

Cross Agency Priority Goal

Quarterly Progress Update

STEM Education

Goal leaders: Jo Handelsman, Deputy Director for Technology and Innovation,
Office of Science and Technology Policy;

Joan Ferrini-Mundy; Assistant Director, National Science Foundation, Education
and Human Resources



FY2014 Quarter 3

Overview

Goal Statement

Improve science, technology, engineering, and mathematics (STEM) education by implementing the Federal STEM Education 5-Year Strategic Plan, announced in May 2013, specifically:

- Improve STEM instruction
- Increase and sustain youth and public engagement in STEM
- Enhance STEM experience of undergraduate students
- Better serve groups historically under-represented in STEM fields
- Design graduate education for tomorrow's STEM workforce
- Build new models for leveraging assets and expertise
- Build and use evidence-based approaches

Urgency

- Advances in STEM have long been central to our Nation's economy, security, and ability to preserve the health of its people and the environment; enhancing U.S. students' engagement and success in STEM disciplines is essential to the United States maintaining its preeminent position in the world.
- We have considerable progress to make given that our K-12 system ranks "middle of the pack" in international comparisons.
- Meeting the growing demand for STEM expertise and competency is important to the economy and our democracy.
- Increasing opportunities in STEM for more Americans is critical to building a just and inclusive society.

Vision

- The Federal STEM Education 5-Year Strategic Plan sets out ambitious national goals to drive Federal investment in five priority STEM education areas toward which significant progress will require improved coherence and coordination across Federal agencies with STEM assets and expertise and STEM education resources.

Progress Update

Federal Coordination in STEM Education (FC-STEM) updates:

- FC-STEM drafted charters for the five Inter-agency Working Groups (IWGS) which are currently in the approval process.
- Lead and Co-lead agencies and individuals have been identified for Inter-agency Working Groups.
- All five IWGS have met and begun Strategic Plan Implementation work and most have established regular meeting schedules.

Collaborations and consideration examples:

- Internal agency-level consolidations:
 - Consolidation of NSF's education investments in undergraduate education within a coherent framework
 - Reorganization of NASA's education investments through the Office of Education's STEM Education and Accountability Projects (SEAP) program
- Cross-agency partnership examples:
 - Smithsonian Institution's collaboration with multiple agencies on the Waterways Initiative
 - Issuance of *Common Guidelines for Education Research and Development* by NSF and the Institute of Education Sciences at the Department of Education.

Meetings and Outreach

- The FC-STEM co-chairs briefed the CoSTEM co-chairs on progress towards implementation of the 5-year Strategic Plan
- IWG co-chairs participated in a milestone and metric workshop facilitated by the Performance Improvement Council

