for STEM education programs among the agencies ranged from about $998 million to about $4.7 million. NIH and NSF accounted for about 71 percent of the total—about $2 billion of the approximate $2.8 billion. NIH spent

[9]The program funding levels, as provided by agency officials, contain both actual and estimated amounts for fiscal year 2004.

about $998 million in fiscal year 2004, about 3.6 percent of its $28 billion appropriation, and NSF spent about $997 million, which represented 18 percent of its appropriation. Four other agencies, some with a few programs, spent about 23 percent of the total: $636 million. For example, the National Aeronautics and Space Administration (NASA) spent about $231 million on 5 programs and the Department of Education (Education) spent about $221 million on 4 programs during fiscal year 2004. Figure 1 shows the 6 federal civilian agencies that used the most funds for STEM education programs and the funds used by the remaining 7 agencies.

Figure 1: Amounts Funded by Agencies for STEM-Related Federal Education Programs in Fiscal Year 2004



Source: GAO survey responses from 13 federal agencies.

The funding reported for individual STEM education programs varied significantly, and many of the programs have been funded for more than 10 years. The funding ranged from $4,000 for an USDA-sponsored program that offered scholarships to U.S. citizens seeking bachelor's degrees at Hispanic-serving institutions, to about $547 million for a NIH grant program that is designed to develop and enhance research training opportunities for individuals in biomedical, behavioral, and clinical research by supporting training programs at institutions of higher education. As shown in table 5, most programs were funded at $5 million or less and 13 programs were funded at more than $50 million in fiscal year 2004. About half of the STEM education programs were first funded after 1998. The oldest program began in 1936, and 72 programs are over 10 years old.[10] Appendix III describes the STEM education programs that received funding of $10 million or more during fiscal year 2004 or 2005.[11]

Table 5: Funding Levels for Federal STEM Education Programs in Fiscal Year 2004

Program funding levels	Numbers of STEM education programs	Percentage of total STEM education programs
Less than $1 million	93	45
$1 million to $5 million	51	25
$5.1 million to $10 million	19	9
$10.1 million to $50 million	31	15
More than $50 million	13	6
Total	**207**	**100**

Source: GAO survey responses from 13 federal agencies.

Federal Agencies Reported Most STEM Programs Had Multiple Goals and Were Targeted to Multiple Groups

Agencies reported that most of the STEM education programs had multiple goals. Survey respondents reported that 80 percent (165 of 207) of the education programs had multiple goals, with about half of these identifying four or more goals for individual programs.[12] Moreover, according to the survey responders, few programs had a single goal. For example, 2 programs were identified as having one goal of attracting and preparing students at any education level to pursue coursework in the STEM areas, while 112 programs identified this as one of multiple goals. Table 6 shows the program goals and numbers of STEM programs aligned with them.

[10]Six survey respondents did not include the date the program was initially funded.

[11]Fiscal year 2005 funding levels were not available for all of the 207 STEM education programs.

[12]Three survey respondents did not identify the program goals.

Table 6: Program Goals and Numbers of STEM Programs with One or Multiple Goals

Program goal	Programs with only this goal	Programs with multiple goals including this goal	Total programs with this goal and other goal(s)
Attract and prepare students at any education level to pursue coursework in STEM areas	2	112	114
Attract students to pursue degrees (2-year through Ph.D.) and postdoctoral appointments	6	131	137
Provide growth and research opportunities for college and graduate students in STEM fields	3	100	103
Attract graduates to pursue careers in STEM fields	17	114	131
Improve teacher education in STEM areas	8	65	73
Improve or expand the capacity of institutions to promote or foster STEM fields	3	87	90

Source: GAO survey responses from 13 federal agencies.

The STEM education programs provided financial assistance to students, educators, and institutions. According to the survey responses, 131 programs provided financial support for students or scholars, and 84 programs provided assistance for teacher and faculty development.[13] Many of the programs provided financial assistance to multiple beneficiaries, as shown in table 7.

Table 7: Numbers of STEM Programs with One or Multiple Types of Assistance and Beneficiaries

Type of assistance	Programs that provide only this type of assistance	Programs that provide this type and other types of assistance	Total programs that provide this type of assistance
Financial support for students or scholars	54	77	131
Institutional support to improve educational quality	6	70	76
Support for teacher and faculty development	12	72	84
Institutional physical infrastructure support	1	26	27

Source: GAO survey responses from 13 federal agencies.

Most of the programs were not targeted to a specific group but aimed to serve a wide range of students, educators, and institutions. Of the 207 programs, 54 were targeted to 1 group and 151 had multiple target

[13]One survey respondent did not identify the type of assistance supported by the program.

groups.[14] In addition, many programs were targeted to the same group. For example, while 12 programs were aimed solely at graduate students, 88 other programs had graduate students as one of multiple target groups. Fewer programs were targeted to elementary and secondary teachers and kindergarten through 12th grade students than to other target groups. Table 8 summarizes the numbers of STEM programs targeted to one group and multiple groups.

Table 8: Numbers of STEM Programs Targeted to One Group and Multiple Groups

Targeted group	Targeted to only this group	Targeted to this and other groups	Total programs targeted to this group
Kindergarten through grade 12 students			
Elementary school students	0	28	28
Middle or junior high school students	1	33	34
High school students	3	50	53
Undergraduate students			
2-year college students	1	57	58
4-year college students	4	92	96
Graduate students and postdoctoral scholars			
Graduate students	12	88	100
Postdoctoral scholars	12	58	70
Teachers, college faculty and instructional staff			
Elementary school teachers	0	39	39
Secondary school teachers	3	47	50
College faculty or instructional staff	4	75	79
Institutions	5	77	82

Source: GAO survey responses from13 federal agencies.

Some programs limited participation to certain groups. According to survey respondents, U.S. citizenship was required to be eligible for 53 programs, and an additional 75 programs were open only to U.S. citizens or permanent residents.[15] About one-fourth of the programs had no

[14]Two survey respondents did not identify the group targeted by the program.

[15]Lawful permanent residents, also commonly referred to as immigrants, are legally accorded the privilege of residing permanently in the United States. They may be issued immigrant visas by the Department of State overseas or adjusted to permanent resident status by the Department of Homeland Security in the United States.

citizenship requirement, and 24 programs allowed noncitizens or permanent residents to participate in some cases. According to a NSF official, students receiving scholarships or fellowships through NSF programs must be U.S. citizens or permanent residents. In commenting on a draft of this report, NSF reported that these restrictions are considered to be an effective strategy to support its goal of creating a diverse, competitive, and globally-engaged U.S. workforce of scientists, engineers, technologists, and well-prepared citizens. Officials at two universities said that some research programs are not open to non-citizens. Such restrictions may reflect concerns about access to sensitive areas. In addition to these restrictions, some programs are designed to increase minority representation in STEM fields. For example, NSF sponsors a program called Opportunities for Enhancing Diversity in the Geosciences to increase participation by African Americans, Hispanic Americans, Native Americans (American Indians and Alaskan Natives), Native Pacific Islanders (Polynesians or Micronesians), and persons with disabilities.

Agency Officials Reported That Evaluations Were Completed or Under Way for About Half of the Federal Programs

Evaluations had been completed or were under way for about half of the STEM education programs. Agency officials responded that evaluations were completed for 55 of the 207 programs and that for 49 programs, evaluations were under way at the time we conducted our survey. Agency officials provided us documentation for evaluations of 43 programs, and most of the completed evaluations reviewed reported that the programs met their objectives or goals. For example, a March 2004 report on the outcomes and impacts of NSF's Minority Postdoctoral Research Fellowships program concluded that there was strong qualitative and quantitative evidence that this program is meeting its broad goal of preparing scientists from those ethnic groups that are significantly underrepresented in tenured U.S. science and engineering professorships and for positions of leadership in industry and government.

However, evaluations had not been done for 103 programs, some of which have been operating for many years. Of these, it may have been too soon to expect evaluations for about 32 programs that were initially funded in fiscal year 2002 or later. However, of the remaining 71 programs, 17 have been operating for over 15 years and have not been evaluated. In commenting on a draft of this report NSF noted that all of its programs undergo evaluation and that it uses a variety of mechanisms for program evaluation. We reported in 2003 that several agencies used various strategies to develop and improve evaluations.[16] Evaluations play an important role in improving program operations and ensuring an efficient use of federal resources. Although some of the STEM education programs are small in terms of their funding levels, evaluations can be designed to consider the size of the program and the costs associated with measuring outcomes and collecting data.

A Subcommittee Was Established in 2003 to Help Coordinate STEM Education Programs among Federal Agencies

Coordination of federal STEM education programs has been limited. In January 2003 the National Science and Technology Council (NSTC), Committee on Science (COS), established a subcommittee on education and workforce development. The purpose of the subcommittee is to advise and assist COS and NSTC on policies, procedures, and programs relating to STEM education and workforce development. According to its charter, the subcommittee will address education and workforce policy issues and research and development efforts that focus on STEM education issues at all levels, as well as current and projected STEM workforce needs, trends, and issues. The members include representatives from 20 agencies and offices—the 13 agencies that responded to our survey as well as the Departments of Defense, State, and Justice, and the Office of Science and Technology Policy, the Office of Management and Budget, the Domestic Policy Council, and the National Economic Council. The subcommittee has working groups on (1) human capacity in STEM areas, (2) minority programs, (3) effective practices for assessing federal efforts, and (4) issues affecting graduate and postdoctoral researchers. The Human Capacity in STEM working group is focused on three strategic initiatives: defining and assessing national STEM needs, including programs and research projects; identifying and analyzing the available data regarding the STEM workforce; and creating and implementing a comprehensive national response that enhances STEM workforce development.

NSTC reported that as of June 2005 the subcommittee had a number of accomplishments and projects under way that related to attracting students to STEM fields. For example, it has (1) surveyed federal agency education programs designed to increase the participation of women and underrepresented minorities in STEM studies; (2) inventoried federal fellowship programs for graduate students and postdoctoral fellows; and (3) coordinated the Excellence in Science, Technology, Engineering, and

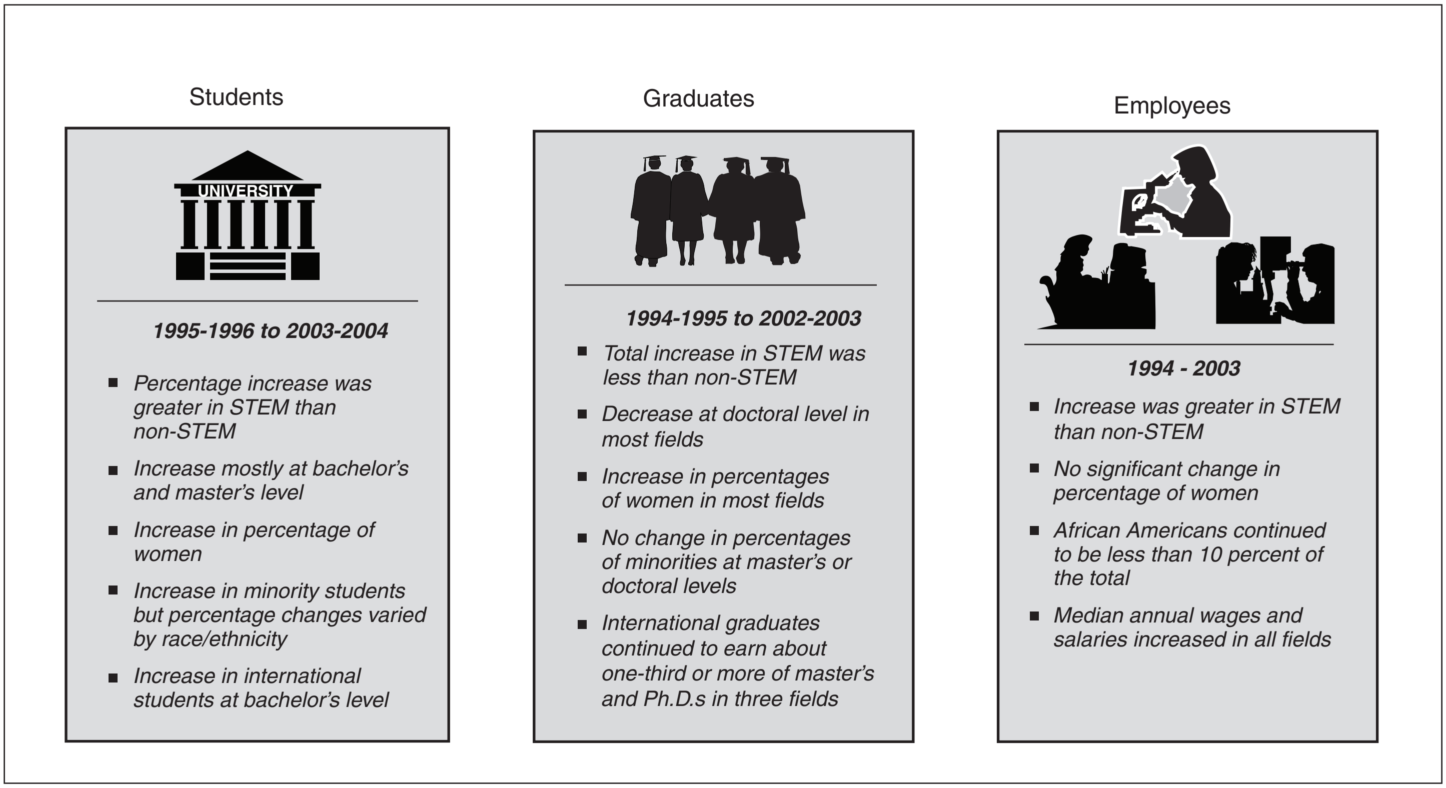
[16] GAO, *Program Evaluation: An Evaluation Culture and Collaborative Partnerships Help Build Agency Capacity*, GAO-03-454 (Washington, D.C.: May 2, 2003).

Mathematics Education Week activities, which provide an opportunity for the nation's schools to focus on improving mathematics and science education. In addition, the subcommittee is developing a Web site for federal educational resources in STEM fields and a set of principles that agencies would use in setting levels of support for graduate and postdoctoral fellowships and traineeships.

Numbers of Students, Graduates, and Employees in STEM Fields Generally Increased, but Percentage Changes Varied

While the total numbers of students, graduates, and employees have increased in STEM fields, percentage changes for women, minorities, and international students varied during the periods reviewed. The increase in the percentage of students in STEM fields was greater than the increase in non-STEM fields, but the change in percentage of graduates in STEM fields was less than the percentage change in non-STEM fields. Moreover, employment increased more in STEM fields than in non-STEM fields. Further, changes in the percentages of minority students varied by race or ethnic group, international graduates continued to earn about a third or more of the advanced degrees in three STEM fields, and there was no statistically significant change in the percentage of women employees. Figure 2 summarizes key changes in the students, graduates, and employees in STEM fields.

Figure 2: Key Changes in Students, Graduates, and Employees in STEM Fields



Source: GAO analysis of CPS, IPEDS, and NPSAS data; graphics in part by Art Explosion.

Numbers of Students in STEM Fields Grew, but This Increase Varied by Education Level and Student Characteristics

Total enrollments of students in STEM fields have increased, and the percentage change was greater for STEM fields than non-STEM fields, but the percentage of students in STEM fields remained about the same. From the 1995-1996 academic year to the 2003-2004 academic year, total enrollments in STEM fields increased 21 percent—more than the 11 percent enrollment increase in non-STEM fields. The number of students enrolled in STEM fields represented 23 percent of all students enrolled during the 2003-2004 academic year, a modest increase from the 21 percent these students constituted in the 1995-1996 academic year. Table 9 summarizes the changes in overall enrollment across all education levels from the 1995-1996 academic year to the 2003-2004 academic year.

Table 9: Estimated Changes in the Numbers and Percentages of Students in the STEM and Non-STEM Fields across All Education Levels, Academic Years 1995-1996 and 2003-2004

	Academic year 1995-1996		Academic year 2003-2004	
Enrollment measures	**STEM**	**Non-STEM**	**STEM**	**Non-STEM**
Students enrolled (in thousands)	4,132	15,243	4,997	16,883
Percentage of total enrollment	21	79	23	77

Source: GAO calculations based upon NPSAS data.

Note: The totals for STEM and non-STEM enrollment include students in bachelor's, master's, and doctoral programs as well as students enrolled in certificate, associate's, other undergraduate, first-professional degree, and post-bachelor's or post-master's certificate programs. The percentage changes between the 1995-1996 and 2003-2004 academic years for STEM and non-STEM students are statistically significant. See appendix V for confidence intervals associated with these estimates.

The increase in the numbers of students in STEM fields is mostly a result of increases at the bachelor's and master's levels. Of the total increase of about 865,000 students in STEM fields, about 740,000 was due to the increase in the numbers of students at the bachelor's and master's levels. See table 23 in appendix IV for additional information on the estimated numbers of students in STEM fields in academic years 1995-1996 and 2003-2004.

The percentage of students in STEM fields who are women increased from the 1995-1996 academic year to the 2003-2004 academic year, and in the 2003-2004 academic year women students constituted at least 50 percent of the students in 3 STEM fields—biological sciences, psychology, and social sciences. However, in the 2003-2004 academic year, men students continued to outnumber women students in STEM fields, and men constituted an estimated 54 percent of the STEM students overall. In addition, men constituted at least 76 percent of the students enrolled in computer sciences, engineering, and technology.[17] See tables 24 and 25 in appendix IV for additional information on changes in the numbers and

[17]In 2004, we reported on women's participation in federally funded science programs. Among other issues, this report discussed priorities pertaining to compliance with provisions of Title IX of the Education Amendments of 1972. For additional information, see GAO, *Gender Issues: Women's Participation in the Sciences Has Increased, but Agencies Need to Do More to Ensure Compliance with Title IX*, GAO-04-639, (Washington, D.C.: July 22, 2004).

percentages of women students in the STEM fields for academic years 1995-1996 and 2003-2004.

While the numbers of domestic minority students in STEM fields also increased, changes in the percentages of minority students varied by racial or ethnic group. For example, Hispanic students increased 33 percent, from the 1995-1996 academic year to the 2003-2004 academic year. In comparison, the number of African American students increased about 69 percent. African American students increased from 9 to 12 percent of all students in STEM fields while Asian/Pacific Islander students continued to constitute about 7 percent. Table 10 shows the numbers and percentages of minority students in STEM fields for the 1995-1996 academic year and the 2003-2004 academic year.

Table 10: Estimated Percentage Changes in the Numbers and Percentages of Domestic Minority Students in STEM fields for All Education Levels for Academic Years 1995-1996 and 2003-2004

Race or ethnicity	Numbers of students, 1995-1996 (in thousands)	Numbers of students, 2003-2004 (in thousands)	Percentage change in the numbers of students between academic years 1995-1996 and 2003-2004	Minority group as a percentage of students in STEM fields, academic year 1995-1996	Minority group as a percentage of students in STEM fields, academic year 2003-2004
Black or African American	360	608	+69	9	12
Asian/Pacific Islander	289	345	+19	7	7
Hispanic or Latino origin	366	489	+33	9	10
American Indian	18	38	+107	0	1
Other/Multiple minorities	29	166	+475	1	3

Source: GAO calculations based upon NPSAS data.

Note: All percentage changes are statistically significant. See appendix V for confidence intervals associated with these estimates.

From the 1995-1996 academic year to the 2003-2004 academic year, the number of international students in STEM fields increased by about 57 percent solely because of an increase at the bachelor's level. The numbers of international students in STEM fields at the master's and doctoral levels declined, with the largest decline occurring at the doctoral level. Table 11 shows the numbers and percentage changes in international students from the 1995-1996 academic year to the 2003-2004 academic year.

Table 11: Estimated Changes in Numbers of International Students in STEM fields by Education Levels from the 1995-1996 Academic Year to the 2003-2004 Academic Year

Education level	Number of international students, 1995-1996	Number of international students, 2003-2004	Percentage change
Bachelor's	31,858	139,875	+339
Master's	40,025	22,384	-44
Doctoral	36,461	7,582	-79
Total	**108,344**	**169,841**	**+57**

Source: GAO calculations based upon NPSAS data.

Note: Changes in enrollment between the 1995-1996 and 2003-2004 academic years are significant at the 95 percent confidence level for international students and for all education levels. See appendix V for confidence intervals associated with these estimates.

According to the Institute of International Education, from the 2002-2003 academic year to the 2003-2004 academic year, the number of international students declined for the first time in over 30 years, and that was the second such decline since the 1954-1955 academic year, when the institute began collecting and reporting data on international students.[18] Moreover, in November 2004, the Council of Graduate Schools (CGS) reported a 6 percent decline in first-time international graduate student enrollment from 2003 to 2004. Following a decade of steady growth, CGS also reported that the number of first-time international students studying in the United States decreased between 6 percent and 10 percent for 3 consecutive years.

