STEM Education

Goal Leaders:
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National Science Foundation, Education and Human Resources

FY2016 Quarter 2

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 U.S. 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: FY16 Quarter 2 Highlights

1. On January 13, 2016, the Committee on STEM Education (CoSTEM) met at the Eisenhower Executive Office Building. Presentations on recent accomplishments were made by co-leads from the Undergraduate STEM Education and Broadening Participation IWGs. Discussions focused on federal spending in STEM education, issues of inclusion and diversity in STEM, and plans to develop the next Federal STEM Education 5-year Strategic Plan.

2. On January 28, 2016, the National Science Foundation (NSF) hosted an agency-wide event with all IWG co-leads/representatives present to provide an overview of the IWGs' goals and recent activities. The workshop was designed to update staff on the progress of the *Federal STEM Education 5-year Strategic Plan* and to encourage participation in future IWG activities.

3. On January 31, 2016, the Administration announced Computer Science for All, a cross-agency initiative to increase access to computer science educational opportunities for all students in the nation. This included a $4.1B proposal from the Department of Education (ED), a $120M investment from NSF, and additional investments from the Department of Defense.
    a. NSF released a Dear Colleague Letter on March 10, 2016 to stimulate proposals that might be funded out of NSF's FY16 commitment.
    b. ED plans to release a Dear Colleague Letter in April to states, school districts, schools and education partners on how to maximize federal funds to support and enhance innovative STEM.

4. In January, NASA's acting Minority University Research and Education Program (MUREP) Manager and MUREP Community College Curriculum Improvement Activity Manager participated in a meeting of the Interagency Community College Workgroup, hosted by ED. The meeting included updates on community college opportunities from each participating federal agency and a recap of the November 2015 Minority Serving Institution Convening.

5. On February 10, 2016, the U.S. Department of Agriculture (USDA) hosted the Rural Community College Alliance (RCCA) and its Community College Presidents in Washington, DC., in order to learn from USDA about federal programs that could assist rural colleges and communities in a variety of ways.

Progress Update: FY16 Quarter 2 Highlights

6. On February 29, ED, in partnership with the White House Initiative on Historically Black Colleges and Universities, and the Board on Higher Education and Workforce of the National Academies of Sciences, Engineering, and Medicine, hosted the workshop *Solutions for STEM Diversity: Lessons from HBCUs and other Leaders in Diversifying the Pipeline*. During this interactive conversation, leaders from HBCUs, and the private, nonprofit, and academic sectors shared successful tactics in diversifying the STEM pipeline. Federal agency representatives (including the Broadening Participation IWG co-lead from NSF) shared past and planned investments into this work.

7. In March, the Department of Energy's (DOE) Office of Science, the other participating CoSTEM agencies, and the Science.gov alliance launched a pair of web-based portals for searching Federally-sponsored opportunities in STEM that target undergraduate students (stemundergrads.science.gov) and graduate students (stemgradstudents.science.gov). This is a product of the Undergraduate STEM education and Graduate STEM Education IWGs. The P-12, Engagement, and Broadening Participation IWGs are determining next steps for portal involvement.

8. On March 7, 2016, under the auspices of a Board on Higher Education and Workforce (BHEW) planning committee, the National Academies of Sciences, Engineering, and Medicine released a new workshop summary, Developing a National STEM Workforce Strategy: A Workshop Summary. The workshop summary discusses how the future competitiveness of the United States in an increasingly interconnected global economy depends on the nation fostering a workforce with strong capabilities and skills in ~~(~~STEM~~)~~. This activity was supported by NSF out of the Division of Graduate Education. The workshop was held on September 21, 2015.

9. On March 9, 2016, members of the Federal Coordination in STEM Education (FC-STEM), a CoSTEM subcomittee, met at the General Services Administration building. Updates were provided from FC-STEM members on recent federal program initiatives and upcoming events. Resources to facilitate collaborations between agency members were shared and discussed.