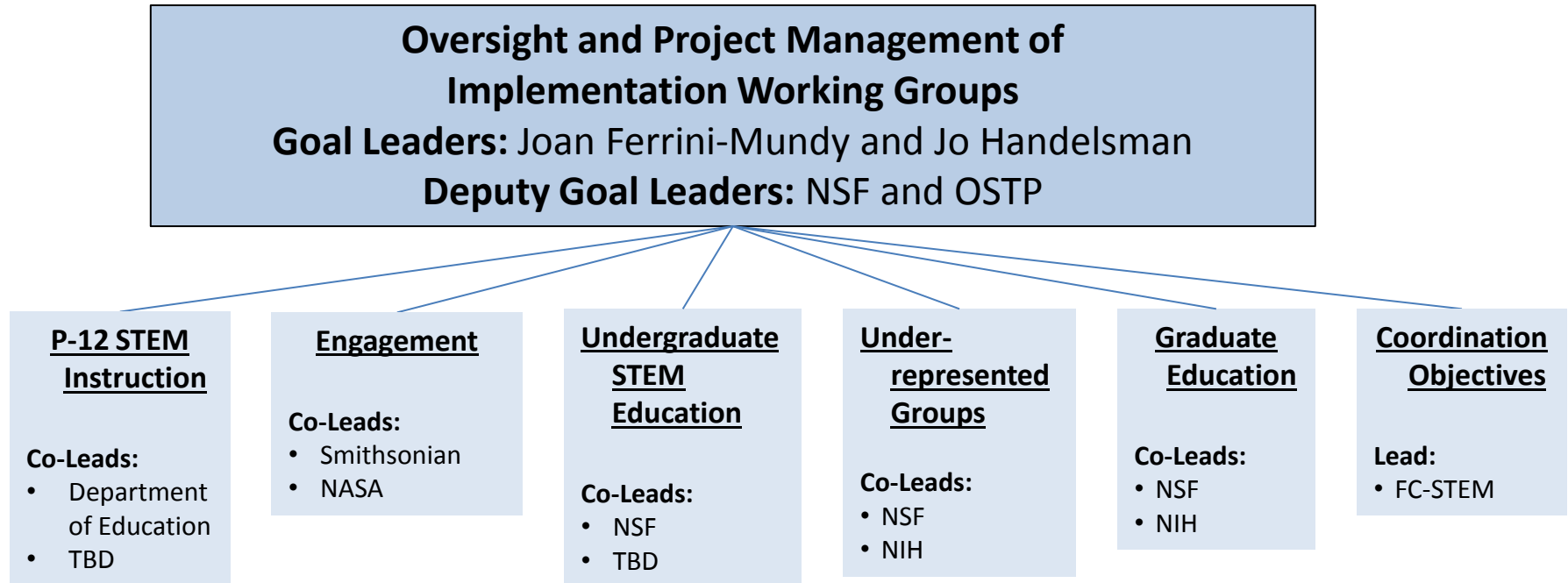
Initiatives and Programs

- Federal Agencies Announced New Commitments at the June 2014 White House Working Families Summit to broaden participation in STEM fields to more women and girls. At this event, the White House hosted a panel session on the important issue of attracting and retaining talented women and girls in STEM careers. Federal agencies made the following announcements:
 - The U.S. Department of Energy (DOE) announced new partnerships with 100kin10 and US2020 to expand their Women @ Energy series profiling women in Federal STEM careers to inspire the next generation of energy scientists and engineers.
 - The National Science Foundation implemented nearly a year ahead of schedule cost allowance policies for childcare at professional conferences that lessen the challenges for working families. With these and other family friendly policies, Federal science research agencies are stepping up to reduce the false choice faced by women and men entering research careers of starting a family or continuing on a trajectory to productive faculty research positions.
 - NIH released a comprehensive summary of research on barriers and opportunities to attract and retain women in biomedical science careers³ and will use this evidence base to guide Administration policies to broaden participation and success in STEM fields.

Action Plan Summary

Sub-goal	Major Strategies to Achieve Impact	Key indicators
1. Improve STEM instruction	<ul style="list-style-type: none"> Support teacher preparation efforts that encourage use of evidence-based STEM learning opportunities Increase and improve authentic STEM experiences for teachers 	<ul style="list-style-type: none"> Percentage of high school mathematics and science teachers who hold degrees in their teaching field or in science of mathematics education Number of STEM bachelor's degrees earned annually Percentage of bachelor's degrees awarded to women, black or African American, Hispanic, and American Indian or Alaska Native students (Plus further indicators in development – see slide 12)
2. Increase and sustain youth and public engagement in STEM	<ul style="list-style-type: none"> Provide access to scientific and engineering assets of the federal government Integrate STEM into school-readiness and after-school programs Improve empirical understanding of how authentic STEM experiences influence learning or interest 	
3. Enhance STEM experience of undergraduate students	<ul style="list-style-type: none"> Implement evidence-based instructional practices and innovations Improve STEM education at 2-year colleges and transfer to 4-year colleges Support the development of university-industry partnerships to provide relevant and authentic experiences Address high failure rates in introductory undergraduate mathematics 	
4. Better serve groups historically under-represented in STEM fields	<ul style="list-style-type: none"> Be more responsive to rapidly changing demographics Focus investments on developing and testing strategies for improving preparation for higher education Invest in efforts to create campus climates that are effective in improving success for students from under-represented groups 	
5. Design graduate education for tomorrow's STEM workforce	<ul style="list-style-type: none"> Recognize and provide financial support to students of high potential Provide opportunities for fellows' preparation in areas critical to the Nation Combine and enhance mechanisms that evaluate the impact of fellowships to inform future federal investments 	
6. Build new models for leveraging assets and expertise	<ul style="list-style-type: none"> Collaborate to build implementation roadmaps in the goal areas Reduce administrative barriers to collaboration Develop a framework to guide coordinated CoSTEM agency budget requests 	
7. Build and use evidence-based approaches	<ul style="list-style-type: none"> Support syntheses of existing research on critical issues in STEM priority areas Improve and align evaluation and research strategies across federal agencies Streamline processes for interagency collaboration 	