Total Numbers of Graduates with STEM Degrees Increased, but Numbers Decreased in Some Fields, and Percentages of Minority Graduates at the Master's and Doctoral Levels Did Not Change

The number of graduates with degrees in STEM fields increased by 8 percent from the 1994-1995 academic year to the 2002-2003 academic year. However, during this same period the number of graduates with degrees in non-STEM fields increased by 30 percent. From academic year 1994-1995 to academic year 2002-2003, the percentage of graduates with STEM degrees decreased from 32 percent to 28 percent of total graduates. Table 12 provides data on the changes in the numbers and percentages of graduates in STEM and non-STEM fields.

[18] Institute of International Education, *Open Doors: Report on International Educational Exchange*, 2004, New York.

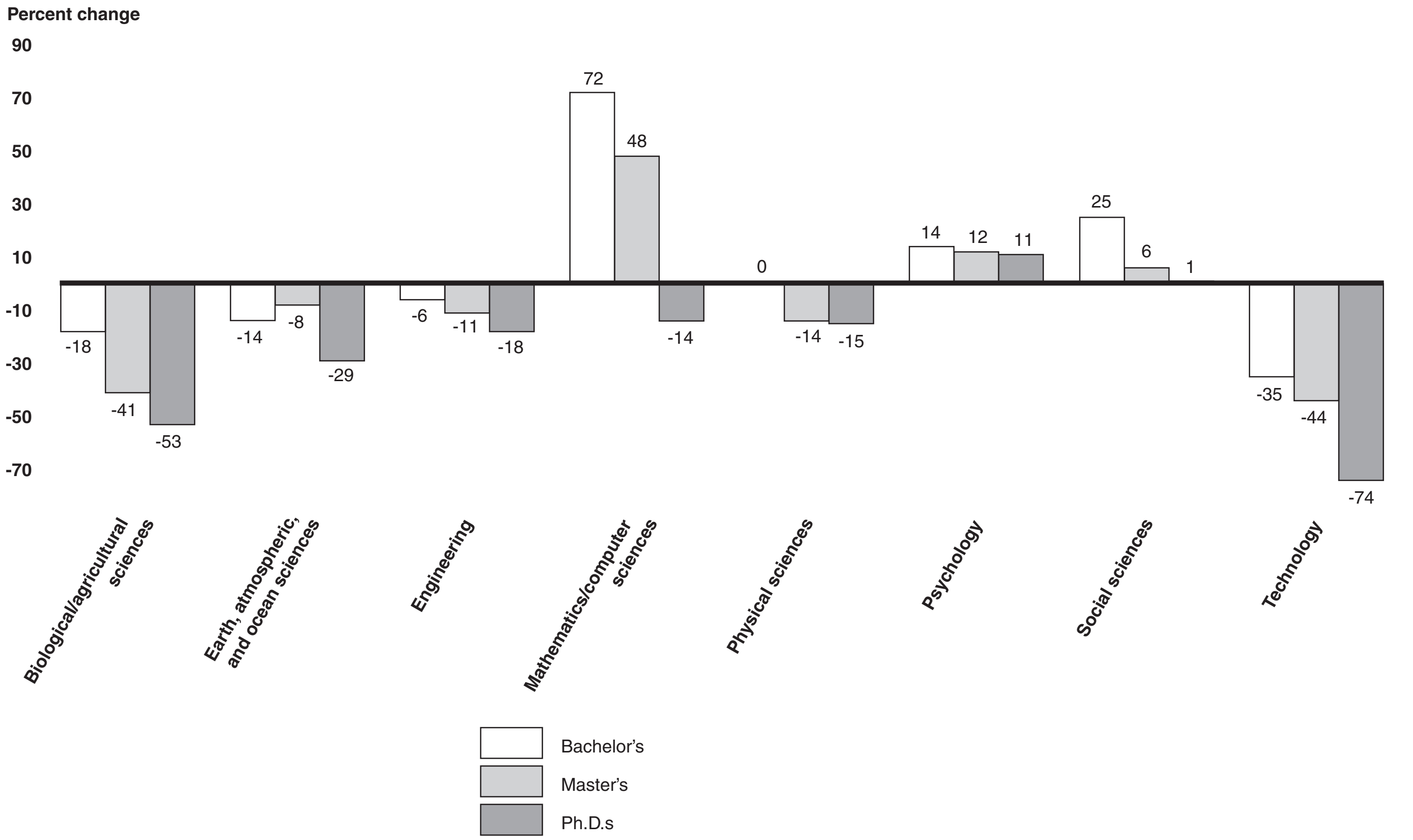
Table 12: Numbers of Graduates and Percentage Changes in STEM and Non-STEM Fields across All Degree Levels from the 1994-1995 Academic Year to the 2002-2003 Academic Year

	STEM fields			Non-STEM fields		
Graduation measures	**1994-1995**	**2002-2003**	**Percentage change**	**1994-1995**	**2002-2003**	**Percentage change**
Graduates (in thousands)	519	560	+8	1,112	1,444	+30
Percentage of total graduates	32	28	-4	68	72	+4

Source: GAO calculations based upon IPEDS data.

Decreases in the numbers of graduates occurred in some STEM fields at each education level, but particularly at the doctoral level. The numbers of graduates with bachelor's degrees decreased in four of eight STEM fields, the numbers with master's degrees decreased in five of eight fields, and the numbers with doctoral degrees decreased in six of eight STEM fields. At the doctoral level, these declines ranged from 14 percent in mathematics/computer sciences to 74 percent in technology. Figure 3 shows the percentage change in graduates with degrees in STEM fields from the 1994-1995 academic year to the 2002-2003 academic year.

Figure 3: Percentage Changes in Bachelor's, Master's, and Doctoral Graduates in STEM Fields from Academic Year 1994-1995 to Academic Year 2002-2003



Source: GAO calculations based upon IPEDS data.

From the 1994-1995 academic year to the 2002-2003 academic year, the total number of women graduates increased in four of the eight fields, and the percentages of women earning degrees in STEM fields increased in six of the eight fields at all three educational levels. Conversely, the total number of men graduates decreased, and the percentages of men graduates declined in six of the eight fields at all three levels from the 1994-1995 academic year to the 2002-2003 academic year. However, men continued to constitute over 50 percent of the graduates in five of eight fields at all three education levels. Table 13 summarizes the numbers of graduates by gender, level, and field. Table 26 in appendix IV provides additional data on the percentages of men and women graduates by STEM field and education level.

Table 13: Numbers and Percentage Changes in Men and Women Graduates with STEM Degrees by Education Level and Field for Academic Years 1994-1995 and 2002-2003

Education level	STEM field	Number of men graduates 1994-1995	Number of men graduates 2002-2003	Percentage change in men graduates	Number of women graduates 1994-1995	Number of women graduates 2002-2003	Percentage change in women graduates
Bachelor's level	Biological/agricultural sciences	36,108	23,266	-36	35,648	35,546	0
	Earth, atmospheric, and ocean sciences	2,954	2,243	-24	1,524	1,626	+7
	Engineering	52,562	48,214	-8	10,960	11,709	+7
	Mathematics and computer sciences	25,258	46,381	+84	13,651	20,436	+50
	Physical sciences	9,607	8,739	-9	5,292	6,222	+18
	Psychology	19,664	18,616	-5	53,010	64,470	+22
	Social sciences	56,643	63,465	+12	56,624	77,701	+37
	Technology	14,349	9,174	-36	1,602	1,257	-22
Master's level	Biological/agricultural sciences	4,768	2,413	-49	4,340	2,934	-32
	Earth, atmospheric, and ocean sciences	1,032	805	-22	451	552	+22
	Engineering	24,031	20,258	-16	4,643	5,271	+14
	Mathematics and computer sciences	10,398	14,531	+40	4,474	7,517	+68
	Physical sciences	2,958	2,350	-21	1,283	1,299	+1
	Psychology	4,013	3,645	-9	10,319	12,433	+20
	Social sciences	11,952	11,057	-7	11,398	13,674	+20
	Technology	927	467	-50	222	173	-22
Doctoral level	Biological/agricultural sciences	3,616	1,526	-58	2,160	1,161	-46
	Earth, atmospheric, and ocean sciences	488	315	-35	134	125	-7
	Engineering	5,401	4,159	-23	728	839	+15
	Mathematics and computer sciences	1,690	1,378	-18	434	439	+1
	Physical sciences	2,939	2,396	-18	922	892	-3
	Psychology	1,529	1,380	-10	2,511	3,086	+23
	Social sciences	2,347	2,111	-10	1,463	1,729	+18
	Technology	24	7	-71	3	0	-100

Source: GAO calculations based upon IPEDS data.

The total numbers of domestic minority graduates in STEM fields increased, although the percentage of minority graduates with STEM degrees at the master's or doctoral level did not change from the 1994-1995 academic year to the 2002-2003 academic year. For example, while the number of Native American graduates increased 37 percent, Native American graduates remained less than 1 percent of all STEM graduates at the master's and doctoral levels. Table 14 shows the percentages and numbers of domestic minority graduates for the 1994-1995 academic year and the 2002-2003 academic year.

Table 14: Numbers and Percentage Changes in Domestic Minority Graduates in STEM Fields by Education Levels and Race or Ethnicity for Academic Years 1994-1995 and 2002-2003

Race or ethnicity	Degree Level	Number of graduates in STEM fields, 1994-1995	Number of graduates in STEM fields, 2002-2003	Percentage change in graduates	Percentage of total graduates in STEM fields, 1994-1995	Percentage of total graduates in STEM fields, 2002-2003
Black or African American	Total	33,121	44,475	+34	6	8
	Bachelor's	28,236	37,195	+32	5	7
	Master's	4,358	6,588	+51	1	1
	Doctoral	527	692	+31	0	0
Hispanic or Latino origin	Total	25,781	37,056	+44	5	7
	Bachelor's	22,268	32,255	+45	4	6
	Master's	3,015	4,121	+37	1	1
	Doctoral	498	680	+37	0	0
Asian/Pacific Islanders	Total	37,393	46,941	+26	7	8
	Bachelor's	29,389	39,030	+33	6	7
	Master's	6,064	6,814	+12	1	1
	Doctoral	1,940	1,097	-43	0	0
Native Americans	Total	2,488	3,409	+37	0	1
	Bachelor's	2,115	2,903	+37	0	1
	Master's	320	425	+33	0	0
	Doctoral	53	81	+53	0	0

Source: GAO calculations based upon IPEDS data.

International students earned about one-third or more of the degrees at both the master's and doctoral levels in several fields in the 1994-1995 and the 2002-2003 academic years. For example, in academic year 2002-2003, international students earned between 45 percent and 57 percent of all degrees in engineering and mathematics/computer sciences at the master's and doctoral levels. However, at each level there were changes in the numbers and percentages of international graduates. At the master's level, the total number of international graduates increased by about 31 percent from the 1994-1995 academic year to the 2002-2003 academic year; while the number of graduates decreased in four of the fields and the percentages of international graduates declined in three fields. At the doctoral level, the total number of international graduates decreased by 12 percent, while the percentage of international graduates increased or remained the same in all fields. Table 15 shows the numbers and percentages of international graduates in STEM fields.

Table 15: Changes in Numbers and Percentages of International Graduates in STEM fields at the Master's and Doctoral Degree Levels, 1994-1995 and 2002-2003 Academic Years

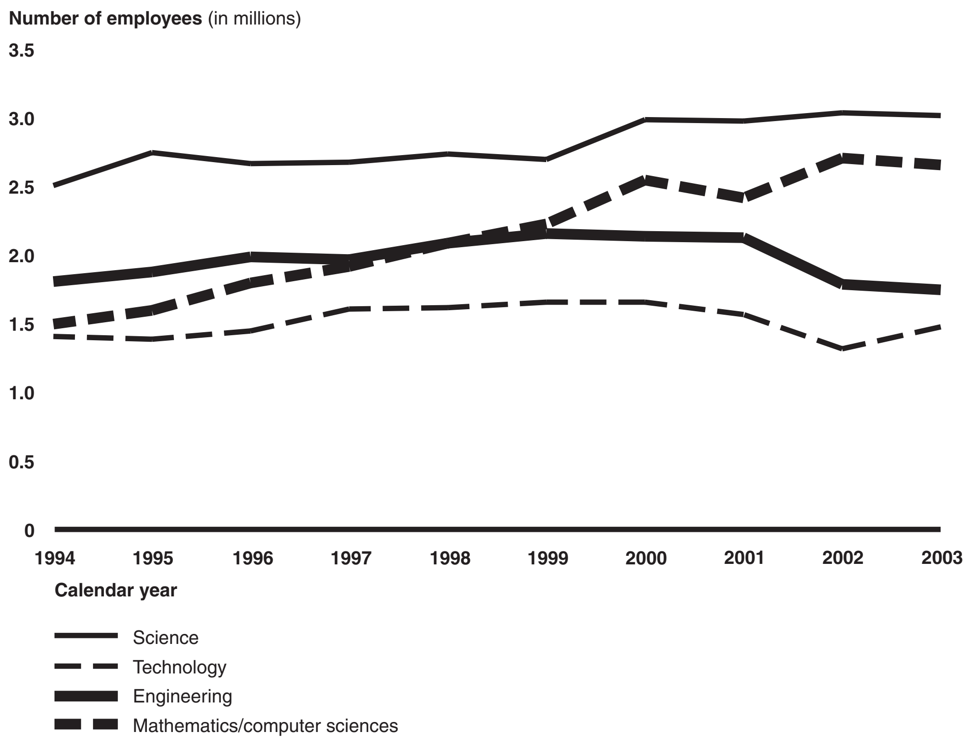
	1994-1995		2002-2003	
Masters' level	**Number**	**Percentage of all graduates**	**Number**	**Percentage of all graduates**
Agriculture/biological sciences	1,549	17	633	12
Earth, atmospheric, and ocean sciences	285	19	192	14
Engineering	9,720	34	11,512	45
Mathematics/computer sciences	5,105	34	10,335	47
Physical sciences	1,467	35	1,171	32
Psychology	493	3	704	4
Social sciences	3,749	16	4,795	19
Technology	169	15	118	18
Total	**22,537**		**29,460**	
Doctoral level				
Agriculture/biological sciences	1,616	28	743	28
Earth, atmospheric, and ocean sciences	183	29	140	32
Engineering	3,001	49	2,853	57
Mathematics/computer sciences	927	44	895	49
Physical sciences	1,290	33	1,281	39
Psychology	186	5	202	5
Social sciences	1,123	29	1,192	31
Technology	9	33	4	57
Total	**8,335**		**7,310**	

Source: GAO calculations based upon IPEDS data.

STEM Employment Rose, but the Percentage of Women Remained About the Same and Minorities Continued to be Underrepresented

While the total number of STEM employees increased, this increase varied across STEM fields. Employment increased by 23 percent in STEM fields as compared to 17 percent in non-STEM fields from calendar year 1994 to calendar year 2003. Employment increased by 78 percent in the mathematics/computer sciences field and by 20 percent in the science field over this period. The changes in number of employees in the engineering and technology fields were not statistically significant. Employment estimates from 1994 to 2003 in the STEM fields are shown in figure 4.

Figure 4: Estimated Numbers of Employees in STEM Fields from Calendar Years 1994 through 2003



Source: GAO calculations based upon CPS data.

Note: Estimated number of employees have confidence intervals of within +/-9 percent of the estimate itself. See appendix VI for confidence intervals associated with these estimates.

From calendar years 1994 to 2003, the estimated number of women employees in STEM fields increased from about 2.7 million to about 3.5 million. Overall, there was not a statistically significant change in the percentage of women employees in the STEM fields. Table 16 shows the numbers and percentages of men and women employed in the STEM fields for calendar years 1994 and 2003.

Table 16: Estimated Numbers and Percentages of Employees in STEM Fields by Gender in Calendar Years 1994 and 2003 (numbers in thousands)

	1994				2003			
	Men		Women		Men		Women	
STEM field	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Science	792	32	1,711	68	829	28	2,179	72
Technology	955	68	445	32	1,050	71	425	29
Engineering	1,658	92	*141	8	1,572	90	*169	10
Mathematics/ computer sciences	1,056	71	432	29	1,952	74	695	26
Total	**4,461**	**62**	**2,729**	**38**	**5,404**	**61**	**3,467**	**39**

Source: GAO calculations based upon CPS data.

Note: Estimated employee numbers noted by an asterisk have a 95 percent confidence interval of within +/- 25 percent of the estimate itself. All other estimated employee numbers have a 95 percent confidence interval of within +/- 16 percent of the estimate. See appendix VI for confidence intervals associated with these estimates. Calculations of percentages and numbers may differ due to rounding.

In addition, the estimated number of minorities employed in the STEM fields as well as the percentage of total STEM employees they constituted increased, but African American and Hispanic employees remain underrepresented relative to their percentages in the civilian labor force.[19] Between 1994 and 2003, the estimated number of African American employees increased by about 44 percent, the estimated numbers of Hispanic employees increased by 90 percent, as did the estimated numbers of other minorities employed in STEM fields.[20] In calendar year 2003, African Americans comprised about 8.7 percent of STEM employees compared to about 10.7 percent of the CLF. Similarly, Hispanic employees comprised about 10 percent of STEM employees in calendar year 2003, compared to about 12.6 percent of the CLF. Table 17 shows the estimated percentages of STEM employees by selected racial or ethnic groups in 1994 and 2003.

[19]On the basis of March 2004 CPS estimates, the Pew Hispanic Research Center reported that over 10 million unauthorized immigrants resided in the United States and that people of Hispanic and Latino origin constituted a significant portion of these unauthorized immigrants.

[20]Other minorities include Asian/Pacific Islanders and American Indian or Alaska Native.

Table 17: Estimated Percentages of STEM Employees by Selected Racial or Ethnic Group for Calendar Years 1994 and 2003

Race or ethnicity	Percentage of total STEM employees, 1994	Percentage of total STEM employees, 2003
Black or African American	7.5	8.7
Hispanic or Latino origin	5.7	10.0
Other minorities[a]	4.5	6.9

Source: GAO calculations based upon CPS data.

Note: Estimated percentages have 95 percent confidence intervals of +/- 1 percentage point. Changes for African Americans between calendar years 1994 and 2003 were not statistically significant at the 95-percent confidence level. Differences for Hispanic or Latino origin and other minorities were statistically significant. See appendix VI for confidence intervals associated with these estimates.

[a]Other minorities include Asian/Pacific Islanders and American Indian or Alaska Native.

International employees have filled hundreds of thousands of positions, many in STEM fields, through the H-1B visa program. However, the numbers and types of occupations have changed over the years. We reported that while the limit for the H-1B program was 115,000 in 1999, the number of visas approved exceeded the limit by more than 20,000 because of problems with the system used to track the data.[21] Available data show that in 1999, the majority of the approved occupations were in STEM fields. Specifically, an estimated 60 percent of the positions approved in fiscal year 1999 were related to information technology and 5 percent were for electrical/electronics engineering. By 2002, the limit for the H-1B program had increased to 195,000, but the number approved, 79,000, did not reach this limit. In 2003, we reported that the number of approved H-1B petitions in certain occupations had declined. For example, the number of approvals for systems analysis/programming positions declined by 106,671 from 2001 to 2002.[22]

Although the estimated total number of employees in STEM fields increased from 1994 to 2003, according to an NSF report, many with STEM degrees were not employed in these occupations. In 2004, NSF reported that about 67 percent of employees with degrees in science or engineering

[21]GAO, *H-1B Foreign Workers: Better Controls Needed to Help Employers and Protect Workers*, GAO/HEHS-00-157 (Washington, D.C.: Sept. 7, 2000).

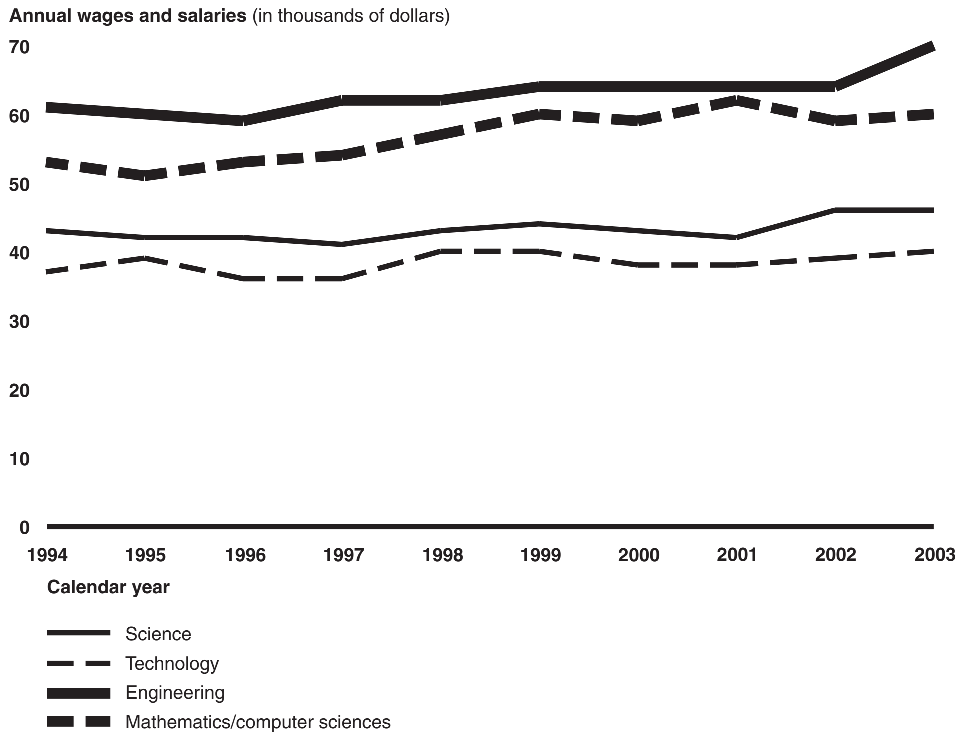
[22]GAO, *H-1B Foreign Workers: Better Tracking Needed to Help Determine H-1B Program's Effects on U.S. Workforce*, GAO-03-883 (Washington, D.C.: Sept. 10, 2003).

were employed in fields somewhat or not at all related to their degree.[23] Specifically, 70 percent of employees with bachelor's degrees, 51 percent with master's degrees, and 54 percent with doctoral degrees reported that their employment was somewhat or not at all related to their degree in science or engineering.