10. On March 21 and 22, 2016, representatives from the National Institutes for Health and NSF contributed to T-Summit 2016: Transformational Approaches to Creating T-Shaped Professionals (T-shaped professionals are characterized by their deep disciplinary knowledge in at least one area, an understanding of systems, and their ability to function as "adaptive innovators" and cross the boundaries between disciplines). The T-Summit 2016 included representatives from academia, industry, foundations, and the government to learn and also design models that foster and develop the T-shaped characteristics for both the current and future workforce needs.

Action Plan Summary

Sub-Goals	Major Strategies to Achieve Impact See Page 16 for STEM Education CAP Goal Indicators
1. Improve STEM instruction	• Support teacher preparation efforts that encourage use of evidence-based STEM learning opportunities • Increase and improve authentic STEM experiences for teachers
2. Increase and sustain youth and public engagement in STEM	• 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	• 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	• 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	• 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	• 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	• 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

National Science Technology Council Committee of STEM Education (CoSTEM)
Co-Chairs: France A. Córdova (NSF) and Jo Handelsman (OSTP)

Oversight and Project Management of Federal Coordination in STEM Education (FC-STEM)
Co-Chairs: Joan Ferrini-Mundy (NSF) and Donald James (NASA)

Oversight and Project Management of Cross Agency Priority (CAP) Goal on STEM Education
Goal Leaders: Joan Ferrini-Mundy (NSF) and Jo Handelsman (OSTP)
Deputy Goal Leaders: NSF and OSTP

Below are the **6 FC-STEM Interagency Working Groups (IWGs),** who report their activities quarterly to FC-STEM through the CAP Goal Report.

IWG: P-12 STEM Instruction (CAP SubGoal 1)

Co-Leads:
- Department of Education
- NSF

IWG: Engagement (CAP SubGoal 2)

Co-Leads:
- Smithsonian
- NASA

IWG: Undergraduate STEM Education (CAP SubGoal 3)

Co-Leads:
- NSF
- Department of Energy

IWG: Under represented Groups/ Broadening Participation (CAP SubGoal 4)

Co-Leads:
- NSF
- HHS (NIH)

IWG: Graduate Education (CAP SubGoal 5)

Co-Leads:
- NSF
- HHS (NIH)

IWG: Coordination Objectives (CAP SubGoals 6 and 7)

Lead:
- FC-STEM

Work Plan Sub-goal 1: Improve STEM Instruction

Strategic Objectives

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

Barriers/Challenges

- *Capacity to compile resources and develop webinars*
- **Milestone date revised:* Adjusted to 09/2016 to align with Back-to-School

Key Milestones (Lead: Department of Education/NSF)	Milestone Due Date	Milestone Status	Owner
Compile information about Federal resources for P-12 STEM teachers in an online repository, one-pager and a PowerPoint presentation for use at STEM education conferences and events and for distribution to P-12 STEM educators	09/2016*	On Track	IWG P-12
Utilizing Federal resources curated by the P-12 IWG (existing literature and research), develop a set of recommendations for evaluating professional development for STEM teachers	06/2016	On Track	IWG P-12
Collect information on successful inter-agency collaborations that have impacted educators and share these examples	06/2016	On Track	IWG P-12
Develop materials to conduct a webinar series for STEM teachers on Federal professional development and funding opportunities	09/2016*	On Track	IWG P-12
Finalize FY17 outcomes, activities, and milestones	10/2016	On Track	IWG P-12
Identify effective practices across agencies used to disseminate and communicate Federal opportunities to STEM Teachers and share and/develop communication resources	01/2017	On Track	IWG P-12

Work Plan Sub-goal 2: Engagement in STEM Education

Strategic Objectives

- 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 or interest

Barriers/Challenges

- No barriers/challenges to report FY16 Q2.

Key Milestones (Lead: SI/NASA)	Milestone Due Date	Milestone Status	Owner
Identify STEM engagement activities of CoSTEM agencies	4/2016	On Track	IWG Engagement
Identify evaluation approaches used to effectively study the impact of engagement	6/2016	On Track	IWG Engagement
Create outreach plan and disseminate information on Federal investment in STEM Engagement through national conferences/events held in the D.C. area	5/2016	On Track	IWG Engagement
Investigate available metrics from existing data sources on student engagement in formal and informal settings (and investigate existing surveys where we might add new questions) that could indicate a baseline regarding the number of U.S. youth who participate in an authentic STEM experience (e.g. NAEP for in-school metrics)	8/2016	Not Started	IWG Engagement
Develop and prioritize activities and correlating milestones for FY16 to the end of FY17.	10/2016	On Track	IWG Engagement

Work Plan Sub-goal 3: Undergraduate STEM Education

Strategic Objectives

- 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 level.