STEM Education Goal Team and Governance Plan



Governance

- Co-STEM: Jo Handelsman (OSTP) and France Córdova (NSF) are Co-Chairs. Annual report from FC-STEM to Co-STEM
- FC-STEM: Joan Ferrini-Mundy (NSF) and Shelley Canright (NASA) are Co-Chairs. Quarterly reports from Inter-agency Working Groups to FC-STEM

Work Plan: Governance and Coordination

- Build new models for leveraging assets and expertise.
- Build and use evidence based approaches.

Barriers/Challenges

- Working groups are at varying stages of development of goal priorities, indicators, and milestones.
- FC-STEM is actively working on strengthening coordination among the working groups.
- Baseline data not easily available for several key areas.

Key Milestones	Milestone Due Date	Milestone Status	Owner	Anticipated Barriers or Other Issues Related to Milestone Completion
Processes for working groups reporting out to Co-STEM established	05/2014	Complete	FC-STEM	No barriers identified.
Working groups finalized for each sub-goal, including executive secretary	06/2014	Missed	FC-STEM	FC-STEM is identifying appropriate co-lead agencies for the remaining two working groups and an FC-STEM executive secretary.
Key milestones/metrics/indicators established for all sub-goals	08/2014	On track	FC-STEM	A potential obstacle may be the lack of regularly collected metrics. A joint meeting of all co-leads to develop milestones will be held in August
Identify baseline data, when appropriate, using relevant data sources	08/2014	On track	FC-STEM	Baseline data may not always be available or costly to develop.
Evaluate best practices for sharing and coordinating products of working groups	08/2014	On track	FC-STEM	No barriers identified. Increased coordination will be discussed at the joint August meeting.
Identify and support opportunities for collaboration across working groups	12/2014	On track	FC-STEM	No barriers identified.
Simplification of key processes such as development of MOU's to encourage common procedures and collaborations	03/2015	On track	FC-STEM	No barriers identified.

Work Plan Sub-goal 1: P-12 STEM Education

- Support teacher preparation efforts that encourage use of evidence-based STEM learning opportunities
- Increase authentic STEM experiences for teachers

Key Milestones (Lead: Department of Education / TBD)	Milestone Due Date	Milestone Status	Owner	Anticipated Barriers or Other Issues Related to Milestone Completion
Conduct an initial analysis of teacher internship, fellowship, and scholarship programs supported by CoSTEM agencies	01/2014	Complete	IWG P-12	No barriers identified.
Create a map of physical STEM assets managed by CoSTEM agencies to provide guidance for coordinated regional efforts to improve STEM instruction	01/2014	Complete	IWG P-12	No barriers identified.
Launch STEM-focused teacher training grant competition to grow pathways for effective STEM educators	05/2014	Complete	Department of Education	No barriers identified.
Key milestones/metrics/indicators established for all sub-goals	08/2014	On track	IWG P-12	No barriers identified
Create a repository of best practices and research related to teacher preparation and professional learning	09/2014	On track	IWG P-12	No barriers identified.
Conduct an in-depth analysis of one regional “hotspot zone” to identify all relevant federal asset activity, programs, and local non-governmental efforts to improve STEM instruction	11/2014	On track	IWG P-12	No barriers identified.