In addition to increases in the numbers of employees in STEM fields, inflation-adjusted median annual wages and salaries increased in all four STEM fields over the 10-year period (1994 to 2003). These increases ranged from 6 percent in science to 15 percent in engineering. Figure 5 shows trends in median annual wages and salaries for STEM fields.

[23]National Science Foundation, *Science and Engineering Indicators*, 2004, Volume 1, National Science Board, January 15, 2004.

Figure 5: Estimated Median Annual Wages and Salaries in STEM Fields for Calendar Years 1994 through 2003



Source: GAO calculations based upon CPS data.

Note: Median annual wages and salaries have been adjusted for inflation. Estimated median annual wages and salaries have 95 percent confidence intervals of within +/- 2.3 percent. See appendix VI for confidence intervals associated with these estimates.

University Officials and Others Cited Several Factors That Influence Decisions about Participation in STEM Fields and Suggested Ways to Encourage Greater Participation

University officials, researchers, and students identified several factors that influenced students' decisions about pursuing STEM degrees and occupations, and they suggested some ways to encourage more participation in STEM fields. Specifically, university officials said and researchers reported that the quality of teachers in kindergarten through 12th grades and the levels of mathematics and science courses completed during high school affected students' success in and decisions about STEM fields. In addition, several sources noted that mentoring played a key role in the participation of women and minorities in STEM fields. Current students from five universities we visited generally agreed with these observations, and several said that having good mathematics and science instruction was important to their overall educational success. International students' decisions about participating in STEM education and occupations were affected by opportunities outside the United States and the visa process. To encourage more student participation in the STEM fields, university officials, researchers, and others have made several suggestions, and four were made repeatedly. These suggestions focused on teacher quality, high school students' math and science preparation, outreach activities, and the federal role in STEM education.

Teacher Quality and Mathematics and Science Preparation Were Cited as Key Factors Affecting Domestic Students' STEM Participation Decisions

University officials frequently cited teacher quality as a key factor that affected domestic students' interest in and decisions about pursuing STEM degrees and occupations. Officials at all eight universities we visited expressed the view that a student's experience from kindergarten through the 12th grades played a large role in influencing whether the student pursued a STEM degree. Officials at one university we visited said that students pursuing STEM degrees have associated their interests with teachers who taught them good skills in mathematics or excited them about science. On the other hand, officials at many of the universities we visited told us that some teachers were unqualified and unable to impart the subject matter, causing students to lose interest in mathematics and science. For example, officials at one university we visited said that some elementary and secondary teachers do not have sufficient training to effectively teach students in the STEM fields and that this has an adverse effect on what students learn in these fields and reduces the interest and enthusiasm students express in pursuing coursework in high school, degree programs in college, or careers in these areas.

Teacher quality issues, in general, have been cited in past reports by Education. In 2002, Education reported that in the 1999-2000 school year, 14 to 22 percent of middle-grade students taking English, mathematics, and science were in classes led by teachers without a major, minor, or certification in these subjects—commonly referred to as "out-of-field" teachers.[24] Also, approximately 30 to 40 percent of the middle-grade students in biology/life science, physical science, or English as a second language/bilingual education classes had teachers lacking these credentials. At the high school level, 17 percent of students enrolled in physics and 36 percent of those enrolled in geology/earth/space science were in classes instructed by out-of-field teachers. The percentages of

[24]National Center for Education Statistics, *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching 1987-88 to 1999-2000*, May 2002, revised August 2004,Washington, D.C.

students taught by out-of-field teachers were significantly higher when the criteria used were teacher certification and a major in the subject taught. For example, 45 percent of the high school students enrolled in biology/life science and approximately 30 percent of those enrolled in mathematics, English, and social science classes had out-of-field teachers. During the 2002-2003 school year, Education reported that the number and distribution of teachers on waivers—which allowed prospective teachers in classrooms while they completed their formal training—was problematic. Also, states reported that the problem of underprepared teachers was worse on average in districts that serve large proportions of high-poverty children—the percentage of teachers on waivers was larger in high-poverty school districts than all other school districts in 39 states. Moreover, in 2004, Education reported that 48 of the 50 states granted waivers.[25]

In addition to teacher quality, students' high school preparation in mathematics and science was cited by university officials and others as affecting students' success in college-level courses and their decisions about pursuing STEM degrees and occupations. University officials at six of the eight universities we visited cited students' ability to opt out of mathematics and science courses during high school as a factor that influenced whether they would participate and succeed in the STEM fields during undergraduate and graduate school. University officials said, for example, that because many students had not taken higher-level mathematics and science courses such as calculus and physics in high school, they were immediately behind other students who were better prepared. In July 2005, on the basis of findings from the 2004 National Assessment of Educational Progress, the National Center for Education Statistics reported that 17 percent of the 17-year-olds reported that they had taken calculus, and this represents the highest percentage in any previous assessment year.[26] In a study that solicited the views of several hundred students who had left the STEM fields, researchers found that the effects of inadequate high school preparation contributed to college students' decisions to leave the science fields.[27] These researchers found

[25]U.S. Department of Education, *The Secretary's Third Annual Report on Teacher Quality*, Office of Postsecondary Education, 2004, Washington, D.C.

[26]U.S. Department of Education, National Center for Education Statistics, Institute of Education Sciences, *The Nation's Report Card, NAEP 2004: Trends in Academic Progress*, July 2005, Washington, D.C.

[27]Seymour, Elaine, and Nancy M. Hewitt, *Talking about Leaving: Why Undergraduates Leave the Sciences*, Westview Press, 1997, Boulder, Colorado.

that approximately 40 percent of those college students who left the science fields reported some problems related to high school science preparation. The underpreparation was often linked to problems such as not understanding calculus; lack of laboratory experience or exposure to computers, and no introduction to theoretical material or to analytic modes of thought. Further, 12 current students we interviewed said they were not adequately prepared for college mathematics or science. For example, one student stated that her high school courses had been limited because she attended an all-girls school where the curriculum catered to students who were not interested in STEM, and so it had been difficult to obtain the courses that were of interest to her.

Several other factors were mentioned during our interviews with university officials, students, and others as influencing decisions about participation in STEM fields. These factors included relatively low pay in STEM fields, additional tuition costs to obtain STEM degrees, lack of commitment on the part of some students to meet the rigorous academic demands, and the inability of some professors in STEM fields to effectively impart their knowledge to students in the classrooms. For example, officials from five universities said that low pay in STEM fields relative to other fields such as law and business dissuaded students from pursuing STEM degrees in some areas. Also, in a study that solicited the views of college students who left the STEM fields as well as those who continued to pursue STEM degrees, researchers found that students experienced greater financial difficulties in obtaining their degrees because of the extra time needed to obtain degrees in certain STEM fields. Researchers also noted that poor teaching at the university level was the most common complaint among students who left as well as those who remained in STEM fields. Students reported that faculty do not like to teach, do not value teaching as a professional activity, and therefore lack any incentive to learn to teach effectively.[28] Finally, 11 of the students we interviewed commented about the need for professors in STEM fields to alter their methods and to show more interest in teaching to retain students' attention.

[28]Seymour and Hewitt.

Mentoring Cited as a Key Factor Affecting Women's and Minorities' STEM Participation Decisions

University officials and students said that mentoring is important for all students but plays a vital role in the academic experiences of women and minorities in the STEM fields. Officials at seven of the eight universities discussed the important role that mentors play, especially for women and minorities in STEM fields. For example, one professor said that mentors helped students by advising them on the best track to follow for obtaining their degrees and achieving professional goals. Also, four students we interviewed—three women and one man—expressed the importance of mentors. Specifically, while all four students identified mentoring as critical to academic success in the STEM fields, two students expressed their satisfaction since they had mentors, while the other two students said that it would have been helpful to have had someone who could have been a mentor or role model.

Studies have also reported that mentors play a significant role in the success of women and minorities in the STEM fields. In 2004, some of the women students and faculty with whom we talked reported a strong mentor was a crucial part in the academic training of some of the women participating in sciences, and some women had pursued advanced degrees because of the encouragement and support of mentors.[29] In September 2000, a congressional commission reported that women were adversely affected throughout the STEM education pipeline and career path by a lack of role models and mentors.[30] For example, the report found that girls rejection of mathematics and science may be partially driven by teachers, parents, and peers when they subtly, and not so subtly, steer girls away from the informal technical pastimes (such as working on cars, fixing bicycles, and changing hardware on computers) and science activities (such as science fairs and clubs) that too often were still thought of as the province of boys. In addition, the commission reported that a greater proportion of women switched out of STEM majors than men, relative to their representation in the STEM major population. Reasons cited for the higher attrition rate among women students included lack of role models, distaste for the competitive nature of science and engineering education, and inability to obtain adequate academic guidance or advice. Further, according to the report, women's retention and graduation in STEM graduate programs were affected by their interaction with faculty,

[29] GAO-04-639.

[30] Report of the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, *Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering, and Technology*, September 2000.

integration into the department (versus isolation), and other factors, including whether there were role models, mentors, and women faculty.

International Students' STEM Participation Decisions Were Affected by Opportunities Outside the United States and the Visa Process

Officials at seven of the eight universities visited, along with education policy experts, told us that competition from other countries for top international students, and educational or work opportunities, affected international students' decisions about studying in the United States. They told us that other countries, including Canada, Australia, New Zealand, and the United Kingdom, had seized the opportunity since September 11 to compete against the United States for international students who were among the best students in the world, especially in the STEM fields. Also, university officials told us that students from several countries, including China and India, were being recruited to attend universities and get jobs in their own countries. In addition, education organizations and associations have reported that global competition for the best science and engineering students and scholars is under way. One organization, NAFSA: Association of International Educators reported that the international student market has become highly competitive, and the United States is not competing as well as other countries.[31]

According to university officials, international students' decisions about pursuing STEM degrees and occupations in the United States were also influenced by the perceived unwelcoming attitude of Americans and the visa process. Officials from three of the universities said that the perceived unwelcoming attitude of Americans had affected the recruitment of international students to the United States. Also, officials at six of the eight universities visited expressed their concern about the impact of the tightened visa procedures and/or increased security measures since September 11 on international graduate school enrollments. For example, officials at one university stated that because of the time needed to process visas, a few students had missed their class start dates. Officials from one university told us that they were being more proactive in helping new international students navigate the visa system, to the extent possible. While some university officials acknowledged that visa processing had significantly improved, since 2003 several education associations have

[31]NAFSA: Association of International Educators, *In America's Interest: Welcoming International Students*, Report of the Strategic Task Force on International Student Access, January 14, 2003, Washington, D.C.

requested further changes in U.S. visa policies because of the lengthy procedures and time needed to obtain approval to enter the country.

We have reported on various aspects of the visa process, made several recommendations, and noted that some improvements have been made. In October 2002 we cited the need for a clear policy on how to balance national security concerns with the desire to facilitate legitimate travel when issuing visas and we made several recommendations to help improve the visa process.[32] In 2003, we reported that the Departments of State, Homeland Security, and Justice could more effectively manage the visa function if they had clear and comprehensive policies and procedures and increased agency coordination and information sharing.[33] In February 2004 and February 2005, we reported on the State Department's efforts to improve the program for issuing visas to international science students and scholars. In 2004 we found that the time to adjudicate a visa depended largely on whether an applicant had to undergo a security check known as Visas Mantis, which is designed to protect against sensitive technology transfers. Based on a random sample of Visas Mantis cases for science students and scholars, it took State an average of 67 days to complete the process.[34] In 2005, we reported a significant decline in Visas Mantis processing times and in the number of cases pending more than 60 days.[35] We also reported that, in some cases, science students and scholars can obtain a visa within 24 hours.

We have also issued several reports on SEVIS operations. In June 2004 we noted that when SEVIS began operating, significant problems were reported.[36] For example, colleges and universities and exchange programs had trouble gaining access to the system, and when access was obtained, these users' sessions would "time out" before they could complete their tasks. In that report we also noted that SEVIS performance had improved,

[32]GAO, *Border Security: Visa Process Should Be Strengthened as an Antiterrorism Tool*, GAO-03-132NI (Washington, D.C.: Oct. 21, 2002).

[33]GAO, *Border Security: New Policies and Increased Interagency Coordination Needed to Improve Visa Process*, GAO-03-1013T (Washington, D. C.: July 15, 2003).

[34]GAO, *Border Security: Improvements Needed to Reduce Time Taken to Adjudicate Visas for Science Students and Scholars*, GAO-04-371 (Washington, D.C.: Feb. 25, 2004).

[35]GAO-05-198.

[36]GAO, *Homeland Security: Performance of Information System to Monitor Foreign Students and Exchange Visitors Has Improved, but Issues Remain*, GAO-04-690 (Washington, D.C.: June 18, 2004).

but that several key system performance requirements were not being measured. In March 2005, we reported that the Department of Homeland Security (DHS) had taken steps to address our recommendations and that educational organizations generally agreed that SEVIS performance had continued to improve.[37] However, educational organizations continued to cite problems, which they believe created hardships for students and exchange visitors.

Several Suggestions Were Made to Encourage More Participation in the STEM Fields

To increase the number of students entering STEM fields, officials from seven universities and others stated that teacher quality needs to improve. Officials of one university said that kindergarten through 12th grade classrooms need teachers who are knowledgeable in the mathematics and science content areas. As previously noted, Education has reported on the extent to which classes have been taught by teachers with little or no content knowledge in the STEM fields. The Congressional Commission on the Advancement of Women and Minorities reported that teacher effectiveness is the most important element in a good education.[38] The commission also suggested that boosting teacher effectiveness can do more to improve education than any other single factor. States are taking action to meet NCLBA's requirement of having all teachers of core academic subjects be highly qualified by the end of the 2005-2006 school year.

University officials and some students suggested that better preparation and mandatory courses in mathematics and science were needed for students during their kindergarten through 12th grade school years. Officials from five universities suggested that mandatory mathematics and science courses, especially in high school, may lead to increased student interest and preparation in the STEM fields. With a greater interest and depth of knowledge, students would be better prepared and more inclined to pursue STEM degrees in college. Further, nearly half of the students who replied to this question suggested that students needed additional mathematics and science training prior to college. However, adding

[37] GAO, *Homeland Security: Performance of Foreign Student and Exchange Visitor Information System Continues to Improve, but Issues Remain*, GAO-05-440T (Washington, D.C.: March 17, 2005).

[38] Report of the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, *Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering, and Technology*, September 2000.

mathematics and science classes has resource implications, since more teachers in these subjects would be needed. Also this change could require curriculum policy changes that would take time to implement.

More outreach, especially to women and minorities from kindergarten through the 12th grade, was suggested by university officials, students, and other organizations. Officials from six of the universities we visited suggested that increased outreach activities are needed to help create more interest in mathematics and science for younger students. For example, at one university we visited, officials told us that through inviting students to their campuses or visiting local schools, they have provided some students with opportunities to engage in science laboratories and hands-on activities that foster interest and excitement for students and can make these fields more relevant in their lives. Officials from another university told us that these experiences were especially important for women and minorities who might not have otherwise had these opportunities. The current students we interviewed also suggested more outreach activities. Specifically, two students said that outreach was needed to further stimulate students' interest in the STEM fields. One organization, Building Engineering and Science Talent (BEST), suggested that research universities increase their presence in prekindergarten through 12th grade mathematics and science education in order to strengthen domestic students' interests and abilities. BEST reported that one model producing results entailed universities adopting students from low-income school districts from 7th through 12th grades and providing them advanced instruction in algebra, chemistry, physics, and trigonometry. However, officials at one university told us that because of limited resources, their efforts were constrained and only a few students would benefit from this type of outreach.

Furthermore, university officials from the eight schools and other education organizations made suggestions regarding the role of the federal government. University officials suggested that the federal government could enhance its role in STEM education by providing more effective leadership through developing and implementing a national agenda for STEM education and increasing federal funding for academic research. Officials at six universities suggested that the federal government undertake a new initiative modeled after the National Defense Education Act of 1958, enacted in response to the former Soviet Union's achievement in its space program, which provided new funding for mathematics and science education and training at all education levels. In June 2005, CGS called for a renewed commitment to graduate education by the federal government through actions such as providing funds to support students trained at the doctoral level in the sciences, technology, engineering, and mathematics; expanding U.S. citizen participation in doctoral study in selected fields through graduate support awarded competitively to universities across the country; requiring recruitment, outreach, and mentoring activities that promote greater participation and success, especially for underrepresented groups; and fostering interdisciplinary research preparation. In August 2003, the National Science Board recommended that the federal government direct substantial new support to students and institutions in order to improve success in science and engineering studies by domestic undergraduate students from all demographic groups. According to this report, such support could include scholarships and other forms of financial assistance to students, incentives to institutions to expand and improve the quality of their science and engineering programs in areas in which degree attainment is insufficient, financial support to community colleges to increase the success of students in transferring to 4-year science and engineering programs, and expanded funding for programs that best succeed in graduating underrepresented minorities and women in science and engineering. BEST also suggested that the federal government allocate additional resources to expand the mathematics and science education opportunities for underrepresented groups. However, little is known about how well federal resources have been used in the past. Changes that would require additional federal funds would likely have an impact on other federal programs, given the nation's limited resources and growing fiscal imbalance, and changing the federal role could take several years.

Concluding Observations

While the total numbers of STEM graduates have increased, some fields have experienced declines, especially at the master's and doctoral levels. Given the trends in the numbers and percentages of students pursuing STEM degrees, particularly advanced degrees, and recent developments that have influenced international students' decisions about pursuing degrees in the United States, it is uncertain whether the number of STEM graduates will be sufficient to meet future academic and employment needs and help the country maintain its technological competitive advantage. Moreover, it is too early to tell if the declines in international graduate student enrollments will continue in the future. In terms of employment, despite some gains, the percentage of women in the STEM workforce has not changed significantly, minority employees remain underrepresented, and many with degrees in STEM fields are not employed in STEM occupations.

To help improve the trends in the numbers of students, graduates, and employees in STEM fields, university officials and others made several suggestions, such as increasing the federal commitment to STEM education programs. However, before making changes, it is important to know the extent to which existing STEM education programs are appropriately targeted and making the best use of available federal resources. Additionally, in an era of limited financial resources and growing federal deficits, information about the effectiveness of these programs can help guide policy makers and program managers.

Agency Comments and Our Evaluation

We received written comments on a draft of this report from Commerce, the Department of Health and Human Services (HHS), NSF, and NSTC. These comments are reprinted in appendixes VII, VIII, IX, and X, respectively. We also received technical comments from the Departments of Commerce, Health and Human Services, Homeland Security, Labor, and Transportation; and the Environmental Protection Agency and National Aeronautics and Space Administration, which we incorporated when appropriate.

In commenting on a draft of this report, Commerce, HHS, and NSTC commended GAO for this work. Commerce explicitly concurred with several findings and agreed with our overall conclusion. However, Commerce suggested that we revise the conclusion to point out that despite overall increases in STEM students, the numbers of graduates in certain fields have declined. We modified the concluding observations to make this point. HHS agreed with our conclusion that it is important to evaluate ongoing programs to determine the extent to which they are achieving their desired results. The comments from NSTC cited improvements made to help ensure that international students, exchange visitors, and scientists are able to apply for and receive visas in a timely manner. We did not make any changes to the report since we had cited another GAO product that discussed such improvements in the visa process.

NSF commented about several of our findings. NSF stated that our program evaluations finding may be misleading largely because the type of information GAO requested and accepted from agencies was limited to program level evaluations and did not include evaluations of individual underlying projects. NSF suggested that we include information on the range of approaches used to assure program effectiveness. Our finding is based on agency officials' responses to a survey question that did not limit or stipulate the types of evaluations that could have been included.

Nonetheless, we modified the report to acknowledge that NSF uses various approaches to evaluate its programs.