Barriers/Challenges

- No barriers/challenges to report FY16 Q2.

Key Milestones (Lead: NSF/DoE)	Milestone Due Date	Milestone Status	Owner
In collaboration with the IWG on Graduate Education, develop and launch an undergraduate research experiences portal	12/2015	Complete	IWG Undergrad
Develop a communications plan for the federal research experiences portal with Graduate Education IWG	04/2016	On Track	IWG Undergrad
Develop an Undergraduate Education Knowledge Exchange that aligns with the four strategic objectives and host an event bringing together key stakeholder in a one-day Summit	06/2016	On Track	IWG Undergrad
After the Exchange Summit, release Summit products (meeting report, video clips, and graphic recording)	12/2016	On Track	IWG Undergrad
Develop community engagement plan for widespread uptake of Knowledge Exchange generated resources.	12/2016	On Track	IWG Undergrad
~~For knowledge exchange amongst undergraduate STEM education researchers and developers, NSF will host a symposium on improving undergraduate STEM education*~~	~~04/2016~~		~~IWG Undergrad~~

* This is duplicative of the milestone #3.

Work Plan Sub-goal 3: Undergraduate STEM Education (continued)

Key Milestones (Lead: NSF/DoE)	Milestone Due Date	Milestone Status	Owner
Include item on undergraduate mathematics instruction in National Center for Education Statistics (NCES) 2009 High School Longitudinal Survey (HSLS) second follow up: Survey data collected from HSLS	12/2016	Not Started	IWG Undergrad
Include item on undergraduate mathematics instruction in National Center for Education Statistics (NCES) 2009 High School Longitudinal Survey (HSLS) second follow up: Survey results available	12/2017	Not Started	IWG Undergrad
Develop an Undergraduate STEM Research Playbook and vet draft at Undergraduate Education Knowledge Exchange	06/2016	On Track	IWG Undergrad
Release Undergraduate STEM Research Playbook	12/2016	On Track	IWG Undergrad

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

Strategic Objectives

- 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

Barriers/Challenges

- Following initial discussions with the American Council on Education about a potential partnership to design a convening of campus leadership for developing supportive campus climate initiatives, the date for the convening may need to be pushed past spring 2017.

Key Milestones (Lead: NIH/NSF)	Milestone Due Date	Milestone Status	Owner
Conduct a gap analysis to assess programs that support changes to campus climate and culture in post-secondary institutions to identify areas for program development based on the FC-STEM inventory	3/2016	Complete	IWG BP
Design a convening of campus leadership via cross-agency coordination to obtain buy-in for effective approaches to inclusion to create a campus climate where students are likely to succeed	7/2016	On Track	IWG BP
Agencies identify and begin implementation of modifications to existing program portfolio to address gaps to provide more opportunities for URMs in STEM	12/2016*	Not Started	IWG BP
Ideas proposed to maximize the impact of the federal investment with a timeline for agency adoption	12/2016*	Not Started	IWG BP

*Revised milestones- Progress dependent on gap analysis and other ongoing activities.

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

Key Milestones (Lead: NIH/NSF)	Milestone Due Date	Milestone Status	Owner
Establish a protocol to receive feedback from targeted audiences on Federally funded programs with broadening participation in STEM education opportunities	9/2016	Not Started	IWG BP
Convene a workshop for external stakeholders and experts to discuss potential solutions to improve the STEM preparation of underrepresented groups (in K-12 settings) and propose a research framework and/or agenda	6/2016	On Track	IWG BP
Work with the Graduate Education IWG on a goal related to identifying best practices for defining and measuring diversity and broadening participation in graduate education	9/2017	On Track	IWG BP
Working with UG and Grad IWGs, develop a cross-agency effort to eliminate bias in Federally-funded higher education institutions as a strategy for enhancing inclusion and eliminating isolation. Fund interventions for evidence-based strategies for enhancing inclusion and eliminating isolation resulting from campus climate	9/2017	Not Started	IWG BP
Identify existing language used by FC-STEM agencies related to BP in publications. Propose new language and/or policy suggestions for agencies to use that addresses BP in general and/or campus climate	9/2016	On Track	IWG BP

Work Plan Sub-goal 5: Graduate STEM Education

Strategic Objectives

- 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

Barriers/Challenges

- No barriers/challenges to report FY16 Q2.