Work Plan Sub-goal 2: Engagement in STEM Education

- Access to scientific and engineering assets of the Federal Government
- Integration of STEM into school readiness and after-school programs
- Empirical understanding of how STEM experiences influence learning

Key Milestones (Lead: Smithsonian Institute / NASA)	Milestone Due Date	Milestone Status	Owner	Anticipated Barriers or Other Issues Related to Milestone Completion
Identify exemplar scientific and engineering assets that feature evaluation to serve as models for STEM Engagement activities	12/2013	Complete	IWG-Engagement	No barriers identified.
Identify audiences that should receive STEM Engagement resources and programs	02/2014	Complete	IWG-Engagement	No barriers identified.
Identify STEM Engagement Activities of CoSTEM agencies	07/2014	On track	IWG-Engagement	No barriers identified.
Identify evaluation models used to effectively study engagement	09/2014	On track	IWG-Engagement	No barriers identified.
Implementation of agency commitments related to Making and student engagement announced by President Obama at the White House Maker Faire	06/2015	On track	OSTP and relevant agencies	No barriers identified.

Work Plan Sub-goal 3: Undergraduate STEM Education

- Implementation of evidence-based instructional practices and innovations
- Improve STEM education at 2-year colleges and transfer to 4-year colleges
- Support the development of university-industry partnerships to provide relevant and authentic experiences
- Address high failure rates in introductory mathematics at undergraduate

Key Milestones (Lead: NSF/TBD)	Milestone Due Date	Milestone Status	Owner	Anticipated Barriers or Other Issues Related to Milestone Completion
Develop shared resource or research-base on undergraduate authentic STEM experiences	09/2014	Complete	IWG Undergrad	No barriers identified.
Share evaluation approaches for undergraduate authentic STEM experiences, including mentoring evaluation instruments	08/2014	On track	IWG Undergrad	No barriers identified.
Compile agency resources that could be useful to Engineering Deans who signed on to the NAE Grand Challenges effort	09/2014	On track	IWG Undergrad	No barriers identified.
Identify opportunities to leverage related efforts of IWG on Graduate Education	12/2014	On track	IWG Undergrad	No barriers identified.
Identify common evaluation elements for undergraduate authentic STEM experiences to be used across federal agencies	10/2015	On track	IWG Undergrad	Potential obstacles include range of purposes motivating agency commitment to undergraduate research and intern opportunities.

Work Plan Sub-goal 4: Broadening Participation in STEM Fields

- Be more responsive to rapidly changing demographics
- Focus investments
- Invest in efforts to create campus climates that are effective in improving success for students from underrepresented groups

Key Milestones (Lead: NIH/NSF)	Milestone Due Date	Milestone Status	Owner	Anticipated Barriers or Other Issues Related to Milestone Completion
Ideas proposed to maximize the impact of the federal investment with a timeline for agency adoption	10/2014	On track	IWG BP	No barriers identified.
Agencies identify and begin implementation of modifications to existing program portfolio to address gaps to provide more opportunities for URM students in STEM	01/2015	On track	IWG BP	No barriers identified.
Agencies identify strategies and timeline for incorporating campus climate guidelines and best practices into funding opportunities	06/2015	On track	IWG BP	No barriers identified.