NSF criticized the methodology we used to support our finding on the factors that influence decisions about pursuing STEM fields and suggested that we make it clearer in the body of the report that the findings are based on interviews with educators and administrators from 8 colleges and universities, and responses from 31 students. Also, NSF suggested that we improve the report by including corroborating information from reports and studies. Our finding was not limited to interviews at the 8 colleges and universities and responses from 31 current students but was also based on interviews with numerous representatives and policy experts from various organizations as well as findings from research and reports—which are cited in the body of the report. Using this approach, we were able to corroborate the testimonial evidence with data from reports and research as well as to determine whether information in the reports and research remained accurate by seeking the views of those currently teaching or studying in STEM fields. As NSF noted, this approach yielded reasonable observations. Additional information about our methodology is listed in appendix I, and we added a bibliography that identifies the reports and research used during the course of this review.

NSF also commented that the report mentions the NSTC efforts for interagency collaboration, but does not mention other collaboration efforts such as the Federal Interagency Committee on Education and the Federal Interagency Coordinating Council. NSF also pointed out that interagency collaboration occurs at the program level. We did not modify the report in response to this comment. In conducting our work, we determined that the NSTC effort was the primary mechanism for interagency collaboration focused on STEM programs. The coordinating groups cited by NSF are focused on different issues. The Federal Interagency Committee on Education was established to coordinate the federal programs, policies, and practices affecting education broadly, and the Federal Interagency Coordinating Council was established to minimize duplication of programs and activities relating to children with disabilities.

In addition, NSF provided information to clarify examples related to their programs that we cited in the report, stated that some data categories were not clear, and commented on the graduate level enrollment data we used in the report. NSF pointed out that while its program called Opportunities for Enhancing Diversity in the Geosciences is designed to increase participation by minorities, it does not limit eligibility to minorities. Also, NSF noted that while the draft report correctly indicated that students receiving scholarships or fellowships from NSF must be U.S. citizens or permanent residents, the reason given for limiting participation in these programs in the draft report was not accurate. According to NSF, these restrictions are considered to be an effective strategy to support its goal of creating a diverse, competitive and globally engaged U.S. workforce of scientists, engineers, technologists and well prepared citizens. We revised the report to reflect these changes. Further, NSF commented that the data categories were not clear, particularly the technology degrees and occupations, and that the data did not include associate degrees. We added information that lists all of the occupations included in the analysis, and we added footnotes to clarify which data included associate degrees and which ones did not. In addition, NSF commented that the graduate level enrollment data for international students based on NPSAS data are questionable in comparison with other available data and that this may be because the NPSAS data include a relatively small sample for graduate education. We considered using NPSAS and other data but decided to use the NPSAS data for two reasons: NPSAS data were more comprehensive and more current. Specifically, the NPSAS data were available through the 2003-2004 academic year and included numbers and characteristics of students enrolled for all degree fields—STEM and non-STEM—for all education levels, and citizenship information.

Copies of this report are being sent to the Secretaries of Agriculture, Commerce, Education, Energy, Health and Human Services, Interior, Homeland Security, Labor, and Transportation; the Administrators for the Environmental Protection Agency and the National Aeronautics and Space Administration; and the Directors of the National Science Foundation and the National Science and Technology Council; appropriate congressional committees; and interested parties. Copies will be made available to others upon request. The report is also available on GAO's Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me on (202) 512-7215 or ashbyc@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 major contributions to this report are listed in appendix VII.

Sincerely yours,

Cornelia M. Ashby

Cornelia M. Ashby, Director
Education, Workforce, and Income Security Issues

Appendix I: Objectives, Scope, and Methodology

Objectives

The objectives of our study were to determine (1) the number of federal civilian education programs funded in fiscal year 2004 that were specifically designed to increase the number of students and graduates pursuing science, technology, engineering, and mathematics (STEM) degrees and occupations, or improve educational programs in STEM fields, and what agencies report about their effectiveness; (2) how the numbers, percentages, and characteristics of students, graduates, and employees in STEM fields have changed over the years; and (3) factors cited by educators and others as influencing people's decisions about pursuing STEM degrees and occupations, and suggestions to encourage greater participation in STEM fields.

Scope and Methodology

In conducting our review, we used multiple methodologies. We (1) conducted a survey of federal departments and agencies that sponsored education programs specifically designed to increase the number of students and graduates pursuing STEM degrees and occupations or improve educational programs in STEM fields; (2) obtained and analyzed data, including the most recent data available, on students, graduates, and employees in STEM fields and occupations; (3) visited eight colleges and universities; (4) reviewed reports and studies; and (5) interviewed agency officials, representatives and policy experts from various organizations, and current students. We conducted our work between October 2004 and October 2005 in accordance with generally accepted government auditing standards.

Survey

To provide Congress with a better understanding of what programs federal agencies were supporting to increase the nation's pool of scientists, technologists, engineers, and mathematicians, we designed a survey to determine (1) the number of federal education programs (prekindergarten through postdoctorate) designed to increase the quantity of students and graduates pursuing STEM degrees and occupations or improve the educational programs in STEM fields and (2) what agencies reported about the effectiveness of these programs. The survey asked the officials to describe the goals, target population, and funding levels for fiscal years 2003, 2004, and 2005 of such programs. In addition, the officials were asked when the programs began and if the programs had been or were being evaluated.

We identified the agencies likely to support STEM education programs by reviewing the Catalog of Federal Domestic Assistance and the Department of Education's Eisenhower National Clearinghouse, Guidebook of Federal

Resources for K-12 Mathematics and Science, 2004-05. Using these resources, we identified 15 agencies with STEM education programs. The survey was conducted via e-mail using an ActiveX enabled MSWord attachment. A contact point was designated for each agency, and questionnaires were sent to that individual. One questionnaire was completed for each program the agency sponsored. Agency officials were asked to provide confirming documentation for their responses whenever possible.

The questionnaire was forwarded to agencies on February 15, 2005, and responses were received through early May 2005. We received 244 completed surveys and determined that 207 of them met the criteria for STEM programs. The following agencies participated in our survey: the Departments of Agriculture, Commerce, Education, Energy, Homeland Security, Interior, Labor, and Transportation. In addition, the Health Resources and Services Administration, Indian Health Service, and National Institutes of Health, all part of Health and Human Services, took part in the survey. Also participating were the U.S. Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation. Labor's programs did not meet our criteria for 2004 and the Department of Defense (DOD) did not submit a survey. According to DOD officials, DOD needed 3 months to complete the survey and therefore could not provide responses within the time frames of our work. We obtained varied amounts of documentation from 13 civilian agencies for the 207 STEM education programs funded in 2004 and information about the effectiveness of some programs.

Because we administered the survey to all of the known federal agencies sponsoring STEM education programs, our results are not subject to sampling error. However, the practical difficulties of conducting any survey may introduce other types of errors, commonly referred to as nonsampling errors. For example, differences in how a particular question is interpreted, the sources of information available to respondents in answering a question, or the types of people who do not respond can introduce unwanted variability into the survey results. We included steps in the development of the survey, the collection of data, and the editing and analysis of data for the purpose of minimizing such nonsampling errors. To reduce nonsampling error, the questionnaire was reviewed by survey specialists and pretested in person with three officials from agencies familiar with STEM education programs to develop a questionnaire that was relevant, easy to comprehend, unambiguous, and unbiased. We made changes to the content and format of the questionnaire based on the specialists' reviews and the results of the pretests. To further reduce nonsampling error, data for this study returned electronically were entered directly into the instrument by the respondents and converted into a database for analysis. Completed questionnaires returned as hard copy were keypunched, and a sample of these records was verified by comparing them with their corresponding questionnaires, and any errors were corrected. When the data were analyzed, a second, independent analyst checked all computer programs. Finally, to assess the reliability of key data obtained from our survey about some of the programs, we compared the responses with the documentation provided, or we independently researched the information from other publicly available sources.

Analyses of Student, Graduate, and Employee Data

To determine how the numbers and characteristics of students, graduates, and employees in STEM fields have changed, we obtained and analyzed data from the Department of Education (Education) and the Department of Labor. Specifically, we analyzed the National Postsecondary Student Aid Study (NPSAS) data and the Integrated Postsecondary Education Data System (IPEDS) data from the Department of Education's National Center for Education Statistics (NCES), and we analyzed data from the Department of Labor's Bureau of Labor Statistics' (BLS) Current Population Survey (CPS). Based on National Science Foundation's categorization of STEM fields, we developed STEM fields of study from NPSAS and IPEDS, and identified occupations from the CPS. Using these data sources, we developed nine STEM fields for students, eight STEM fields for graduates, and four broad STEM fields for occupations.

For our data reliability assessment, we reviewed agency documentation on the data sets and conducted electronic tests of the files. On the basis of these reviews, we determined that the required data elements from NPSAS, IPEDS and CPS were sufficiently reliable for our purposes. These data sources, type, time span, and years analyzed are shown in table 18.

Table 18: Sources of Data, Data Obtained, Time Span of Data, and Years Analyzed

Department	Agency	Database	Data obtained	Time span of data	Years analyzed
Education	NCES	NPSAS	College student enrollment	9 years	Academic years 1995-1996 and 2003-2004
Education	NCES	IPEDS	Graduation/degrees	9 years	Academic years 1994-1995 and 2002-2003
Labor	BLS	CPS	Employment	10 years	Calendar years 1994 through 2003

Sources: NPSAS, IPEDS, and CPS data.

NPSAS is a comprehensive nationwide study designed to determine how students and their families pay for postsecondary education, and to describe some demographic and other characteristics of those enrolled. The study is based on a nationally representative sample of students in postsecondary education institutions, including undergraduate, graduate, and first-professional students. The NPSAS has been conducted every several years since the 1986-1987 academic year. For this report, we analyzed the results of the NPSAS survey for the 1995-1996 academic year and the 2003-2004 academic year to compare student enrollment and demographic characteristics between these two periods for the nine STEM fields and non-STEM fields.

Because the NPSAS sample is a probability sample of students, the sample is only one of a large number of samples that might have been drawn. Since each sample could have provided different estimates, confidence in the precision of the particular sample's results is expressed as a 95-percent confidence interval (for example, plus or minus 4 percentage points). This is the interval that would contain the actual population value for 95 percent of the samples that could have been drawn. As a result, we are 95 percent confident that each of the confidence intervals in this report will include the true values in the study population. NPSAS estimates used in this report and the upper and lower bounds of the 95 percent confidence intervals for each estimate relied on in this report are presented in appendix V.

IPEDS is a single, comprehensive system designed to encompass all institutions and educational organizations whose primary purpose is to provide postsecondary education. IPEDS is built around a series of interrelated surveys to collect institution-level data in such areas as enrollments, program completions, faculty, staff, and finances. For this report, we analyzed the results of IPEDS data for the 1994-1995 academic year and the 2002-2003 academic year to compare the numbers and characteristics of graduates with degrees in eight STEM fields and non-STEM fields.

To analyze changes in employees in STEM and non-STEM fields, we obtained employment estimates from BLS's Current Population Survey March supplement for 1995 through 2004 (calendar years 1994 through 2003). The CPS is a monthly survey of households conducted by the U.S. Census Bureau (Census) for BLS. The CPS provides a comprehensive body of information on the employment and unemployment experience of the nation's population, classified by age, sex, race, and a variety of other characteristics. A more complete description of the survey, including sample design, estimation, and other methodology can be found in the CPS documentation prepared by Census and BLS.[1]

This March supplement (the Annual Demographic Supplement) is specifically designed to estimate family characteristics, including income from all sources and occupation and industry classification of the job held longest during the previous year. It is conducted during the month of March each year because it is believed that since March is the month before the deadline for filing federal income tax returns, respondents would be more likely to report income more accurately than at any other point during the year.[2]

We used the CPS data to produce estimates on (1) four STEM fields, (2) men and women, (3) two separate minority groups (Black or African American, and Hispanic or Latino origin), and (4) median annual wages and salaries. The measures of median annual wages and salaries could include bonuses, but do not include noncash benefits such as health insurance or pensions. CPS salary reported in March of each year was for the longest held position actually worked the year before and reported by the worker himself (or a knowledgeable member of the household). Tables 19 and 20 list the classification codes and occupations included in our analysis of CPS data over a 10-year period (1994-2003). In developing the STEM groups, we considered the occupational requirements and educational attainment of individuals in certain occupations. We also excluded doctors and other health care providers except registered nurses. During the period of review, some codes and occupation titles were changed; we worked with BLS officials to identify variations in codes and occupations and accounted for these changes where appropriate and possible.

[1]See Technical Paper 63RV:Current Population Survey—Design and Methodology, issued Mar. 2002. Electronic version available at http://www.censusgov/prod/2002pubs/tp63rv.pdf.

[2]See Technical Paper 63RV, page 11-4.

Table 19: Classification codes and Occupations, 2002-2003

Science	Technology	Engineering	Mathematics/Computer Science
1600 – Agricultural and food scientists	1540 – Drafters	1300 – Architects, except naval	1000 – Computer scientists and systems analysts
1610 – Biological scientists	1550 – Engineering technicians, except drafters	1310 – Surveyors, cartographers, and photogrammetrists	1010 – Computer programmers
1640 – Conservation scientists and foresters	1560 – Surveying and mapping technicians	1320 – Aerospace engineers	1020 – Computer software engineers
1650 – Medical scientists	1900 – Agricultural and food science technicians	1330 – Agricultural engineers	1040 – Computer support specialists
1700 – Astronomers and physicists	1910 – Biological technicians	1340 – Biomedical engineers	1060 – Database administrators
1710 – Atmospheric and space scientists	1920 – Chemical technicians	1350 – Chemical engineers	1100 – Network and computer systems administrators
1720 – Chemists and materials scientists	1930 – Geological and petroleum technicians	1360 – Civil engineers	1110 – Network systems and data communications analysts
1740 – Environmental scientists and geoscientists	1940 – Nuclear technicians	1400 – Computer hardware engineers	1200 – Actuaries
1760 – Physical scientists, all other	1960 – Other life, physical, and social science technicians	1410 – Electrical and electronic engineers	1210 – Mathematicians
1800 – Economists	3300 – Clinical laboratory technologists and technicians	1420 – Environmental engineers	1220 – Operations research analysts
1810 – Market and survey researchers	7010 – Computer, automated teller and office machine repairers	1430 – Industrial engineers, including health and safety	1230 – Statisticians
1820 – Psychologists	8760 – Medical, dental, and ophthalmic laboratory technicians	1440 – Marine engineers and naval architects	1240 – Miscellaneous mathematical science occupations
1830 – Sociologists		1450 – Materials engineers	
1840 – Urban and regional planners		1460 – Mechanical engineers	
1860 – Miscellaneous social scientists and related workers		1500 – Mining and geological engineers, including mining safety engineers	
2010 – Social workers		1510 – Nuclear engineers	
3130 – Registered nurses		1520 – Petroleum engineers	
6010 – Agricultural inspectors		1530 – Engineers, all other	

Source: GAO analysis of CPS occupation classifications.

Table 20: Classification codes and occupations, 1994-2001

Science	Technology	Engineering	Mathematics/Computer Science
069 – Physicists and astronomers	203 – Clinical laboratory technologists and technicians	043 – Architects	064 – Computer systems analysts and scientists
073 – Chemists, except biochemists	213 – Electrical and electronic technicians	044 – Aerospace engineers	065 – Operations and systems researchers and analysts
074 – Atmospheric and space scientists	214 – Industrial engineering technicians	045 – Metallurgical and materials engineers	066 – Actuaries
075 – Geologists and geodesists	215 – Mechanical engineering technicians	046 – Mining engineers	067 – Statisticians
076 – Physical scientists, n.e.c.	216 – Engineering technicians, n.e.c.	047 – Petroleum engineers	068 – Mathematical scientists, n.e.c.
077 – Agricultural and food scientists	217 – Drafting occupations	048 – Chemical engineers	229 – Computer programmers
078 – Biological and life scientists	218 – Surveying and mapping technicians	049 – Nuclear engineers	
079 – Forestry and conservation scientists	223 – Biological technicians	053 – Civil engineers	
083 – Medical scientists	224 – Chemical technicians	054 – Agricultural engineers	
095 – Registered Nurses	225 – Science technicians, n.e.c.	055 – Electrical and electronic engineers	
166 – Economists	235 – Technicians, n.e.c.	056 – Industrial engineers	
167 – Psychologists	525 – Data processing equipment repairers	057 – Mechanical engineers	
168 – Sociologists		058 – Marine and naval architects	
169 – Social scientists, n.e.c.		059 – Engineers, n.e.c.	
173 – Urban planners		063 – Surveyors and mapping scientists	
174 – Social workers			
489 – Inspectors, agricultural products			

Source: GAO analysis of CPS occupation classifications.

Note: For occupations not elsewhere classified (n.e.c.).

Because the CPS is a probability sample based on random selections, the sample is only one of a large number of samples that might have been drawn. Since each sample could have provided different estimates, confidence in the precision of the particular sample's results is expressed as a 95 percent confidence interval (e.g., plus or minus 4 percentage points). This is the interval that would contain the actual population value for 95 percent of the samples that could have been drawn. As a result, we are 95 percent confident that each of the confidence intervals in this report will include the true values in the study population. We use the CPS general variance methodology to estimate this sampling error and report it as confidence intervals. Percentage estimates we produce from the CPS data have 95 percent confidence intervals of plus or minus 6 percentage points or less. Estimates other than percentages have 95 percent confidence intervals of no more than plus or minus 10 percent of the estimate itself, unless otherwise noted. Consistent with the CPS documentation guidelines, we do not produce estimates based on the March supplement data for populations of less than 75,000.

GAO's internal control procedures provide reasonable assurance that our data analyses are appropriate for the purposes we are using them. These procedures include, but are not limited to, having skilled staff perform the analyses, supervisory review by senior analysts, and indexing/referencing (confirming that the analyses are supported by the underlying audit documentation) activities.

College and University Visits

We interviewed administrators and professors during site visits to eight colleges and universities—the University of California at Los Angeles and the University of Southern California in California; Clark Atlanta University, Georgia Institute of Technology, and Spelman College in Georgia; the University of Illinois; Purdue University in Indiana; and Pennsylvania State University. These colleges and universities were selected based on the following factors: large numbers of domestic and international students in STEM fields, a mix of public and private institutions, number of doctoral degrees conferred, and some geographic diversity. We also selected three minority-serving colleges and universities, one of which serves only women students. Clark Atlanta University and Spelman College were selected, in part, because of their partnerships with the College of Engineering at the Georgia Institute of Technology. During these visits we asked the university officials about factors that influenced whether people pursue a STEM education or occupations and suggestions for addressing those factors that may influence participation. For example, we asked university officials to identify (1) issues related to the education pipeline; (2) steps taken by their university to alleviate some of the conditions that may discourage student participation in STEM areas; and (3) the federal role, if any, in attracting and retaining domestic students in STEM fields. We also obtained documents on programs they sponsored to help support STEM students and graduates.

Reviews of Reports and Studies

We reviewed several articles, reports, and books related to trends in STEM enrollment and factors that have an effect on people's decisions to pursue STEM fields. For two studies, we evaluated the methodological soundness using common social science and statistical practices. We examined each study's methodology, including its limitations, data sources, analyses, and conclusions.

- *Talking about Leaving: Why Undergraduates Leave the Sciences*, by Elaine Seymour and Nancy Hewitt.[3] This study used interviews and focus groups/group interviews at selected universities to identify self-reported reasons for changing majors from science, mathematics, or engineering. The study had four primary objectives: (1) to identify sources of qualitative differences in educational experiences of science, mathematics, and engineering students at higher educational institutions of different types; (2) to identify differences in structure, culture, and pedagogy of science, mathematics, and engineering departments and the impact on student retention; (3) to compare and contrast causes of science, mathematics, and engineering students' attrition by race/ethnicity and gender; and (4) to estimate the relative importance of factors found to contribute to science, mathematics, and engineering students' attrition. The researchers selected seven universities to represent the types of colleges and universities that supply most of the nations' scientists, mathematicians, and engineers. The types of institutions were selected to test whether there are differences in educational experiences, culture and pedagogy, race/ethnicity and gender attrition, and reasons for attrition by type of institution. Because the selection of students was not strictly random and because there is no documentation that the data were weighted to reflect the proportions of types of students selected, it is not possible to determine confidence intervals. Thus it is not possible to say which differences are statistically significant. The findings are now more than a decade old and thus might not reflect current pedagogy and other factors about the educational experience, students, or the socioeconomic environment. It is important to note that the quantitative results of this study are based on the views of one constituency or stakeholder—students. Views of faculty, school administrators, graduates, professional associations, and employers are not included.

[3] Seymour, Elaine, and Nancy M. Hewitt, *Talking about Leaving: Why Undergraduates Leave the Sciences*, Westview Press, 1997, Boulder, Colorado.