Key Milestones (Lead: NSF/NIH)	Milestone Due Date	Milestone Status	Owner
Initiate discussions with the Broadening Participation IWG to develop a goal related to identifying best practices for defining and measuring diversity and broadening participation in graduate education	02/2016	Complete	IWG BP and IWG Grad
Based on the discussions with the NCSES, determine if information about federally-funded teaching assistantships should continue to be collected on the survey	06/2016	On track	IWG Grad
Convene a Graduate Research Internship Program (GRIP) Host Agency Summit	06/2016*	On track	IWG Grad
Develop an inter-agency seminar series for graduate students focusing on professional development, careers, and communication skills.	06/2016	On track	IWG Grad
Expand the outreach for GRIP with a goal of increasing the number of applications by 25% in 2016	06/2016	On track	IWG Grad
Explore the inclusion of additional resources for the portal	09/2016	On track	IWG Grad

*As of 11/15, host agencies include: U.S. Census Bureau, Department of Homeland Security, the Environmental Protection Agency, the Federal Bureau of Investigation, the National Oceanic and Atmospheric Administration, the Office of Naval Research, Smithsonian Institution, and the U.S. Geological Survey.

Work Plan Sub-goal 5: Graduate STEM Education (continued)

Key Milestones (Lead: NSF/NIH)	Milestone Due Date	Milestone Status	Owner
Work with the Undergraduate IWG to explore expanding GRIP to undergraduate students supported by NSF's S-STEM program	12/2016	On track	IWG UG and IWG Grad
Enlist stakeholders such as NAS and CGS to examine the evidence base for the reform of graduate education	12/2016	On track	IWG Grad
Explore the use of individual development plans (IDPs) by graduate students funded through different mechanisms and agencies	12/2017	On track	IWG Grad
Programmatic evaluation of GRIP	12/2017	Not started	IWG Grad
Continue discussions with programs/initiatives designed to provide graduate students a broad range of professional skills and expose them to a variety of potential careers in order to (a) learn about which strategies/approaches are most effective, and (b) explore opportunities for federally-funded graduate programs to adopt effective strategies for broadening graduate education	12/2017	On track	IWG Grad

Work Plan Sub-goal 6 and 7: Coordination Objectives

Strategic Objectives

Build new models for leveraging assets and expertise.

- Collaborate to build implementation roadmaps in the goal areas
- Reduce administrative barriers to collaboration
- Develop a framework to guide coordinated CoSTEM agency budget requests

Build and use evidence based approaches.

- 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

Barriers/Challenges

- No barriers/challenges to report FY16 Q2.

Key Milestones (Lead: FC-STEM)	Milestone Due Date	Milestone Status	Owner
Analysis and meeting report out of the 14 participating federal agencies' FY17 and FY16 STEM Education budgets as compared to FY11's	6/2016	On Track	FC-STEM
Reach consensus on the range of activities that are considered "authentic STEM experiences" as a reference for cataloging IWG activities that are considered to be authentic STEM experiences	04/2016	On Track	Cross-IWG FC-STEM Task Group
Develop a collaborative tool that provides live information to the Federal Agencies involved in STEM education about Federal STEM education programs and activities	12/2017	On Track	FC-STEM
Create a synthesis of promising practices for the use in designing and revision of Federal STEM education programs	12/2017	On Track	FC-STEM