Work Plan Sub-goal 5: Graduate STEM Education

- Recognize and provide financial support to students of high potential
- Provide opportunities for fellows' preparation in areas critical to the Nation
- Combine and enhance mechanisms that evaluate the impact of fellowships to inform future federal investments

Key Milestones (Lead: NSF/NIH)	Milestone Due Date	Milestone Status	Owner	Anticipated Barriers or Other Issues Related to Milestone Completion
Establish MOUs across agencies to broaden research opportunities of NSF fellows	10/2014	On track	IWG Grad	No barriers identified.
Assemble inventory of evaluation approaches for graduate programs	01/2015	On track	IWG Grad	No barriers identified.
Identify available resources for the evaluation of graduate programs	01/2015	On track	IWG Grad	No barriers identified.
Identify options such as courses and internships to enhance the quality of graduate training to better address the needs of a future STEM workforce	01/2015	On track	IWG Grad	No barriers identified.
Create common portal for fellowship and traineeship opportunities for graduate students	02/2015	On track	IWG Grad	No barriers identified.

Key Indicators

Key Implementation Data						
Indicator	Source	Baseline	Target?	Frequency	Latest data	Trend
Percentage of high school mathematics and science teachers who hold degrees in their teaching field or in science of mathematics education	Science and Engineering Indicators (S&EI) 2014	2012 (See slide 13)	N/A	Reported in S&EI 2014 biannually but based on variable survey	2012	
Number of STEM bachelor's degrees earned annually	S&EI 2014	554,365 (See slides 14 and 15)	N/A	Biannually	2011	Increasing
Percentage of bachelor's degrees awarded to women, black or African American, Hispanic, and American Indian or Alaska Native students	S&EI 2014	2011 (See slides 16-19)	N/A	Biannually	2011	Increasing

Indicators in Development:	
Potential High Level Indicator	Potential Target Areas
<ul style="list-style-type: none">Teachers' science and mathematics content knowledge for teachingNumber of STEM graduate students at institutions by mechanism of support and supporting federal agency	

Mathematics and Science Teachers with an Undergraduate or Graduate Degree in Mathematics or Science, by Grade Level (2012)

Mathematics and science teachers with an undergraduate or graduate degree in mathematics or science, by grade level: 2012

(Percent)

Grade level	Mathematics teachers' degree				Science teachers' degree			
	Mathematics	Mathematics education	Mathematics or mathematics education	None of these fields	Science or engineering	Science education	Science, engineering, or science education	None of these fields
Elementary	4	2	4	96	4	2	5	95
Middle	23	26	35	65	26	27	41	59
High	52	54	73	27	61	48	82	18

SOURCE: Banilower ER, Smith PS, Weiss IR, Malzahn KA, Campbell KM, Weis AM, *Report of the 2012 National Survey of Science and Mathematics Education* (2013).

Number of STEM Bachelor's Degrees Earned Annually (2011)