- NCES's *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching*, 1987-1988 to 1999-2000 report. This study is an analysis based upon the Schools and Staffing Survey for 1999-2000. The report was issued in 2004 by the Institute of Education Sciences, U.S. Department of Education. NCES's Schools and Staffing Survey (SASS) is a representative sample of U.S. schools, districts, principals, and teachers. The report focusing on teacher's qualifications uses data from the district and teacher portion of SASS. The 1999-2000 SASS included a nationally representative sample of public schools and universe of all public charter schools with students in any of grades 1 through 12 and in operation in school year 1999-2000. The 1999-2000 SASS administration also included nationally representative samples of teachers in the selected public and public charter schools who taught students in grades kindergarten through 12 in school year 1999-2000. There were 51,811 public school teachers in the sample and 42,086 completed public school teacher interviews. In addition, there are 3,617 public charter school teachers in the sample with 2,847 completed interviews. The overall weighted teacher response rate was 76.7 percent for public school teachers and 71.8 percent for public charter school teachers. NCES has strong standards for carrying out educational surveys. The Office of Management and Budget vetted the questionnaire and sample design. The Census Bureau carried out survey quality control and data editing. One potential limitation is the amount of time it takes the Census Bureau to get the data from field collection to public release, but this is partly due to the thoroughness of the data quality steps followed. The SASS survey meets GAO standards for use as evidence in a report.

Interviews

We interviewed officials from 13 federal agencies with STEM education programs to obtain information about the STEM programs and their views on related topics, including factors that influence students' decisions about pursuing STEM degrees and occupations, and the extent of coordination among the federal agencies. We also interviewed officials from the National Science and Technology Council to discuss coordination efforts. In addition, we interviewed representatives and policy experts from various organizations. These organizations were the American Association for the Advancement of Science, the Commission on Professionals in Science and Technology, the Council of Graduate Schools, NAFSA: Association of International Educators, the National Academies, and the Council on Competitiveness.

We also conducted interviews via e-mail with 31 students. We asked officials from the eight universities visited to identify students to complete our e-mail interviews, and students who completed the interviews attended five of the colleges we visited. Of the 31 students: 16 attended Purdue University, 6 attended the University of Southern California, 6 attended Spelman College, 2 attended the University of California Los Angeles, and 1 attended the Georgia Institute of Technology. In addition, 19 students were undergraduates and 12 were graduate students; 19 students identified themselves as women and 12 students identified themselves as men. Of the 19 undergraduate students, 9 said that they plan to pursue graduate work in a STEM field.

Appendix II: List of 207 Federal STEM Education Programs

Based on surveys submitted by officials representing the 13 civilian federal agencies, table 21 contains a list of the 207 science, technology, engineering, and mathematics (STEM) education programs funded in fiscal year 2004.

Table 21: Federal STEM Education Programs Funded in FY 2004

Program number	Program name	Fiscal year 04 funding
Department of Agriculture		
1.	1890 Institution Teaching and Research Capacity Building Grants Program	$11.4 million
2.	Higher Education Challenge Grants Program	$4.6 million
3.	Hispanic-Serving Institutions Education Grants Program	$4.6 million
4.	Alaska Native-Serving and Native Hawaiian-Serving Institutions Education Grants Program	$3 million
5.	Food and Agricultural Sciences National Needs Graduate and Postdoctoral Fellowships Grants Program	$2.9 million
6.	Tribal Colleges Endowment Program	$1.9 million
7.	Tribal Colleges Education Equity Grants Program	$1.7 million
8.	Tribal Colleges Research Grant Program	$1.1 million
9.	Higher Education Multicultural Scholars Program	$986,000
10.	International Science and Education Competitive Grants Program	$859,000
11.	Secondary and Two-Year Postsecondary Agricultural Education Challenge Grants Program	$839,000
12.	Agriculture in the Classroom	$623,000
13.	Career Intern Program	$272,000
14.	Veterinary Medical Doctoral Program	$140,000
15.	1890 National Scholars Program	$16,000
16.	Hispanic Scholars Program	$4,000
Department of Commerce		
17.	Educational Partnership Program with Minority Serving Institutions	$7.4 million
18.	National Marine Sanctuaries Education Program	$4.4 million
19.	National Sea Grant College Program	$4 million
20.	Chesapeake Bay Watershed Education and Training Program	$2.5 million
21.	Coral Reef Conservation Program	$1.8 million
22.	Exploration, Education and Outreach	$1.3 million
23.	National Estuarine Research Reserve Graduate Research Fellowship Program	$1 million
24.	Bay Watershed Education and Training Hawaii Program	$500,000
25.	Monterey Bay Watershed Education and Training Program	$500,000
26.	Dr. Nancy Foster Scholarship Program	$494,000

Program number	Program name	Fiscal year 04 funding
27.	EstuaryLive	$115,000
28.	Teacher at Sea Program	$95,000
29.	High School-High Tech	$11,000
Department of Education		
30.	Mathematics and Science Partnerships Program	$149 million
31.	Upward Bound Math and Science Program	$32.8 million
32.	Graduate Assistance in Areas of National Need	$30.6 million
33.	Minority Science and Engineering Improvement Program	$8.9 million
Department of Energy		
34.	Science Undergraduate Laboratory Internship	$2.5 million
35.	Computational Science Graduate Fellowship	$2 million
36.	Global Change Education Program	$1.4 million
37.	Laboratory Science Teacher Professional Development	$1 million
38.	National Science Bowl	$702,000
39.	Community College Institute of Science and Technology	$605,000
40.	Albert Einstein Distinguished Educator Fellowship	$600,000
41.	QuarkNet	$575,000
42.	Fusion Energy Sciences Fellowship Program	$555,000
43.	Pre-Service Teacher Fellowships	$510,000
44.	National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences	$300,000
45.	Fusion Energy Postdoctoral Research Program	$243,000
46.	Faculty and Student Teams	$215,000
47.	Advancing Precollege Science and Mathematics Education	$209,000
48.	Pan American Advanced Studies Institute	$200,000
49.	Trenton Community Partnership	$200,000
50.	Fusion/Plasma Education	$125,000
51.	National Middle School Science Bowl	$100,000
52.	Research Project on the Recruitment, Retention, and Promotion of Women in the Chemical Sciences	$100,000
53.	Used Energy Related Laboratory Equipment	$80,000
54.	Plasma Physics Summer Institute for High School Physics Teachers	$78,000
55.	Pre-Service Teacher Program	$45,000
56.	Wonders of Physics Traveling Show	$45,000
57.	Hampton University Graduate Studies	$40,000
58.	Contemporary Physics Education Project	$23,000

Program number	Program name	Fiscal year 04 funding
59.	Cooperative Education Program	$17,000
Environmental Protection Agency		
60.	Science to Achieve Results Research Grants Program	$93.3 million
61.	Science to Achieve Results Graduate Fellowship Program	$10 million
62.	Post-Doctoral Fellows Environmental Research Growth Opportunities	$7.4 million
63.	Intern Program	$3 million
64.	Environmental Science and Engineering Fellows Program	$2.5 million
65.	Greater Research Opportunities Graduate Fellowship Program	$1.5 million
66.	Environmental Risk & Impact in Communities of Color and Economically Disadvantaged Communities	$824,000
67.	Research Internship for Students in Ecology	$698,000
68.	National Network for Environmental Management Studies Fellowship Program	$589,000
69.	Cooperative Agreements for Training Cooperative Partnerships	$352,000
70.	University of Cincinnati/EPA Research Training Grant	$300,000
71.	P3 Award: National Student Design Competition for Sustainability	$150,000
72.	Environmental Protection Agency and the Hispanic Association of Colleges and Universities Cooperative Agreement	$121,000
73.	Environmental Science Program	$100,000
74.	Environmental Career Organization's Internship Program	$89,000
75.	EPA—Cincinnati Research Apprenticeship Program	$75,000
76.	Environmental Protection Internship Program Summer Training Initiative	$72,000
77.	Tribal Lands Environmental Science Scholarship Program	$60,000
78.	Internship Program for University of Arizona Engineering Students	$50,000
79.	Teacher Professional Development Workshop for Teachers Grade 6-12	$18,000
80.	Saturday Academy, Apprenticeships in Science and Engineering Program	$6,000
Department of Health and Human Services/Health Resources and Services Administration		
81.	Scholarships for Disadvantaged Students Program	$45.5 million
82.	Nursing Workforce Diversity	$16 million
83.	Faculty Loan Repayment Program	$1.1 million
Department of Health and Human Services/Indian Health Service		
84.	Indian Health Professions Scholarship	$8.1 million
85.	Health Professions Scholarship Program for Indians	$3.7 million
Department of Health and Human Services/National Institutes of Health		
86.	Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants	$546.9 million
87.	Ruth L. Kirschstein National Research Service Awards for Individual Postdoctoral Fellows	$72.6 million
88.	Research Supplements to Promote Diversity in Health-Related Research	$70 million

Program number	Program name	Fiscal year 04 funding
89.	Postdoctoral Visiting Fellow Program	$64.8 million
90.	Clinical Research Loan Repayment Program	$40.6 million
91.	Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellows, Predoctoral Minority Students, and Predoctoral Students with Disabilities	$33.8 million
92.	Minority Access to Research Careers Program	$30.7 million
93.	Postdoctoral Intramural Research Training Award Program	$30.2 million
94.	Science Education Partnership Award	$16 million
95.	Pediatric Research Loan Repayment Program	$15.9 million
96.	Post-baccalaureate Intramural Research Training Award Program	$9.1 million
97.	Ruth L. Kirschstein National Research Service Award Short-Term Institutional Research Training Grants	$9 million
98.	Health Disparities Research Loan Repayment Program	$8.7 million
99.	Graduate Program Partnerships	$7.4 million
100.	Student Intramural Research Training Award Program	$6.3 million
101.	Career Opportunities in Research Education and Training Honors Undergraduate Research Training Grant	$5 million
102.	General Research Loan Repayment Program	$4.9 million
103.	Ruth L. Kirschstein National Research Service Awards for Individual M.D./Ph.D. Predoctoral Fellows	$4.7 million
104.	Science Education Drug Abuse Partnership Award	$3.1 million
105.	Pharmacology Research Associate Training Program	$2.7 million
106.	Technical Intramural Research Training Award	$1.9 million
107.	Fellowships in Cancer Epidemiology and Genetics	$1.8 million
108.	Clinical Research Loan Repayment Program for Individuals from Disadvantaged Backgrounds	$1.7 million
109.	Contraception and Infertility Research Loan Repayment Program	$1 million
110.	Medical Infomatics Training Program	$853,000
111.	Undergraduate Scholarship Program for Individuals from Disadvantaged Backgrounds	$838,000
112.	Curriculum Supplement Series	$788,000
113.	National Science Foundation and the National Institute of Biomedical Imaging and Bioengineering	$782,000
114.	Summer Institute for Training in Biostatistics	$694,000
115.	Summer Institute on Design and Conduct of Randomized Clinical Trials Involving Behavioral Interventions	$622,000
116.	Clinical Research Loan Repayment Program for Individuals from Disadvantaged Background	$551,000
117.	Clinical Research Training Program	$407,000
118.	NIH Academy	$385,000
119.	Health Communications Internship Program	$340,000

Program number	Program name	Fiscal year 04 funding
120.	NIH/National Institute of Standards and Technology Joint Postdoctoral Program	$338,000
121.	Summer Genetics Institute	$323,000
122.	AIDS Research Loan Repayment Program	$271,000
123.	Intramural NIAID Research Opportunities	$271,000
124.	Cancer Research Interns in Residence	$250,000
125.	Comparative Molecular Pathology Research Training Program	$199,000
126.	Office of Research on Women's Health-funded Programs with the Office of Intramural Research	$179,000
127.	Summer Institute for Social Work Research	$144,000
128.	Office of Research on Women's Health-funded Programs with the Office of Intramural Training and Education	$119,000
129.	CCR/JHU Master of Science in Biotechnology Concentration in Molecular Targets and Drug Discovery Technologies	$111,000
130.	Introduction to Cancer Research Careers	$96,000
131.	Fellows Award for Research Excellence Program	$61,000
132.	Office of Research on Women's Health-funded Programs Supplements to Promote Reentry into Biomedical and Behavioral Research Careers	$60,000
133.	Translational Research in Clinical Oncology	$28,000
134.	National Institute of Environmental Health Sciences Office of Fellows' Career Development	$20,000
135.	Mobilizing for Action to Address the Unequal Burden of Cancer: NIH Research and Training Opportunities	$10,000
136.	Sallie Rosen Kaplan Fellowship for Women in Cancer Research	$5,000
Department of Homeland Security		
137.	Scholars and Fellows Program	$4.7 million
Department of the Interior		
138.	Cooperative Research Units Program	$15.3 million
139.	Water Resources Research Act Program	$6.4 million
140.	U.S. Geological Survey Mendenhall Postdoctoral Research Fellowship Program	$3.5 million
141.	Student Educational Employment Program	$1.8 million
142.	EDMAP Component of the National Cooperative Geologic Mapping Program	$490,000
143.	Student Career Experience Program	$177,000
144.	Cooperative Development Energy Program	$60,000
145.	Diversity Employment Program	$30,000
146.	Cooperative Agreement with Langston University	$15,000
147.	Mathematics, Science, and Engineering Academy	$15,000
148.	Shorebird Sister Schools Program	$15,000
149.	Build a Bridge Contest	$14,000

Program number	Program name	Fiscal year 04 funding
150.	VIVA Technology	$8,000
National Aeronautics and Space Administration		
151.	Minority University Research Education Program	$106.6 million
152.	Higher Education	$77.4 million
153.	Elementary and Secondary Education	$31.3 million
154.	E-Education	$9.7 million
155.	Informal Education	$5.5 million
National Science Foundation		
156.	Math and Science Partnership Program	$138.7 million
157.	Graduate Research Fellowship Program	$96 million
158.	Integrative Graduate Education and Research Traineeship Program	$67.7 million
159.	Teacher Professional Continuum	$61.5 million
160.	Research Experiences for Undergraduates	$51.7 million
161.	Graduate Teaching Fellows in K-12 Education	$49.8 million
162.	Advanced Technological Education	$45.9 million
163.	Course, Curriculum, and Laboratory Improvement	$40.7 million
164.	Research on Learning and Education	$39.4 million
165.	Computer Science, Engineering, and Mathematics Scholarships	$33.9 million
166.	Louis Stokes Alliances for Minority Participation	$33.3 million
167.	Centers for Learning and Teaching	$30.8 million
168.	Instructional Materials Development	$29.3 million
169.	Science, Technology, Engineering, and Mathematics Talent Expansion Program	$25 million
170.	Historically Black Colleges and Universities Undergraduate Program	$23.8 million
171.	Interagency Education Research Initiative	$23.6 million
172.	Information Technology Experiences for Students and Teachers	$20.9 million
173.	Enhancing the Mathematical Sciences Workforce in the 21st Century	$20.6 million
174.	Centers of Research Excellence in Science and Technology	$19.8 million
175.	ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers	$19.4 million
176.	Federal Cyber Service: Scholarship for Service	$15.8 million
177.	Alliances for Graduate Education and the Professoriate	$15.3 million
178.	Research on Gender in Science and Engineering	$10 million
179.	Tribal Colleges and Universities Program	$10 million
180.	Model Institutions for Excellence	$9.7 million
181.	Grants for the Department-Level Reform of Undergraduate Engineering Education	$8.2 million
182.	Robert Noyce Scholarship Program	$8 million
183.	Research Experiences for Teachers	$5.8 million

Program number	Program name	Fiscal year 04 funding
184.	Nanoscale Science and Engineering Education	$4.8 million
185.	Research in Disabilities Education	$4.6 million
186.	Opportunities for Enhancing Diversity in the Geosciences	$4 million
187.	Mathematical Sciences Postdoctoral Research Fellowships	$3.7 million
188.	Minority Postdoctoral Research Fellowships and Supporting Activities	$3.2 million
189.	Partnerships for Research and Education in Materials	$3 million
190.	Undergraduate Research Centers	$3 million
191.	Centers for Ocean Science Education Excellence	$2.8 million
192.	Undergraduate Mentoring in Environmental Biology	$2.2 million
193.	Director's Award for Distinguished Teaching Scholars	$1.8 million
194.	Astronomy and Astrophysics Postdoctoral Fellowship Program	$1.6 million
195.	Geoscience Education	$1.5 million
196.	Internships in Public Science Education	$1.2 million
197.	Discovery Corps Fellowship Program	$1.1 million
198.	East Asia & Pacific Summer Institutes for U.S. Graduate Students	$1 million
199.	Pan-American Advanced Studies Institutes	$800,000
200.	Distinguished International Postdoctoral Research Fellowships	$788,000
201.	Postdoctoral Fellowships in Polar Regions Research	$667,000
202.	Arctic Research and Education	$300,000
203.	Developing Global Scientists and Engineers	$172,000
Department of Transportation		
204.	University Transportation Centers Program	$32.5 million
205.	Dwight David Eisenhower Transportation Fellowship Program	$2 million
206.	Summer Transportation Institute	$2 million
207.	Summer Transportation Internship Program for Diverse Groups	$925,000

Source: GAO survey responses from 13 federal agencies.

Appendix III: Federal STEM Education Programs Funded at $10 Million or More

The federal civilian agencies reported that the following science, technology, engineering, and mathematics (STEM) education programs were funded with at least $10 million in either fiscal year 2004 or 2005. However, programs that received $10 million or more in fiscal year 2004 but were unfunded for fiscal year 2005 were excluded from table 22. Agency officials also provided the program descriptions in table 22.

Table 22: Federal STEM Education Programs Funded at $10 Million or More during Fiscal Year 2004 or Fiscal Year 2005

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Department of Agriculture				
1890 Institution Teaching and Research Capacity Building Grants Program	Is intended to strengthen teaching and research programs in the food and agricultural sciences by building the institutional capacities of the 1890 Land-Grant Institutions and Tuskegee University and West Virginia State University through cooperative linkages with federal and nonfederal entities. The program supports projects that strengthen teaching programs in the food and agricultural sciences in the targeted educational need areas of curriculum design and materials development, faculty preparation and enhancement of teaching, student experiential learning, and student recruitment and retention.	1990	$11.4	$12.5
Department of Education				
Mathematics and Science Partnerships Program	Is intended to increase the academic achievement of students in mathematics and science by enhancing the content knowledge and teaching skills of classroom teachers. Partnerships are between high-need school districts and the science, technology, engineering, and mathematics faculties of institutions of higher education.	2002	$149	$180
Upward Bound Math and Science Program	Designed to prepare low-income, first-generation college students for postsecondary education programs that lead to careers in the fields of math and science.	1990	$32.8	$32.8
Graduate Assistance in Areas of National Need	Provides fellowships in academic areas of national need to assist graduate students with excellent academic records who demonstrate financial need and plan to pursue the highest degree available in their courses of study.	1988	$30.6	$30.4
Environmental Protection Agency				
Science to Achieve Results Research Grants Program	Funds research grants in numerous environmental science and engineering disciplines. The program engages the nation's best scientists and engineers in targeted research. The grant program is currently focused on the health effects of particulate matter, drinking water, water quality, global change, ecosystem assessment and restoration, human health risk assessment, endocrine disrupting chemicals, pollution prevention and new technologies, children's health, and socio-economic research.	1995	$93.3	$80.1
Science to Achieve Results Graduate Fellowship Program	The purpose of this fellowship program is to encourage promising students to obtain advanced degrees and pursue careers in environmentally related fields.	1995	$10	$10

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Department of Health and Human Services/Health Resources and Services Administration				
Scholarships for Disadvantaged Students Program	Funds are awarded to accredited schools of allopathic medicine, osteopathic medicine, dentistry, optometry, pharmacy, podiatric medicine, veterinary medicine, nursing, public health, chiropractic, or allied health, and schools offering graduate programs in behavioral and mental health practice. Priority is given to schools based on the proportion of graduating students going into primary care, the proportion of underrepresented minority students enrolled, and graduates working in medically underserved communities. Schools select qualified students and provide scholarships that cannot exceed tuition and reasonable educational and living expenses.	1991	$45.5	Not avail.
Nursing Workforce Diversity	To increase nursing education opportunities for individuals who are from disadvantaged backgrounds (including racial and ethnic minorities underrepresented among registered nurses) by providing student stipends, pre-entry preparation, and retention activities.	1989	$16	$16
Department of Health and Human Services/National Institutes of Health				
Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants	Is designed to develop and enhance research training opportunities for individuals in biomedical, behavioral, and clinical research by supporting training programs at institutions of higher education. These institutional training grants allow the director of the program to select the trainees and to develop a curriculum of study and research experiences necessary to provide high-quality research training. The grant helps offset the cost of stipends and tuition for the appointed trainees. Graduate students, postdoctoral trainees, and short-term research training for health professional students can be supported by this grant.	1975	$546.9	Not avail.
Ruth L. Kirschstein National Research Service Awards for Individual Postdoctoral Fellows	To support the advanced training of individual students who have recently received doctoral degrees. This phase of research education and training is performed under the direct supervision of a sponsor who is an active investigator in the area of the proposed research. The training is designed to enhance the fellow's understanding of the health-related sciences and extend his/her potential to become a productive scientist who can perform research in biomedical, behavioral, or clinical fields.	1975	$72.6	Not avail.
Research Supplements to Promote Diversity in Health-Related Research	To improve the diversity of the research workforce by recruiting and supporting students, postdoctoral fellows, and eligible investigators from groups that have been shown to be underrepresented, such as individuals from underrepresented racial and ethnic groups, individuals with disabilities, and individuals from disadvantaged backgrounds.	1989	$70	$70
Postdoctoral Visiting Fellow Program	To provide advanced practical biomedical research experience to individuals who are foreign nationals and are 1 to 5 years beyond obtaining their Ph.D. or professional doctorate (e.g., M.D., DDS, etc.).	1950	$64.8	$70.7