STEM Education Key Indicators

Key Implementation Data

Indicator	Source	Baseline Data	Date Baseline Set	Target/Trend	Frequency	Most Recent Data	Most Recent Date	Most Recent Trend
Percentage of high school mathematics and science teachers who hold degrees in their teaching field or in science or mathematics education	S&EI 2014	73% and 82%	2012	↑	Biannually but based on variable survey	n/a	2012	n/a
Number of STEM bachelor's degrees earned annually	S&EI 2016	554,365	2011	↑	Biannually	615,475	2013	11% Increase
Number of STEM Certificates earned annually	NCES, IPEDS	60,887	2013	↑	Biannually	n/a	2013	n/a
Number of STEM Associate's Degrees earned annually	NCES, IPEDS	88,795	2013	↑	Biannually	n/a	2013	n/a
How many undergraduate students enroll in 4-yr institutions?	S&EI 2016	18,299,791	2011	Stable	Biannually	17,700,719	2013	3% Decrease
What is the retention rate in U.S. 4-yr institutions?	S&EI 2012	57.8%	2011	↑	Biannually	n/a	2011	n/a
Percentage of STEM degrees earned by…								
…Women?	S&EI 2016	50.3%	2011	↑	Biannually	50.3%	2013	No Change
…Racial and Ethnic Minorities?	S&EI 2016	35%	2011	↑	Biannually	36%	2012	1% Increase
Number of associate's degrees earned annually in computer science	S&EI 2016	37,675	2011	↑	Biannually	38,897	2013	3% Increase
Number of associate's degrees earned annually in engineering	S&EI 2016	2,994	2011	↑	Biannually	3,871	2013	29% Increase
Number of bachelor's degrees earned annually in computer science	S&EI 2016	43,586	2011	↑	Biannually	51,586	2013	18% Increase
Number of bachelor's degrees earned annually in engineering	S&EI 2016	78,099	2011	↑	Biannually	87,812	2013	12% Increase
Number of views of the Reaching Students webinar.	NAS, NRC, BOSE	114	June 2015	1% Annual	Quarterly	129	3/31/16	7% Increase
Number of times Reaching Students has been downloaded.	NAS, NRC, BOSE	16512	January 2015	1% Annual	Quarterly	20,986	3/31/16	Target Met
Number of international venues in which Reaching Students has been downloaded	NAS, NRC, BOSE	149	January 2015	1% Annual	Quarterly	153	3/31/16	Target Met

Contributing Agencies

- Department of Agriculture (USDA)
- Department of Commerce (DOC)
- Department of Defense (DOD)
- Department of Education (ED)
- Department of Energy (DOE)
- Department of Health and Human Services (HHS)
- Department of Homeland Security (DHS)
- Department of the Interior (DOI)
- Department of Transportation (DOT)
- Environmental Protection Agency (EPA)
- Smithsonian Institute (SI)
- National Science Foundation (NSF)
- National Aeronautics and Space Administration (NASA)
- Office of Science and Technology Policy (OSTP)
- Office of Management and Budget (OMB)
- Domestic Policy Council (DPC)
- National Economic Council (NEC)

Acronyms

Acronym	Description
AANAPISI	Asian American Native American Pacific Islander Serving Institutions
CAP	Cross Agency Priority
CCIC	Community College Innovation Challenge
E.O.	Executive Order
ED	US Department of Education
FY	Fiscal Year
GRIP	Graduate Research Internship Program
GSS	Survey of Graduate Students and Postdoctorates in Science and Engineering
HSLS	High School Longitudinal Study
IHE	Institutes of Higher Education
IWG	Interagency Working Group
MOU	Memorandum of Understanding
MSI	Minority Serving Institutions
NAS	National Academies of Science
NASA	National Aeronautics and Space Administration
NCES	National Center for Education Statistics
NCSES	National Center for Science and Engineering Statistics

Acronym	Description
NIH	National Institutes of Health
NSB	National Science Board
NSF	National Science Foundation
OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
P-12	Grades preschool through twelve
PIC	Performance Improvement Council
PPEC	Pacific Postsecondary Education Council
Q(Q1)	Quarter (1-4)
S&EI	NSB Science and Engineering Indicators Report
STEM	Science, Technology, Engineering and Mathematics
TCUP	Tribal Colleges and Universities Program
UG	Undergraduate
URM	Underrepresented Minorities
USDA	US Department of Agriculture