S&E degrees awarded, by degree level, Carnegie institution type, and field: 2011

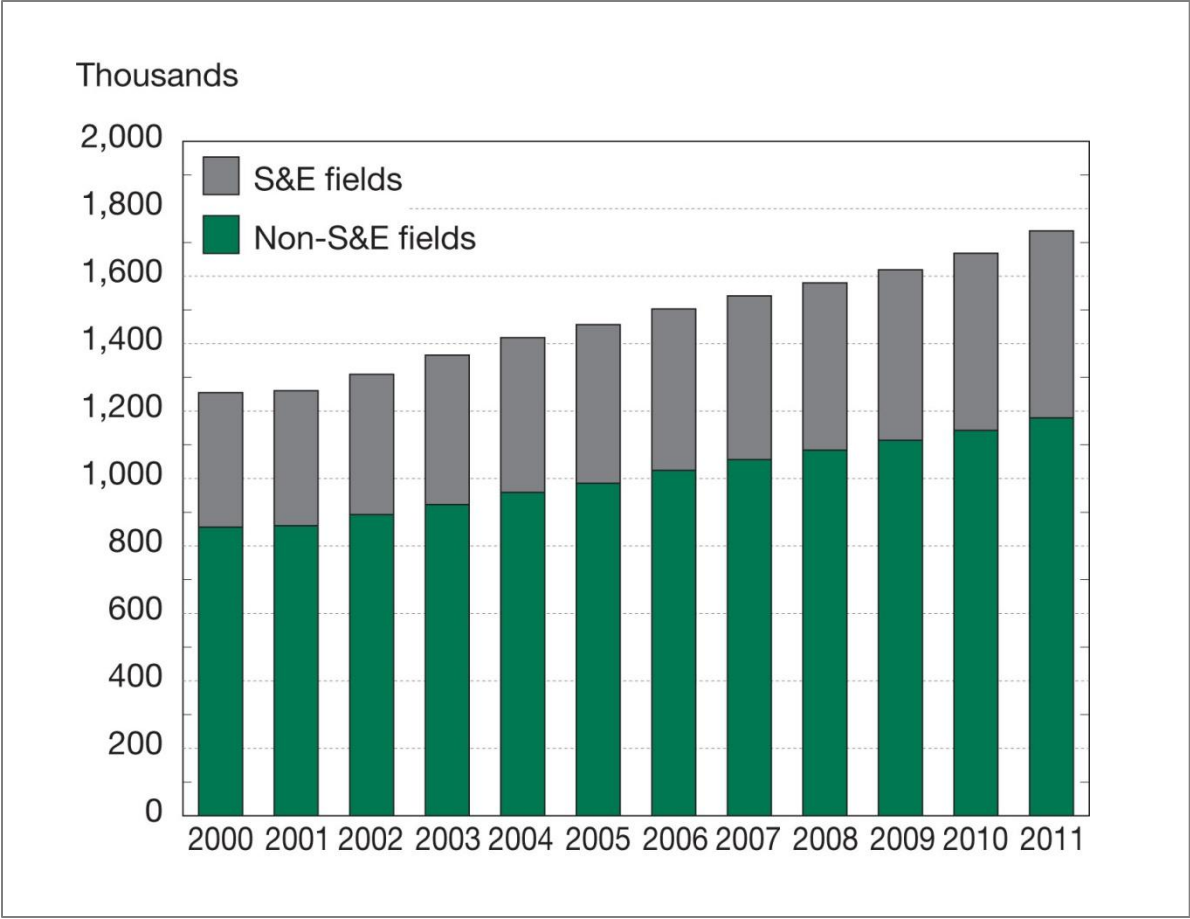
Degree and institution type	S&E field										
	All fields	All S&E	Agricultural sciences	Biological sciences	Computer sciences	Earth, atmospheric, and ocean sciences	Mathematics	Physical sciences	Psychology	Social sciences	Engineering
Bachelor's	1,734,229	554,365	22,759	93,654	43,586	5,299	18,021	19,198	101,568	172,181	78,099
Doctorate-granting universities—very high research activity	444,695	210,425	10,283	37,626	8,193	2,023	6,682	6,852	28,402	69,114	41,250
Doctorate-granting universities—high research activity	249,963	82,410	3,812	13,668	4,909	869	2,176	2,490	13,832	23,135	17,519
Doctoral/research universities	121,588	30,818	874	4,391	4,231	265	835	964	5,389	10,657	3,212
Master's colleges and universities	647,346	158,483	5,162	24,340	16,319	1,397	5,677	5,614	40,877	47,776	11,321
Baccalaureate colleges	199,039	64,878	2,577	12,804	5,554	728	2,626	3,206	12,620	21,163	3,600
Associate's colleges	6,079	845	33	21	778	0	0	0	6	1	6
Medical schools and medical centers	6,435	66	0	66	0	0	0	0	0	0	0
Schools of engineering	1,329	1,168	0	5	41	14	9	25	0	2	1,072
Other specialized institutions	48,610	3,929	0	623	2,679	0	5	37	320	204	61
Tribal colleges	230	68	18	0	2	0	0	0	3	45	0
Not classified	8,915	1,275	0	110	880	3	11	10	119	84	58

NOTES: Medical and other health sciences are included in non-S&E. Carnegie institution type corresponds to the 2010 Carnegie Classification of Academic Institutions.