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Clinical Research Loan Repayment Program	To attract health professionals to careers in clinical research. Clinical research is defined as "patient-oriented clinical research conducted with human subjects, or research on the causes and consequences of disease in human populations involving material of human origin (such as tissue specimens and cognitive phenomena) for which an investigator or colleague directly interacts with human subjects in an outpatient or inpatient setting to clarify a problem in human physiology, pathophysiology or disease, or epidemiologic or behavioral studies, outcomes research or health services research, or developing new technologies, therapeutic interventions, or clinical trials."	2002	$40.6	$42.6
Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellows, Predoctoral Minority Students, and Predoctoral Students with Disabilities	Provides predoctoral fellowships to students who are candidates for doctoral degrees and are performing dissertation research and training under the supervision of a mentor who is an active and established investigator in the area of the proposed research. The applicant and mentor must provide evidence of potential for a productive research career based upon the quality of previous research training, academic record, and training program. The applicant and mentor must propose a research project that will enhance the student's ability to understand and perform scientific research. The training program should be carried out in a research environment that includes appropriate resources and is demonstrably committed to the student's training.	1975	$33.8	Not avail.
Minority Access to Research Careers Program	Offers special research training support to 4-year colleges, universities, and health professional schools with substantial enrollments of minorities such as African Americans, Hispanic Americans, Native Americans (including Alaska Natives), and natives of U.S. Pacific Islands. Individual fellowships are also provided for graduate students and faculty.	1972	$30.7	$30.7
Postdoctoral Intramural Research Training Award Program	To provide advanced practical biomedical research experience to individuals who are 1 to 5 years beyond obtaining their Ph.D. or professional doctorate (e.g., M.D., DDS, etc.).	1986	$30.2	$33.3
Science Education Partnership Award	Provides funds for the development, implementation, and evaluation of innovative kindergarten through 12th grade (K-12) science education programs, teaching materials, and science center/museum programs. This program supports partnerships linking biomedical, clinical researchers, and behavioral scientists with K-12 teachers and schools, museum and science educators, media experts, and other interested organizations.	1992	$16	$16
Pediatric Research Loan Repayment Program	A program to attract health professionals to careers in pediatric research. Qualified pediatric research is defined as "research directly related to diseases, disorders, and other conditions in children."	2002	$15.9	$16

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Post-baccalaureate Intramural Research Training Award Program	To provide (1) recent college graduates (graduated no more than 2 years prior to activation of traineeship), an introduction early in their careers to biomedical research fields; encourage their pursuit of professional careers in biomedical research; and allow additional time to pursue successful application to either graduate or medical school programs or (2) students who have been accepted into graduate, other doctoral, or medical degree programs, and who have written permission from their school to delay entrance for up to 1 year.	1996	$9.1	$12.3
Department of Homeland Security				
University Programs	Provides scholarships for undergraduate and fellowships for graduate students pursuing degrees in mission-relevant fields and postdoctoral fellowships for their contributions to Department of Homeland Security research projects. Students receive professional mentoring and complete a summer internship to connect academic interests with homeland security initiatives. Postdoctoral scholars are also mentored by DHS scientists.	2003	$4.7	$10.7
Department of the Interior				
Cooperative Research Units Program	The program links graduate science training with the research needs of state and federal agencies, and provides students with one-on-one mentoring by federal research scientists working on both applied and basic research needs of interest to the program. Program cooperators and partners provide graduate training opportunities and support.	1936	$15.3	$15
Department of Labor				
Community College/Community Based Job Training Grant Initiative	To build the capacity of community colleges to train in high-growth, high-demand industries and to actually train workers in those industries through partnerships that also include workforce investment boards and employers.	2005	$0	$250
National Aeronautics and Space Administration				
Minority University Research Education Program	To expand and advance NASA's scientific and technological base through collaborative efforts with Historically Black Colleges and Universities (HBCU) and other minority universities (OMU), including Hispanic-serving institutions and Tribal colleges and universities. This program also provides K-12 awards to build and support successful pathways for students to progress to the next level of mathematics and science, through a college preparatory curriculum, and enrollment in college. Higher-education awards are also given that seek to improve the rate at which underrepresented minorities are awarded degrees in STEM disciplines through increased research training and exposure to cutting-edge technologies that better prepare them to enter STEM graduate programs, the NASA workforce pipeline, and employment in NASA-related industries.	2002	$106.6	$73.6

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Higher Education	The Higher Education Program focuses on supporting institutions of higher education in strengthening their research capabilities and providing opportunities that attract and prepare increasing numbers of students for NASA-related careers. The research conducted by the institutions will contribute to the research needs of NASA's Mission Directorates. The student projects serve as a major link in the student pipeline for addressing NASA's human capital strategies and the President's management agenda by helping to build, sustain, and effectively deploy the skilled, knowledgeable, diverse, and high-performing workforce needed to meet the current and emerging needs of government and its citizens.	2002	$77.4	$62.4
Elementary and Secondary Education	To increase the rigor of STEM experiences provided to K-12 students through workshops, summer internships, and classroom activities; provide high-quality professional development to teachers in STEM through NASA programs; develop technological avenues through the NASA Web site that will allow families to have common experiences with learning about space exploration; encourage inquiry teaching in K-12 classrooms; improve the content and focus of grade level/science team meetings in NASA Explorer Schools; and share the knowledge gained through the Educator Astronaut Program with teachers, students, and families.	2002	$31.3	$23.2
Informal Education	The principal purpose of the informal education program is to support projects designed to increase public interest in, understanding of, and engagement in STEM activities. The goal of all informal education programs is an informed citizenry that has access to the ideas of science and engineering and understands its role in enhancing the quality of life and the health, prosperity, welfare, and security of the nation. Informal learning is self-directed, voluntary, and motivated mainly by intrinsic interests, curiosity, exploration, and social interaction.	2002	$5.5	$10.2
National Science Foundation				
Math and Science Partnership (MSP)Program	The MSP is a major research and development effort that supports innovative partnerships to improve kindergarten through grade 12 student achievement in mathematics and science. MSP projects are expected to both raise the achievement levels of all students and significantly reduce achievement gaps in the mathematics and science performance of diverse student populations. Successful projects serve as models that can be widely replicated in educational practice to improve the mathematics and science achievement of all the nation's students.	2002	$138.7	$79.4
Graduate Research Fellowship Program (GRFP)	The purpose of the GRFP is to ensure the vitality of the scientific and technological workforce in the United States and to reinforce its diversity. The program recognizes and supports outstanding graduate students in the relevant science and engineering disciplines who are pursuing research-based master's and doctoral degrees. NSF fellows are expected to become knowledge experts who can contribute significantly to research, teaching, and innovations in science and engineering.	1952	$96	$96.6

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Integrative Graduate Education and Research Traineeship Program	This program provides support to universities for student positions in interdisciplinary areas of science and engineering. Traineeships focus on multidisciplinary and intersectoral research opportunities and prepare future faculty in effective teaching methods, applications of advanced educational technologies, and student mentoring techniques.	1998	$67.7	$69
Teacher Professional Continuum	The program addresses critical issues and needs regarding the recruitment, preparation, induction, retention, and lifelong development of kindergarten through grade 12 STEM teachers. Its goals are to improve the quality and coherence of teacher learning experiences across the continuum through research that informs teaching practice and the development of innovative resources for the professional development of kindergarten through grade 12 STEM teachers.	2004	$61.5	$60.2
Research Experiences for Undergraduates	This program supports active participation by undergraduate students in research projects in any of the areas of research funded by the National Science Foundation. The program seeks to involve students in meaningful ways in all kinds of research—whether disciplinary, interdisciplinary, or educational in focus—linked to the efforts of individual investigators, research groups, centers, and national facilities. Particular emphasis is given to the recruitment of women, minorities, and persons with disabilities.	1987	$51.7	$51.1
Graduate Teaching Fellows in K-12 Education	This program supports fellowships and associated training that enable graduate students in NSF-supported STEM disciplines to acquire additional skills that will broadly prepare them for professional and scientific careers. Through interactions with teachers, graduate students can improve communication and teaching skills while enriching STEM instruction in kindergarten through grade 12 schools. This program also provides institutions of higher education with an opportunity to make a permanent change in their graduate programs by including partnerships with schools in a manner that will mutually benefit faculties and students.	1999	$49.8	$49.9
Advanced Technological Education (ATE)	With an emphasis on 2-year colleges, the ATE program focuses on the education of technicians for the high-technology fields that drive our nation's economy. The program involves partnerships between academic institutions and employers to promote improvement in the education of science and engineering technicians at the undergraduate and secondary school levels. The ATE program supports curriculum development, professional development of college faculty and secondary school teachers, career pathways to 2-year colleges from secondary schools and from 2-year colleges to 4-year institutions, and other activities. The program also invites proposals focusing on applied research relating to technician education.	1994	$45.9	$45.1
Course, Curriculum, and Laboratory Improvement	This program emphasizes projects that build on prior work and contribute to the knowledge base of undergraduate STEM education research and practice. In addition, projects should contribute to building a community of scholars who work in related areas of undergraduate education.	1999	$40.7	$40.6

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Research on Learning and Education	The program seeks to capitalize on important developments across a wide range of fields related to human learning and to STEM education. It supports research across a continuum that includes (1) the biological basis of human learning; (2) behavioral, cognitive, affective, and social aspects of STEM learning; (3) STEM learning in formal and informal educational settings; (4) STEM policy research; and (5) the diffusion of STEM innovations.	2000	$39.4	$38.2
Computer Science, Engineering, and Mathematics Scholarships	This program supports scholarships for academically talented, financially needy students, enabling them to enter the high-technology workforce following completion of an associate, baccalaureate, or graduate-level degree in computer science, computer technology, engineering, engineering technology, or mathematics. Academic institutions apply for awards to support scholarship activities and are responsible for selecting scholarship recipients, reporting demographic information about student scholars, and managing the project at the institution.	1999	$33.9	$75
Louis Stokes Alliances for Minority Participation	The program is aimed at increasing the quality and quantity of students successfully completing STEM baccalaureate degree programs and increasing the number of students interested in, academically qualified for, and matriculated into programs of graduate study. It also supports sustained and comprehensive approaches that facilitate achievement of the long-term goal of increasing the number of students who earn doctorates in STEM, particularly those from populations underrepresented in STEM fields.	1991	$33.3	$35
Centers for Learning and Teaching	The program focuses on the advanced preparation of STEM educators, as well as the establishment of meaningful partnerships among education stakeholders, especially Ph.D.-granting institutions, school systems, and informal education performers. Its goals are to renew and diversify the cadre of leaders in STEM education; to increase the number of kindergarten through undergraduate educators capable of delivering high-quality STEM instruction and assessment; and to conduct research into STEM education issues of national import, such as the nature of learning, teaching strategies, and reform policies and outcomes.	2000	$30.8	$28.4
Instructional Materials Development	This program contains three components. It supports (1) the creation and substantial revision of comprehensive curricula and supplemental materials that are research-based, enhance classroom instruction, and reflect standards for science, mathematics, and technology education developed by professional organizations; (2) the creation of tools for assessing student learning that are tied to nationally developed standards and reflect the most current thinking on how students learn mathematics and science; and (3) research for development of this program and projects.	1983	$29.3	$28.5

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Science, Technology, Engineering, and Mathematics Talent Expansion Program	The program seeks to increase the number of students (U.S. citizens or permanent residents) receiving associate or baccalaureate degrees in established or emerging fields within STEM. Type 1 proposals that provide for full implementation efforts at academic institutions are solicited. Type 2 proposals that support educational research projects on associate or baccalaureate degree attainment in STEM are also solicited.	2002	$25	$25.3
Historically Black Colleges and Universities (HBCU) Undergraduate Program	This program provides awards to enhance the quality of STEM instructional and outreach programs at HBCUs as a means to broaden participation in the nation's STEM workforce. Project strategies include curriculum enhancement, faculty professional development, undergraduate research, academic enrichment, infusion of technology to enhance STEM instruction, collaborations with research institutions and industry, and other activities that meet institutional needs.	1998	$23.8	$25.2
Interagency Education Research Initiative	This is a collaborative effort with the U.S. Department of Education. The goal is to support scientific research that investigates the effectiveness of educational interventions in reading, mathematics, and the sciences as they are implemented in varied school settings with diverse student populations.	1999	$23.6	$13.8
Information Technology Experiences for Students and Teachers	The program is designed to increase the opportunities for students and teachers to learn about, experience, and use information technologies within the context of STEM, including information technology courses. It is in direct response to the concern about shortages of technology workers in the United States. It has two components: (1) youth-based projects with strong emphasis on career and educational paths and (2) comprehensive projects for students and teachers.	2003	$20.9	$25
Enhancing the Mathematical Sciences Workforce in the 21st Century	The long-range goal of this program is to increase the number of U.S. citizens, nationals, and permanent residents who are well prepared in the mathematical sciences and who pursue careers in the mathematical sciences and in other NSF-supported disciplines.	2004	$20.6	$20.7
Centers of Research Excellence in Science and Technology	This program makes resources available to significantly enhance the research capabilities of minority-serving institutions through the establishment of centers that effectively integrate education and research. It promotes the development of new knowledge, enhancements of the research productivity of individual faculty, and an expanded diverse student presence in STEM disciplines.	1987	$19.8	$15.9
ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers	The program goal is to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce. Members of underrepresented minority groups and individuals with disabilities are especially encouraged to apply.	2001	$19.4	$19.8

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Federal Cyber Service: Scholarship for Service	This program seeks to increase the number of qualified students entering the fields of information assurance and computer security and to increase the capacity of the United States' higher education enterprise to continue to produce professionals in these fields to meet the needs of our increasingly technological society. The program has two tracks: provides funds to colleges and universities to (1) award scholarships to students to pursue academic programs in the information assurance and computer security fields for the final 2 years of undergraduate study, or for 2 years of master's-level study, or for the final 2 years of Ph.D.-level study, and (2) improve the quality and increase the production of information assurance and computer security professionals.	2001	$15.8	$14.1
Alliances for Graduate Education and the Professoriate	This program is intended to increase significantly the number of domestic students receiving doctoral degrees in STEM, with special emphasis on those population groups underrepresented in these fields. The program is interested in increasing the number of minorities who will enter the professoriate in these disciplines. Specific objectives are to develop (1) and implement innovative models for recruiting, mentoring, and retaining minority students in STEM doctoral programs, and (2) effective strategies for identifying and supporting underrepresented minorities who want to pursue academic careers.	1998	$15.3	$14.8
Research on Gender in Science and Engineering	The program seeks to broaden the participation of girls and women in all fields of STEM education by supporting research, dissemination of research, and extension services in education that will lead to a larger and more diverse domestic science and engineering workforce. Typical projects will contribute to the knowledge base addressing gender-related differences in learning and in the educational experiences that affect student interest, performance, and choice of careers, and how pedagogical approaches and teaching styles, curriculum, student services, and institutional culture contribute to causing or closing gender gaps that persist in certain fields.	1993	$10	$9.8
Tribal Colleges and Universities Program	This program provides awards to enhance the quality of STEM instructional and outreach programs, with special attention to the use of information technologies at Tribal colleges and universities, Alaskan Native-serving institutions, and Native Hawaiian-serving institutions. Support is available for the implementation of comprehensive institutional approaches to strengthen STEM teaching and learning in ways that improve access to, retention within, and graduation from STEM programs, particularly those that have a strong technological foundation. Through this program, assistance is provided to eligible institutions in their efforts to bridge the digital divide and prepare students for careers in information technology, science, mathematics, and engineering fields.	2001	$10	$9.8

		Funding (in millions of dollars)[a]		
Program	**Description**	**First year**	**2004**	**2005**
Department of Transportation				
University Transportation Centers Program (UTC)	The UTC program's mission is to advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research, and technology transfer at university-based centers of excellence. The UTC program's goals include (1) developing a multidisciplinary program of coursework and experiential learning that reinforces the transportation theme of the center; (2) increasing the numbers of students, faculty, and staff who are attracted to and substantially involved in the undergraduate, graduate, and professional programs of the center; and (3) having students, faculty, and staff who reflect the growing diversity of the U.S. workforce and are substantially involved in the undergraduate, graduate, and professional programs of the center.	1998	$32.5	$32.5

Source: GAO survey responses from 13 federal agencies.

[a]The dollar amounts for fiscal years 2004 and 2005 contain actual and estimated program funding levels.

Appendix IV: Data on Students and Graduates in STEM Fields

Table 23 provides estimates for the numbers of students in science, technology, engineering, and mathematics (STEM) fields by education level for the 1995-1996 and 2003-2004 academic years. Tables 24 and 25 provide additional information regarding students in STEM fields by gender for the 1995-1996 and 2003-2004 academic years. Table 26 provides additional information regarding graduates in STEM fields by gender for the 1994-1995 and 2002-2003 academic years. Appendix V contains confidence intervals for these estimates.

Table 23: Estimated Numbers of Students in STEM Fields by Education Level for Academic Years 1995-1996 and 2003-2004

Education level/STEM field	Academic year 1995-1996	Academic year 2003-2004	Percentage change
Bachelor's level			
Total	**2,218,510**	**2,876,721**	**30**
Agricultural sciences	101,885	87,025	[b]
Biological sciences	407,336	351,595	-14
Computer sciences	261,139	456,303	75
Engineering	363,504	422,230	16
Mathematics	57,133	64,307	[b]
Physical sciences	107,832	129,207	[b]
Psychology	309,810	409,827	32
Social sciences	536,487	825,495	54
Technology	73,384	130,733	78
Master's level			
Total	**321,293**	**403,200**	**25**
Agricultural sciences	[a]	12,977	[a]
Biological sciences	34,701	19,467	-44
Computer sciences	49,071	58,939	[b]
Engineering	66,296	90,234	[b]
Mathematics	[a]	12,531	[a]
Physical sciences	[a]	22,008	[a]
Psychology	30,008	31,918	[b]
Social sciences	82,177	144,895	76
Technology	[a]	10,231	[a]
Doctoral level			
Total	**217,395**	**198,504**	[b]
Agricultural sciences	[a]	5,983	[a]
Biological sciences	[a]	33,884	[a]

Education level/STEM field	Academic year 1995-1996	Academic year 2003-2004	Percentage change
Computer sciences	[a]	9,196	[a]
Engineering	32,181	35,687	[b]
Mathematics	[a]	9,412	[a]
Physical sciences	38,058	24,973	[b]
Psychology	30,291	33,994	[b]
Social sciences	54,092	42,464	[b]
Technology	[a]	2,912	[a]

Source: GAO calculations based upon NPSAS data.

Note: Enrollment totals differ from those cited in table 9 because table 9 includes students enrolled in certificate, associate's, other undergraduate, first-professional degree, and post-bachelor's or post-master's certificate programs.

[a]Sample sizes are insufficient to accurately produce estimates.

[b]Changes between academic years 1995-1996 and 2003-2004 are not statistically significant at the 95-percent confidence level. See table 30 for significance of percentage changes.

Table 24: Estimated Percentages of Students by Gender and STEM Field for Academic Years 1995-1996 and 2003-2004

	Male		Female	
	Percent: 1995-1996	Percent: 2003-2004	Percent: 1995-1996	Percent: 2003-2004
Agricultural sciences				
Total	58	55	42	45
Bachelor's	56	54	44	46
Master's	[a]	[a]	[a]	[a]
Doctorate	[a]	61	[a]	39
Biological sciences				
Total	46	42	54	58
Bachelor's	45	42	55	58
Master's	[a]	26	[a]	74
Doctorate	[a]	50	[a]	50
Computer sciences				
Total	67	76	33	24
Bachelor's	69	77	31	23
Master's	[a]	69	[a]	31
Doctorate	[a]	72	[a]	28
Engineering				
Total	83	83	17	17
Bachelor's	83	83	17	17
Master's	[a]	81	[a]	19

	Male		Female	
	Percent: 1995-1996	Percent: 2003-2004	Percent: 1995-1996	Percent: 2003-2004
Doctorate	[a]	78	[a]	22
Mathematics				
Total	62	55	38	45
Bachelor's	57	54	43	46
Master's	[a]	[a]	[a]	[a]
Doctorate	[a]	68	[a]	32
Physical sciences				
Total	62	56	38	44
Bachelor's	56	53	44	47
Master's	[a]	[a]	[a]	[a]
Doctorate	[a]	68	[a]	32
Psychology				
Total	26	26	74	74
Bachelor's	26	26	74	74
Master's	[a]	21	[a]	79
Doctorate	[a]	30	a	70
Social sciences				
Total	54	41	46	59
Bachelor's	52	42	48	58
Master's	51	35	49	65
Doctorate	83	46	17	54
Technology				
Total	89	81	11	19
Bachelor's	88	81	12	19
Master's	[a]	[a]	[a]	[a]
Doctorate	[a]	[a]	[a]	[a]

Source: GAO calculations based upon NPSAS data.