SOURCES: National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey; National Science Foundation, National Center for Science and Engineering Statistics, Integrated Science and Engineering Resources Data System (WebCASPAR), <http://webcaspar.nsf.gov>.

Science and Engineering Indicators 2014

Bachelor's Degrees by Broad Field of Degree: 2000-11



Percentage of Bachelor's Degrees Awarded to Women

Women’s share of S&E bachelor’s degrees, by field: 2000–11
(Percent)

Year	Physical sciences	Biological/agricultural sciences	Mathematics	Computer sciences	Psychology	Social sciences	Engineering
2000	40.8	55.8	47.8	28.0	76.5	54.2	20.5
2001	41.6	57.3	48.0	27.6	77.5	54.8	20.1
2002	42.7	58.6	46.9	27.5	77.5	54.8	20.9
2003	41.7	59.7	45.6	27.0	77.7	54.7	20.3
2004	42.2	60.1	45.9	25.1	77.8	54.5	20.5
2005	42.6	59.9	44.6	22.3	77.8	54.2	20.0
2006	42.2	59.8	44.9	20.7	77.4	53.7	19.5
2007	41.1	58.6	43.9	18.6	77.4	53.8	18.5
2008	41.1	58.2	43.9	17.7	77.1	53.5	18.5
2009	41.0	58.2	43.0	17.9	77.2	53.6	18.1
2010	40.9	57.8	43.1	18.2	77.1	53.7	18.4
2011	40.3	58.1	43.0	17.7	77.0	54.2	18.8

NOTE: Physical sciences include earth, atmospheric, and ocean sciences.

SOURCES: National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey; National Science Foundation, National Center for Science and Engineering Statistics, WebCASPAR database, <http://webcaspar.nsf.gov>.

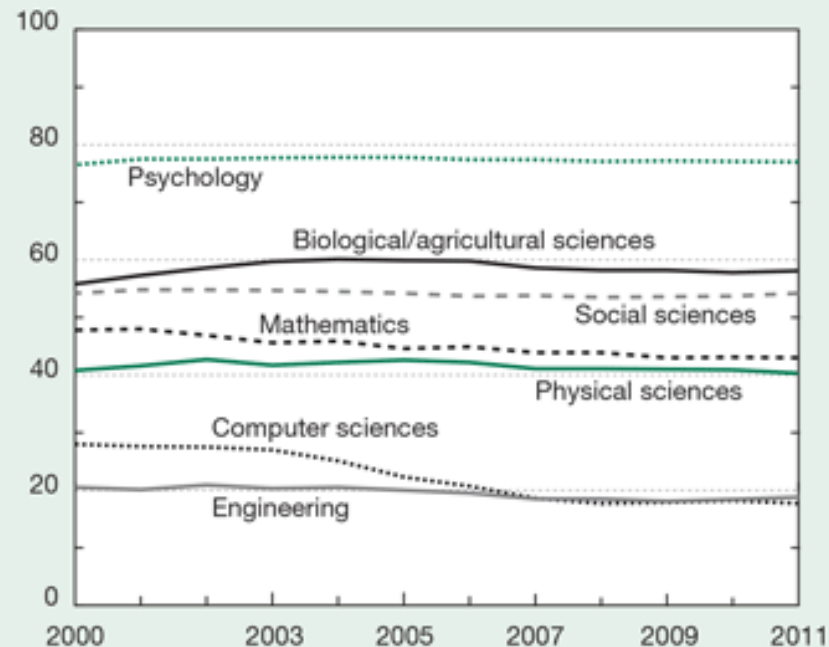
Science and Engineering Indicators 2014

Women's Share of S&E Bachelor's Degrees by Field: 2000-11

Figure 2-18

Women's share of S&E bachelor's degrees, by field: 2000-11

Percent



NOTE: Physical sciences include earth, atmospheric, and ocean sciences.

SOURCES: National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey; and National Science Foundation, National Center for Science and Engineering Statistics, WebCASPAR database, <http://webcaspar.nsf.gov>.

Science and Engineering Indicators 2014

Percentage of Bachelor's Degrees Awarded by Race and Ethnicity (2011)

Share of S&E bachelor's degrees among U.S. citizens and permanent residents, by race and ethnicity: 2000–11

(Percent)

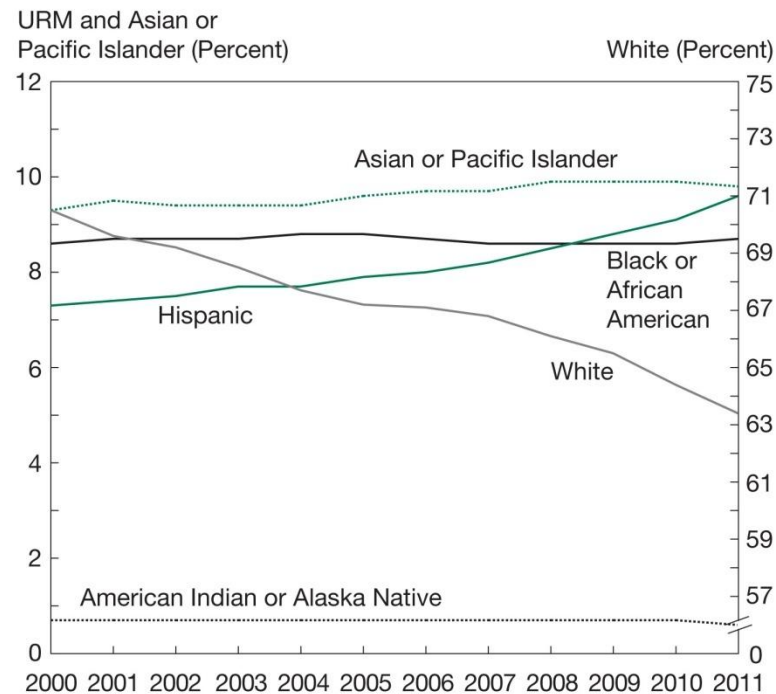
Year	Asian or Pacific Islander	Black or African American	Hispanic	American Indian or Alaska Native	White
2000	9.3	8.6	7.3	0.7	70.5
2001	9.5	8.7	7.4	0.7	69.6
2002	9.4	8.7	7.5	0.7	69.2
2003	9.4	8.7	7.7	0.7	68.5
2004	9.4	8.8	7.7	0.7	67.7
2005	9.6	8.8	7.9	0.7	67.2
2006	9.7	8.7	8.0	0.7	67.1
2007	9.7	8.6	8.2	0.7	66.8
2008	9.9	8.6	8.5	0.7	66.1
2009	9.9	8.6	8.8	0.7	65.5
2010	9.9	8.6	9.1	0.7	64.4
2011	9.8	8.7	9.6	0.6	63.4

NOTES: Hispanic may be any race. American Indian or Alaska Native, Asian or Pacific Islander, black, or African American and white refer to individuals who are not of Hispanic origin. Percentages do not sum to 100 because data do not include individuals who did not report their race and ethnicity.

SOURCES: National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey; National Science Foundation, National Center for Science and Engineering Statistics, WebCASPAR database, <http://webcaspar.nsf.gov>.

Science and Engineering Indicators 2014

Share of S&E Bachelor's Degrees among U.S. Citizens and Permanent Residents by Race and Ethnicity: 2000-11



URM = underrepresented minorities (black, Hispanic, and American Indian or Alaska Native).

NOTES: Hispanic may be any race. American Indian or Alaska Native, Asian or Pacific Islander, black or African American, and white refer to individuals who are not of Hispanic origin. Percentages do not sum to 100 because data do not include individuals who did not report their race and ethnicity.