[a]Sample sizes are insufficient to accurately produce estimates.

Table 25: Estimated Number of Women Students and Percentage Change by Education Level and STEM Field for Academic Years 1995-1996 and 2003-2004

		Number of women students		
	Education level/STEM field	1995-1996	2003-2004	Percentage change in women students
Bachelor's level	Agricultural sciences	44,444	39,702	[b]
	Biological sciences	222,323	203,038	[b]
	Computer sciences	82,013	104,824	[b]
	Engineering	59,985	70,353	[b]
	Mathematics	24,597	29,791	[b]
	Physical sciences	47,421	60,203	[b]
	Psychology	229,772	304,712	+33
	Social sciences	258,023	475,544	+84
	Technology	8,871	25,227	+184
Master's level	Agricultural sciences	[a]	[a]	[a]
	Biological sciences	[a]	14,415	[a]
	Computer sciences	[a]	18,000	[a]
	Engineering	[a]	17,042	[a]
	Mathematics	[a]	5,562	[a]
	Physical sciences	[a]	8,497	[a]
	Psychology	23,857	25,342	[b]
	Social sciences	40,395	94,169	+133
	Technology	[a]	1,280	[a]
Doctoral level	Agricultural sciences	[a]	2,353	[a]
	Biological sciences	[a]	17,074	[a]
	Computer sciences	[a]	2,556	[a]
	Engineering	[a]	7,868	[a]
	Mathematics	[a]	3,042	[a]
	Physical sciences	[a]	8,105	[a]
	Psychology	[a]	23,843	[a]
	Social sciences	9,440	22,931	+143
	Technology	[a]	692	[a]

Source: GAO calculations based upon NPSAS data.

[a] Sample sizes are insufficient to accurately produce estimates.

[b] Changes between academic years 1995-1996 and 2003-2004 are not statistically significant at the 95-percent confidence level. See table 29 for confidence intervals.

Table 26: Comparisons in the Percentage of STEM Graduates by Field and Gender for Academic Years 1994-1995 and 2002-2003

STEM Degree/field	Percentage graduates, men, 1994-1995	Percentage graduates, men, 2002-2003	Percentage graduates, women, 1994-1995	Percentage graduates, women, 2002-2003
Bachelor's degree				
Biological/agricultural sciences	50	40	50	60
Earth, atmospheric, and ocean sciences	66	58	34	42
Engineering	83	80	17	20
Mathematics and computer sciences	65	69	35	31
Physical sciences	64	58	36	42
Psychology	27	22	73	78
Social sciences	50	45	50	55
Technology	90	88	10	12
Master's degree				
Biological/agricultural sciences	52	45	48	55
Earth, atmospheric, and ocean sciences	70	59	30	41
Engineering	84	79	16	21
Mathematics and computer sciences	70	66	30	34
Physical sciences	70	64	30	36
Psychology	28	23	72	77
Social sciences	51	45	49	55
Technology	81	73	19	27
Doctoral degree				
Biological/agricultural sciences	63	57	37	43
Earth, atmospheric, and ocean sciences	78	72	22	28
Engineering	88	83	12	17
Mathematics and computer sciences	80	76	20	24
Physical sciences	76	73	24	27
Psychology	38	31	62	69
Social sciences	62	55	38	45
Technology	89	100	11	0

Source: GAO calculations based upon IPEDS data.

Appendix V: Confidence Intervals for Estimates of Students at the Bachelor's, Master's, and Doctoral Levels

Because the National Postsecondary Student Aid Study (NPSAS) sample is a probability sample of students, the sample is only one of a large number of samples that might have been drawn. Since each sample could have provided different estimates, confidence in the precision of the particular sample's results is expressed as a 95-percent confidence interval (for example, plus or minus 4 percentage points). This is the interval that would contain the actual population value for 95 percent of the samples that could have been drawn. As a result, we are 95 percent confident that each of the confidence intervals in this report will include the true values in the study population. The upper and lower bounds of the 95 percent confidence intervals for each estimate relied on in this report are presented in the following tables.

Table 27: Estimated Changes in the Numbers and Percentages of Students in the STEM and Non-STEM Fields across All Education Levels, Academic Years 1995-1996 and 2003-2004 (95 percent confidence intervals)

Lower and upper bounds of 95 percent confidence interval	STEM field	Non-STEM field
Lower bound: number of students: 1995-1996	3,941,589	14,885,171
Upper bound: number of students: 1995-1996	4,323,159	15,601,065
Lower bound: percentage of students: 1995-1996	20	78
Upper bound: percentage of students: 1995-1996	22	80
Lower bound: number of students: 2003-2004	4,911,850	16,740,049
Upper bound: number of students: 2003-2004	5,082,515	17,025,326
Lower bound: percentage of students: 2003-2004	22	77
Upper bound: percentage of students: 2003-2004	23	78
Lower bound: percentage change: 1995/96-2003/04	15	8
Upper bound: percentage change: 1995/96-2003/04	26.9	13.5

Source: GAO calculations based upon 1995-1996 and 2003-2004 NPSAS data.

Note: The totals for STEM and non-STEM enrollments include students in addition to the bachelor's, master's, and doctorate education levels. These totals also include students enrolled in certificate, associate's, other undergraduate, first-professional degree, and post-bachelor's or post-master's certificate programs. The percentage changes between the 1995-1996 and 2003-2004 academic years for STEM and non-STEM students are statistically significant.

Table 28: Numbers of Students by Education Level in all STEM Fields for Academic Years 1995-1996 and 2003-2004 (95 percent confidence intervals)

		Total	Bachelors	Masters	Doctorate
Total	Lower bound: Number of Students: 1995-1996	2,633,867	2,114,316	271,208	171,824
	Upper bound: Number of Students: 1995-1996	2,880,529	2,322,704	377,821	271,230
	Lower bound: Number of Students: 2003-2004	3,411,004	2,819,206	366,141	185,230
	Upper bound: Number of Students: 2003-2004	3,545,844	2,934,236	442,938	212,471
Agricultural Sciences	Lower bound: Number of Students: 1995-1996	93,346	78,241	[a]	[a]
	Upper bound: Number of Students: 1995-1996	151,132	130,144	[a]	[a]
	Lower bound: Number of Students: 2003-2004	93,543	76,472	7,296	4,661
	Upper bound: Number of Students: 2003-2004	119,613	98,590	21,202	7,553
Biological Sciences	Lower bound: Number of Students: 1995-1996	416,315	360,553	18,883	[a]
	Upper bound: Number of Students: 1995-1996	524,615	454,119	57,066	[a]
	Lower bound: Number of Students: 2003-2004	383,277	330,834	13,728	30,401
	Upper bound: Number of Students: 2003-2004	427,502	372,355	26,694	37,367
Computer Sciences	Lower bound: Number of Students: 1995-1996	275,804	224,616	31,634	[a]
	Upper bound: Number of Students: 1995-1996	363,084	297,662	71,242	[a]
	Lower bound: Number of Students: 2003-2004	495,359	428,927	47,669	7,427
	Upper bound: Number of Students: 2003-2004	554,747	483,679	70,210	11,243
Engineering	Lower bound: Number of Students: 1995-1996	411,868	321,464	45,912	16,620
	Upper bound: Number of Students: 1995-1996	516,391	405,544	90,768	54,155
	Lower bound: Number of Students: 2003-2004	514,794	400,252	63,632	32,113
	Upper bound: Number of Students: 2003-2004	583,058	444,208	116,835	39,261
Mathematics	Lower bound: Number of Students: 1995-1996	68,083	42,910	[a]	[a]
	Upper bound: Number of Students: 1995-1996	119,165	74,456	[a]	[a]
	Lower bound: Number of Students: 2003-2004	75,705	55,314	7,869	7,687
	Upper bound: Number of Students: 2003-2004	97,848	74,318	18,867	11,392
Physical Sciences	Lower bound: Number of Students: 1995-1996	139,416	87,966	[a]	21,279
	Upper bound: Number of Students: 1995-1996	214,274	130,658	[a]	60,546
	Lower bound: Number of Students: 2003-2004	160,895	116,479	14,944	22,043
	Upper bound: Number of Students: 2003-2004	192,534	142,894	31,092	27,903
Psychology	Lower bound: Number of Students: 1995-1996	327,359	271,188	17,600	16,929
	Upper bound: Number of Students: 1995-1996	416,804	348,432	47,037	48,601
	Lower bound: Number of Students: 2003-2004	449,858	385,660	24,218	27,846
	Upper bound: Number of Students: 2003-2004	502,696	433,995	41,116	40,142
Social Sciences	Lower bound: Number of Students: 1995-1996	608,199	478,659	60,792	33,489
	Upper bound: Number of Students: 1995-1996	742,107	594,315	103,562	79,414
	Lower bound: Number of Students: 2003-2004	974,279	791,462	125,457	38,291

		Total	Bachelors	Masters	Doctorate
	Upper bound: Number of Students: 2003-2004	1,052,506	859,527	164,333	46,636
Technology	Lower bound: Number of Students: 1995-1996	63,910	57,446	[a]	[a]
	Upper bound: Number of Students: 1995-1996	104,308	92,251	[a]	[a]
	Lower bound: Number of Students: 2003-2004	130,347	118,492	5,556	1,814
	Upper bound: Number of Students: 2003-2004	158,418	143,848	17,158	4,421

Source: GAO calculations based upon 1995-1996 and 2003-2004 NPSAS data.

[a]Sample sizes are insufficient to accurately produce estimates.

Table 29: Estimated Numbers and Percentage Changes in Women Students in STEM Fields, Academic Years 1995-1996 and 2003-2004 (95 percent confidence intervals)

	Lower bound: Number of Students: 1995-1996	Upper bound: Number of Students: 1995-1996	Lower bound: Number of Students: 2003-2004	Upper bound: Number of Students: 2003-2004	Lower bound: Percentage Change: 1995/96-2003/04	Upper bound: Percentage Change: 1995/96-2003/04
Total						
Total	1,100,766	1,260,962	1,546,340	1,638,269	24.9	44.8
Agricultural sciences	33,541	67,797	39,678	56,710	-41.2	31.4
Biological sciences	215,624	293,386	217,669	251,384	-23.4	7.7
Computer sciences	78,956	129,858	110,119	140,642	-12.6	52.8
Engineering	60,568	100,683	84,556	105,970	-14.3	55
Mathematics	21,805	46,907	31,207	45,593	-34.1	57.6
Physical sciences	42,352	91,230	66,408	87,203	-29.9	59.9
Psychology	236,730	311,792	331,616	376,179	9.6	48.5
Social sciences	267,155	348,561	562,529	622,759	65.2	119.8
Technology	5,136	13,993	21,339	33,060	52.3	361
Bachelor's						
Total	909,030	1,045,868	1,271,939	1,354,847	24.1	44.7
Agricultural sciences	27,943	60,945	32,293	47,111	-47.8	26.4
Biological sciences	188,204	256,442	187,283	218,793	-24.4	7
Computer sciences	61,719	102,307	90,851	118,798	-8.1	63.7
Engineering	45,013	74,957	61,142	79,563	-15.8	50.3
Mathematics	16,558	32,636	23,487	36,094	-26	68.3
Physical sciences	32,641	62,201	51,259	69,147	-16.9	70.8
Psychology	197,530	262,014	284,138	325,287	12	53.3
Social sciences	220,004	296,042	449,103	501,985	55.3	113.3
Technology	5,185	13,867	19,582	30,872	40.2	328.6

	Lower bound: Number of Students: 1995-1996	Upper bound: Number of Students: 1995-1996	Lower bound: Number of Students: 2003-2004	Upper bound: Number of Students: 2003-2004	Lower bound: Percentage Change: 1995/96-2003/04	Upper bound: Percentage Change: 1995/96-2003/04
Master's						
Total	109,116	183,302	170,116	210,777	-5.6	66.1
Agricultural sciences	[a]	[a]	[a]	[a]	[a]	[a]
Biological sciences	[a]	[a]	11,330	16,806	[a]	[a]
Computer sciences	[a]	[a]	11,907	24,093	[a]	[a]
Engineering	[a]	[a]	10,989	24,604	[a]	[a]
Mathematics	[a]	[a]	2,979	8,336	[a]	[a]
Physical sciences	[a]	[a]	4,713	12,802	[a]	[a]
Psychology	15,901	28,488	21,284	28,384	-58.1	70.5
Social sciences	26,605	54,185	79,619	108,720	45.8	220.5
Technology	[a]	[a]	235	3,485	[a]	[a]
Doctorate						
Total	38,103	79,875	81,553	95,377	-6.3	115.6
Agricultural Sciences	[a]	[a]	1,441	3,265	[a]	[a]
Biological Sciences	[a]	[a]	14,455	19,692	[a]	[a]
Computer Sciences	[a]	[a]	1,745	3,503	[a]	[a]
Engineering	[a]	[a]	5,870	9,867	[a]	[a]
Mathematics	[a]	[a]	1,999	4,085	[a]	[a]
Physical Sciences	[a]	[a]	6,298	9,913	[a]	[a]
Psychology	[a]	[a]	19,198	28,489	[a]	[a]
Social Sciences	4,098	17,371	19,778	26,083	4.2	281.6
Technology	[a]	[a]	254	1,339	[a]	[a]

Source: GAO calculations based upon NPSAS data.

[a]Sample sizes are insufficient to accurately produce estimates.

Table 30: Estimated Percentage Changes in Bachelor's, Master's, and Doctoral Students in STEM Fields, Academic Years 1995-1996 and 2003-2004 (95 percent confidence intervals)

		Lower and upper bounds of 95 percent confidence interval			
STEM fields	**Percentage change in academic years 1995-1996 and 2003-2004**	**Total**	**Bachelor's**	**Master's**	**Doctoral**
Agricultural sciences	Lower bound: percentage change	-34.8	-38.7	[a]	[a]
	Upper bound: percentage change	11.9	9.5	[a]	[a]
	Statistically significant	no	no	[a]	[a]
Biological sciences	Lower bound: percentage change	-24.4	-24.8	-79.6	[a]
	Upper bound: percentage change	-2.6	-2.5	-8.3	[a]
	Statistically significant	yes	yes	yes	[a]
Computer sciences	Lower bound: percentage change	41.1	48.1	-34.8	[a]
	Upper bound: percentage change	89.5	101.3	75	[a]
	Statistically significant	yes	yes	no	[a]
Engineering	Lower bound: percentage change	3.5	1.4	-27.5	-55.4
	Upper bound: percentage change	33.8	30.9	99.7	77.2
	Statistically significant	yes	yes	no	no
Mathematics	Lower bound: percentage change	-33.5	-21.8	[a]	[a]
	Upper bound: percentage change	23	46.9	[a]	[a]
	Statistically significant	no	no	[a]	[a]
Physical sciences	Lower bound: percentage change	-21.7	-6.6	[a]	-70.2
	Upper bound percentage change	24.4	46.3	[a]	1.4
	Statistically significant	no	no	[a]	no
Psychology	Lower bound: percentage change	11.7	14	-51.2	-48.8
	Upper bound: percentage change	45.4	50.5	63.9	73.3
	Statistically significant	yes	yes	no	no
Social sciences	Lower bound: percentage change	34.6	36.1	24.7	-59.3
	Upper bound: percentage change	66.5	71.6	127.9	16.3
	Statistically significant	yes	yes	yes	no
Technology	Lower bound: percentage change	30	33.4	[a]	[a]
	Upper bound: percentage change	119.6	122.9	[a]	[a]
	Statistically significant	yes	yes	[a]	[a]
Total	Lower bound: percentage change	20	23.1	1.8	-29.5
	Upper bound: percentage change	32.3	36.3	49.2	12.1
	Statistically significant	yes	yes	yes	no

Source: GAO calculations based upon 1995-1996 and 2003-2004 NPSAS data.

[a]Sample sizes are insufficient to accurately produce estimates.

Table 31: Estimates of STEM Students by Gender and Field for Academic Years 1995-1996 and 2003-2004 (95 percent confidence intervals)

	Men: 1995-1996 academic year		Men: 2003-2004 academic year			Women: 1995-1996 academic year		Women: 2003-2004 academic year		
STEM fields	Lower bound	Upper bound	Lower bound	Upper bound	Statistically significant	Lower bound	Upper bound	Lower bound	Upper bound	Statistically significant
Agricultural sciences										
Bachelor's	44	69	48	61	no	31	56	39	52	no
Master's	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Doctoral	[a]	[a]	49	72	[a]	[a]	[a]	28	51	[a]
Biological sciences										
Bachelor's	40	51	39	45	no	49	60	55	61	no
Master's	[a]	[a]	14	46	[a]	[a]	[a]	54	89	[a]
Doctoral	[a]	[a]	44	55	[a]	[a]	[a]	45	56	[a]
Computer sciences										
Bachelor's	62	75	74	80	no	25	38	20	26	no
Master's	[a]	[a]	61	78	[a]	[a]	[a]	22	39	[a]
Doctoral	[a]	[a]	62	81	[a]	[a]	[a]	19	38	[a]
Engineering										
Bachelor's	80	87	81	85	no	13	20	15	19	no
Master's	[a]	[a]	73	88	[a]	[a]	[a]	12	27	[a]
Doctoral	[a]	[a]	73	83	[a]	[a]	[a]	17	27	[a]
Mathematics										
Bachelor's	44	70	46	61	no	30	56	39	54	no
Master's	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Doctoral	[a]	[a]	59	77	[a]	[a]	[a]	23	41	[a]
Physical sciences										
Bachelor's	46	66	48	59	no	34	54	41	52	no
Master's	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Doctoral	[a]	[a]	62	73	[a]	[a]	[a]	27	38	[a]
Psychology										
Bachelor's	20	32	23	28	no	68	80	72	77	no
Master's	[a]	[a]	10	35	[a]	[a]	[a]	65	90	[a]
Doctoral	[a]	[a]	20	39	[a]	[a]	[a]	61	80	[a]
Social sciences										
Bachelor's	46	57	40	45	yes	43	54	55	60	yes
Master's	38	64	28	42	no	36	62	58	72	no

	Men: 1995-1996 academic year		Men: 2003-2004 academic year			Women: 1995-1996 academic year		Women: 2003-2004 academic year		
STEM fields	**Lower bound**	**Upper bound**	**Lower bound**	**Upper bound**	**Statistically significant**	**Lower bound**	**Upper bound**	**Lower bound**	**Upper bound**	**Statistically significant**
Doctoral	70	91	41	51	yes	9	30	49	59	yes
Technology										
Bachelor's	81	93	77	85	no	7	19	15	23	no
Master's	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Doctoral	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Total students										
Total	55	60	53	55	yes	40	45	45	47	yes
Bachelor's	54	58	53	55	no	42	46	45	47	no
Master's	46	63	48	57	no	37	54	43	52	no
Doctoral	63	82	53	58	yes	18	37	42	47	yes

Source: GAO calculations based upon 1995-1996 and 2003-2004 NPSAS data.

[a]Sample sizes are insufficient to accurately produce estimates.

Table 32: Estimates of Students for Selected Racial or Ethnic Groups in STEM Fields for All Education Levels and Fields for the Academic Years 1995-1996 and 2002-2003 (95 percent confidence intervals)

Race or ethnicity	Lower bound: number of students, academic year, 1995-1996	Upper bound: number of students, academic year, 1995-1996	Lower bound: number of students, academic year, 2003-2004	Upper bound: number of students, academic year, 2003-2004
African American	303,832	416,502	577,854	639,114
Hispanic	285,381	446,621	461,738	515,423
Asian/Pacific Islander	247,347	330,541	322,738	367,377
Native American	11,464	28,103	30,064	47,694
Other/multiple minorities	17,708	44,434	150,264	183,174

Lower bound: percentage change	Upper bound: percentage change	Lower bound: percentage of students, academic year 1995-1996	Upper bound: percentage of students, academic year 1995-1996	Lower bound: percentage of students, academic year 2003-2004	Upper bound: percentage of students, academic year 2003-2004
41	97	7	10	12	13
3	64	7	11	9	10
1	38	6	8	6	7
8	206	0	1	1	1
219	732	0	1	3	4

Source: GAO Calculations based upon 1995-1996 and 2003-2004 NPSAS data.

Table 33: Estimates of International Students in STEM Fields by Education Levels for Academic Years 1995-1996 and 2003-2004 (95 percent confidence intervals)

Education level	Lower bound: number of students, 1995-1996	Upper bound: number of students, 1995-1996	Lower bound: number of students, 2003-2004	Upper bound: number of students, 2003-2004	Lower bound: percentage change	Upper bound: percentage change
Total	80,812	142,192	154,466	186,322	12	102
Bachelor's	20,254	47,684	125,950	154,911	155	523
Master's	23,063	64,587	16,359	29,899	-76	-13
Doctoral	20,525	59,861	5,168	10,735	-90	-68

Source: GAO calculations based upon 1995-1996 and 2003-2004 NPSAS data.

Appendix VI: Confidence Intervals for Estimates of STEM Employment by Gender, Race or Ethnicity, and Wages and Salaries

The current population survey (CPS) was used to obtain estimates about employees and wages and salaries in science, technology, engineering, and mathematics (STEM) fields. Because the current population survey (CPS) is a probability sample based on random selections, the sample is only one of a large number of samples that might have been drawn. Since each sample could have provided different estimates, confidence in the precision of the particular sample's results is expressed as a 95 percent confidence interval (e.g., plus or minus 4 percentage points). This is the interval that would contain the actual population value for 95 percent of the samples that could have been drawn. As a result, we are 95 percent confident that each of the confidence intervals in this report will include the true values in the study population. We use the CPS general variance methodology to estimate this sampling error and report it as confidence intervals. Percentage estimates we produce from the CPS data have 95 percent confidence intervals of plus or minus 6 percentage points or less. Estimates other than percentages have 95 percent confidence intervals of no more than plus or minus 10 percent of the estimate itself, unless otherwise noted. Consistent with the CPS documentation guidelines, we do not produce estimates based on the March supplement data for populations of less than 75,000.

Table 34: Estimated Total Number of Employees by STEM Field between Calendar Years 1994 and 2003

STEM fields	Lower bound: calendar year 1994	Upper bound: calendar year 1994	Lower bound: calendar year 2003	Upper bound: calendar year 2003	Statistically significant
Science	2,349,605	2,656,451	2,874,347	3,143,071	yes
Technology	1,285,321	1,515,671	1,379,375	1,568,189	no
Engineering	1,668,514	1,929,240	1,638,355	1,843,427	no
Mathematics/ computer sciences	1,369,047	1,606,395	2,520,858	2,773,146	yes

Source: GAO calculations based upon 1994 and 2003 CPS data.

Table 35: Estimated Numbers of Employees in STEM Fields by Gender for Calendar Years 1994 and 2003

STEM fields	Lower bound: calendar year 1994, women	Upper bound: calendar year 1994, women	Lower bound: calendar year 2003, women	Upper bound: calendar year 2003, women	Statistically significant	Lower bound: calendar year 1994, men	Upper bound: calendar year 1994, men	Lower bound: calendar year 2003, men	Upper bound: calendar year 2003, men	Statistically significant
Science	1,594,527	1,827,685	2,031,124	2,327,390	yes	708,673	875,171	733,358	925,548	no
Technology	385,433	505,329	357,805	489,899	no	863,785	1,046,445	941,960	1,157,900	no
Engineering	107,109	174,669	126,947	210,407	no	1,538,198	1,777,778	1,440,510	1,703,920	no
Mathematics/ computer sciences	372,953	491,053	610,649	779,525	yes	959,765	1,151,681	1,805,505	2,098,325	yes

Source: GAO calculations based upon 1994 and 2003 CPS data.

Table 36: Estimated Changes in STEM Employment by Gender for Calendar Years 1994 and 2003

STEM fields	Lower bound: calendar year 1994	Upper bound: calendar year 1994	Lower bound: calendar year 2003	Upper bound: calendar year 2003	Statistically significant
	Men		**Men**		
Science	28.87	34.40	24.84	30.30	yes
Technology	64.50	71.90	67.29	75.19	no
Engineering	90.28	94.05	87.93	92.69	no
Mathematics/ computer sciences	67.46	74.46	70.87	76.61	no
	Women		**Women**		
Science	65.71	71.01	69.81	75.05	yes
Technology	28.26	35.35	24.97	32.55	no
Engineering	6.03	9.64	7.41	11.97	no
Mathematics/ computer sciences	25.69	32.39	23.51	29.01	no

Source: GAO calculations based upon 1994 and 2003 CPS data.

Table 37: Estimated Percentages of STEM Employees for Selected Racial or Ethnic Groups for Calendar Years 1994 and 2003

Race or Ethnicity	Lower bound: calendar year 1994	Upper bound: calendar year 1994	Lower bound: calendar year 2003	Upper bound: calendar year 2003	Statistically significant
Black or African American	6.49	8.46	7.66	9.79	no
Hispanic or Latino origin	4.76	6.60	8.83	11.09	yes
Other minorities	3.64	5.28	5.89	7.81	yes

Source: GAO calculations based upon 1994 and 2003 CPS data.

Table 38: Estimated Changes in Median Annual Wages and Salaries in the STEM Fields for Calendar Years 1994 and 2003

STEM fields	Lower bound: calendar year 1994	Upper bound: calendar year 1994	Lower bound: calendar year 2003	Upper bound: calendar year 2003	Statistically significant
Science	$42,212	$45,241	$44,650	$47,008	yes
Technology	$36,241	$39,769	$38,554	$41,286	yes
Engineering	$59,059	$63,134	$67,634	$71,749	yes
Mathematics/computer sciences	$51,922	$55,905	$58,801	$61,679	yes

Source: GAO calculations based upon 1994 and 2003 CPS data.

Appendix VII: Comments from the Department of Commerce

THE DEPUTY SECRETARY OF COMMERCE
Washington, D.C. 20230

September 23, 2005

Ms. Cornelia M. Ashby
Director
Education, Workforce,
and Income Security Issues
U.S. Government Accountability Office
Washington, D. C. 20548

Dear Ms. Ashby:

Thank you for the opportunity to review and comment on the Government Accountability Office's draft report, *Higher Education: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends* (GAO-05-887).

I enclose the U.S. Department of Commerce's recommended changes regarding factual or technical information.

Sincerely,

David A Sampson

Enclosure

U. S. Department of Commerce Comments on Draft GAO Report Entitled "Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends" (GAO-05-887/ September 2005)

General Comments

We commend the Government Accountability Office (GAO) for highlighting these important issues and find the data and methodologies appropriate to address the topic.

Recommended Changes for Factual/Technical Information

Pages 48, Table 19: Federal STEM Education Programs Funded in FY 2004, Department of Commerce:

Change funding for Program 17, Educational Partnership with Minority Serving Institutions from $14.8 million to $7.4 million, to reflect funds expended only for education. The total funding for the 210 Federal Science, Technology, Engineering, and Mathematics Education Programs should be reduced by $7.4 million.

Delete Program 18, Undersea Research Program and its associated funds of $12 million. This program is primarily focused on research, not education. The total funding for the 210 Federal Science, Technology, Engineering, and Mathematics Education Programs should be reduced by $12 million.

Change funding for Program 25, National Marine Sanctuaries Education Program from $5.2 million to $4.4 million. The total funding for the 210 Federal Science, Technology, Engineering, and Mathematics Education Programs should be further reduced by $0.8 million.

As a result of these changes, only 13 programs should be listed under the Department of Commerce for Table 19. There should be a total decrease of $20.2 million due to these changes.

Page 55, Table 20: Federal STEM Education Programs Funded at $10 Million or More during Fiscal Year 2004 or Fiscal Year 2005, Department of Commerce:

Delete the Educational Partnership with Minority Serving Institutions from Table 20, since only $7.4 million in educational funds was expended in FY 2004 and this program is funded at only $7.5 million for education in FY 2005, thus not meeting the threshold requirement of $10 million for this table.

Delete the Undersea Research Program and its associated funds of $12 million for FY 2004 and $12.5 million for FY 2005. This program is primarily focused on research, not education. The total funding for the 210 Federal Science, Technology, Engineering, and Mathematics Education Programs for FY 2005 should be reduced by $12.5 million.

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As a result of these changes, there should be no programs listed under the Department of Commerce for Table 20.

Editorial Comments

Pages 3-4, Results in Brief, second paragraph:
The *Results in Brief* states the numbers and percentages of student and graduates increased in most science, technology, engineering, and mathematics (STEM) fields. However, Figure 3 (page 22) shows significant declines in biological sciences; earth, atmospheric and ocean sciences; engineering; and technology. As the Department of Commerce (National Oceanic and Atmospheric Administration (NOAA)) relies particularly on students in the biological, earth, ocean and atmospheric sciences, we recommend the conclusion point to these declines, despite overall increases in STEM students.

U.S. Department of Commerce Response to Key GAO Conclusions

Page 9, More than 200 Federal Education Programs Are Designed to Increase the Numbers of Students and Graduates or Improve Educational Programs in STEM Fields, but Most Have Not Been Evaluated:

We concur with the importance of evaluation. Evaluation is established as a standard in the NOAA Education Plan and education programs throughout the agency are working to achieve this standard.

Page 30, Teacher Quality and Mathematics and Science Preparation Were Cited as Key Factors Affecting Domestic Students' STEM Participation Decisions:

We concur with the importance of improving teacher content knowledge. The NOAA Education Plan identifies teacher professional development as a key strategy and several education programs are focused on this effort.

Page 33, Mentoring Cited as a Key Factor Affecting Women's and Minorities' STEM Participation Decisions:

We concur. Mentoring and internships are required under NOAA's Ernest F. Hollings Undergraduate Scholarship Program, Nancy Foster Scholarship Program, and the scholarship programs of NOAA's Education Partnership Program with Minority Serving Institutions.

Page 39, Concluding Observations, first paragraph:
GAO reports university officials and others suggested increasing the federal commitment to STEM education programs, but adds the importance of understanding the extent to which existing STEM programs are appropriately targeted. We agree with the conclusion

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regarding targeting. Our STEM education programs within NOAA are specific to NOAA-related mission goals.

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Appendix VIII: Comments from the Department of Health and Human Services

DEPARTMENT OF HEALTH & HUMAN SERVICES — Office of Inspector General

Washington, D.C. 20201

SEP 30 2005

Ms. Cornelia M. Ashby
Director, Education, Workforce,
And Income Security Issues
U.S. Government Accountability Office
Washington, DC 20548

Dear Ms. Ashby:

Enclosed are the Department's comments on the U.S. Government Accountability Office's (GAO's) draft report entitled, "HIGHER EDUCATION: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends" (GAO-05-887). These comments represent the tentative position of the Department and are subject to reevaluation when the final version of this report is received.

The Department provided several technical comments directly to your staff.

The Department appreciates the opportunity to comment on this draft report before its publication.

Sincerely,

Larry J. Goldberg

for Daniel R. Levinson
Inspector General

Enclosure

The Office of Inspector General (OIG) is transmitting the Department's response to this draft report in our capacity as the Department's designated focal point and coordinator for U.S. Government Accountability Office reports. OIG has not conducted an independent assessment of these comments and therefore expresses no opinion on them.

COMMENTS OF THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ON THE U.S. GOVERNMENT ACCOUNTABILITY OFFICE'S DRAFT REPORT ENTITLED, "HIGHER EDUCATION: FEDERAL SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS PROGRAMS AND RELATED TRENDS" (GAO-05-887)

General Comments

The U.S. Department of Health and Human Services (HHS) thanks the U.S. Government Accountability Office (GAO) for providing us the opportunity to review and comment on the draft report.

The education and training of future generations of science, technology, engineering, and mathematics (STEM) professionals is an important investment in the nation's future. This expertise will help provide the personnel devoted to the technological innovation needed to address the research and development requirements of industry and Government. HHS commends GAO for collaborating with 13 departments and agencies to assemble a partial compendium of Federal STEM and related education and training programs that directly and indirectly help lead students to pursue degrees or careers in STEM fields. This information has the potential for further collaborations that will enhance synergy across the Federal departments and agencies that support STEM related education and training.

We agree with GAO that it is important to evaluate ongoing programs to determine the extent to which they are achieving their desired results. HHS, under the auspices of the National Institutes of Health (NIH) and the Agency for Healthcare Research and Quality, supports nearly 17,000 individuals pursuing graduate and postdoctoral research training annually as part of the Ruth L. Kirschstein National Research Service Award (NRSA) Programs noted in the report. NRSA programs were established by an act of the Congress of the United States in 1974 in order to help support and produce a diverse pool of highly trained scientists to perform the nation's biomedical, behavioral, and clinical research.

NRSA programs have been systematically evaluated twelve times by the National Research Council (NRC) of the National Academies. The most recent evaluation, *Advancing the Nation's Health Needs—NIH Research Training Programs*, was completed earlier this year. This report indicated that NRSA institutional training grants, which fund the education and training of the majority of NRSA participants, are widely regarded as one of the best vehicles for learning the theories and techniques of biomedical and behavioral research. In addition, the report noted that the NRSA program has successfully produced high-quality research personnel and has been important for the upgrading of research training in general.

We believe that the NRC evaluations and the HHS responses to them serve important roles in assessing and responding to the changing needs in the education and training of biomedical, behavioral, and clinical research personnel. These evaluations have resulted in the implementation of improvements in NRSA programs in order to better meet the nation's evolving research and research training needs.

Appendix IX: Comments from the National Science Foundation

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

NSF

OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

TO: Cornelia M. Ashby
Director, Education, Workforce and Income Security Issues
U.S. Government Accountability Office

FROM: Donald Thompson, Assistant Director (Acting)
NSF Directorate for Education and Human Resources

RE: Response to Draft GAO Report: ***Federal Science, Technology, Engineering, and Mathematics Programs and Related*** **Trends**

DATE: September 21, 2005

Thank you for the opportunity to respond to the draft of the GAO Report: ***Federal Science, Technology, Engineering, and Mathematics Programs and Related*** **Trends.** This report summarizes an impressive amount of information obtained from federal agencies, workforce data from numerous sources, and results from interviews GAO conducted with several students and university officials. This was a formidable task, especially considering the tight timeline GAO had to conduct its work. The resulting report will be useful.

Below are a few specific comments that are submitted for your consideration.

1. **Evaluation of program effectiveness**

The report contains several statements such as "most [programs] have not been evaluated" and "the agencies report little about the effectiveness of these programs". NSF believes this conclusion, which is presented without definition of what criteria GAO accepted as evidence of evaluation, may be misleading largely because of the type of information GAO requested and accepted from the agencies. Although given the time constraints under which GAO was operating it is understandable that only program level evaluation was collected, evaluation of individual projects is very valuable in determining program effectiveness. Given the alternative approaches that projects develop to achieve the overall program goals, the evaluation of individual projects provides valuable information about the effectiveness and impact of the program. NSF programs require that the individual projects supported be evaluated, but this information was not included in the GAO analysis.

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In addition, NSF conducts Committee of Visitor (COV) reviews for each of its program every three years. GAO studied the COV process and reported on its value as an evaluation process in the previous GAO report 03-454.

In summary, all NSF programs undergo evaluation. This evaluation includes COV review, project evaluations, and, in many cases, third party program evaluation. Other Federal agencies also have a variety of mechanisms for program evaluation. If time permits, we would appreciate having this range of approaches to ensure program effectiveness addressed in more detail in the document.

2. **Study of factors impacting studying/entering S&E fields**

The report includes recommendations that are based on interviews with educators and administrators from eight colleges and universities as well as responses from 31 students at five of these institutions. Although GAO includes reasonable observations based on these interviews, a "pilot study" with this design and scope seems a rather weak basis for significant findings and recommendations. Because the data are relegated to the appendix, the design and scope are not readily apparent. It should be made clearer in the body of the text that the conclusions reached are based on these limited numbers of interviews. Also, the report could be improved by referencing corroborating information from other available reports and studies or findings from research conducted on these topics.

3. **Eligibility for NSF program**

There appears to be a simple misunderstanding regarding NSF program eligibility. Page 15 of the report states; "In addition to these restrictions, some programs limit eligibility to minorities in order to increase their representation in STEM fields. For example, NSF sponsors a program called Opportunities for Enhancing Diversity in the Geosciences to increase participation by African Americans, Hispanic Americans, Native Americans (American Indians and Alaskan Natives), Native Pacific Islanders (Polynesian or Micronesians), and persons with disabilities." Please note that, although the goal of the program is to broaden participation in the geosciences, the program does not limit eligibility to minorities.

4. **US citizen/permanent resident requirement for recipients of scholarships or fellowships**

Another apparent misunderstanding also appears on page 15 of the report. The report states that "According to an NSF official, students receiving scholarships or fellowships through NSF programs must be U.S. citizens or permanent residents." This is correct, but the report goes on with the conjecture that "such restrictions limit may reflect concerns about access to sensitive areas." In fact, this restriction to U.S. citizens and permanent residents is considered primarily to be an effective strategy to support the

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NSF People Goal: "a diverse, competitive, and globally engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens."

5. **Interagency collaboration**

The report only mentions the NSTC efforts for interagency collaboration. Other mechanisms for coordination of federal STEM programs exist. Operating with the Secretary of Education as its chair, the Federal Interagency Committee on Education studies and makes recommendations for assuring effective coordination of Federal programs, policies, and administrative practices affecting education. Similarly, the Federal Interagency Coordinating Council, in order to minimize duplication of programs and activities, coordinates Federal early intervention and preschool programs and policies across Federal agencies; the provision of Federal technical assistance and support activities to States; and identifies gaps in Federal programs and services and barriers to Federal interagency cooperation. Also, when the National Science and Technology Council (NSTC) Committee on Science (COS) established the Subcommittee on Education and Workforce Development (EWD), it assumed the responsibilities of its predecessor, the Interagency Working Group on S&T Workforce of the Future, which, in turn, was the successor of earlier coordinating bodies. The new EWD Subcommittee puts greater emphasis on the interagency coordination of federal education programs.

Interagency collaboration also occurs at the program level. For example, the NSF Federal Cyber Service: Scholarship for Service (SFS) program partners with the Department of Homeland Security (DHS) through an ongoing MOU and contracts with OPM to provide the operational support for placing students in Federal jobs in IT security.

6. **Enrollment and degree data**

The data taxonomy used for the report is not clear. For example, the report includes some, but not all, technology degrees and some, but not all, technology occupations. Also, the report does not appear to include associates degrees in the enrollment and degree analysis. The particular data in Table 11 on international student enrollment are based on GAO analysis of NPSAS data. The graduate level enrollment data in the table are questionable in comparison with other available data. The difficulty may be that the NPSAS data include a relatively small sample for graduate education.

Donald Thompson
Assistant Director (Acting)

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Appendix X: Comments from the National Science and Technology Council

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

September 22, 2005

Ms. Cornelia M. Ashby
Director, Education, Workforce,
and Income Security Issues
Government Accountability Office (GAO)
441 G Street, N.W.
Washington, D.C. 20548

Dear Ms. Ashby:

Thank you for providing a copy of your draft report entitled "Higher Education: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends" (GAO-05-887). I applaud your efforts to provide an overview of the state of Federal support for attracting and retaining students in STEM disciplines.

We understand that any such report will reflect the situation at one point in time and, given a rapidly changing world, research conducted even a short time ago may not fully reflect current conditions. Given this situation we have one comment regarding the discussion of international students' STEM participation decisions, particularly in regards to obtaining visas.

Recent policy changes implemented by the United States Government have resulted in significant reductions in the time it takes to process visas for entry into the U.S. The U.S. government has made and continues to make a concerted effort to ensure that international students, exchange visitors and scientists are able to apply for – and receive – their visas in a timely manner. The State Department and the Department of Homeland Security have implemented a policy that gives priority processing to international students and research scholars, leading to shorter waits to begin the visa application process. In addition, the vast majority of applicants who are approved for student visas get them within two days. The approximately two percent of visa applications that are referred for additional screening are now, on average, processed within 14 days. This represents a significant improvement from the 67 day average processing time reported in the 2004 GAO report entitled "*Border Security: Improvements Needed to Reduce Time Taken to Adjudicate Visas for Science Students and Scholars.*" In February of 2005, Mantis SAO validity periods were extended by up to four years for students and up to two years for exchange visitors. These extensions improve the ability of scientists and students to be able to leave and re-enter the United States as part of their normal course of scientific activities. Another important policy change was announced in May 2005, which will extend the initial duration of visas for certain long-term researchers from three to five years and also allows for extensions of up to five years.

Again, thank you for the opportunity to review this document.

Sincerely,

John Marburger

John H. Marburger, III
Director

Appendix XI: GAO Contact and Staff Acknowledgments

GAO Contact

Cornelia M. Ashby (202) 512-7215

Staff Acknowledgments

In addition to the contact named above, Carolyn M. Taylor, Assistant Director; Tim Hall, Analyst in Charge; Mark Ward; Dorian Herring; Patricia Bundy; Paula Bonin; Scott Heacock; Wilfred Holloway; Lise Levie; John Mingus; Mark Ramage; James Rebbe; and Monica Wolford made key contributions to this report.

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