PROGRESS REPORT ON THE IMPLEMENTATION OF THE FEDERAL STEM EDUCATION STRATEGIC PLAN

A Report by the OFFICE OF SCIENCE AND TECHNOLOGY POLICY

December 2020
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About the Federal Coordination in STEM Education Subcommittee
The Federal Coordination in STEM Education (FC-STEM) is a subcommittee of the NSTC Committee on STEM Education (CoSTEM), which was established pursuant to the requirements of Section 101 of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. §6621). In accordance with the Act, CoSTEM reviews science, technology, engineering, and mathematics (STEM) education programs, investments, and activities, and the respective assessments of each, in Federal agencies to ensure that they are effective; coordinates, with the Office of Management and Budget, STEM education programs, investments, and activities throughout the Federal agencies; and develops and implements through the participating agencies a Federal STEM education strategic plan, to be updated every five years. FC-STEM advises and assists CoSTEM and serves as a forum to facilitate the formulation and implementation of the strategic plan.

About this Document
The intent of this progress report is to provide Congress and the wider STEM education stakeholder community with a window into ongoing and planned Federal activities, with the goal of leading by example toward the North Star vision of the Federal STEM Education Strategic Plan. This progress report includes: a summary of FC-STEM progress on the implementation of the STEM strategy, an analysis of actions developed by the agencies of FC-STEM in support of the Strategic Plan’s objectives, a discussion of major focus areas across the Federal STEM education community, a description of the ways Federal agencies will work together to address common challenges, and an inventory of Federal STEM education programs. The annual report also includes actual investments for FY2019, estimated investments for FY2020, and requested funding levels for FY2021 by agencies’ Federal STEM programs. This report provides an interim update, covering from August 2019 through May 2020 on STEM education activities of the FC-STEM subcommittee and Interagency Working Groups under CoSTEM. It is responsive to the requirements of Section 101(c) of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. §6621).

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<td>AFRL</td>
<td>Air Force Research Laboratory</td>
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<tr>
<td>APHIS</td>
<td>USDA Animal and Plant Health Inspection Service</td>
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<td>CCLC</td>
<td>21st Century Community Learning Centers Program</td>
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<tr>
<td>CISE</td>
<td>NSF Directorate for Computing and Information Science and Engineering</td>
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<td>CNCS</td>
<td>Corporation for National Community Service</td>
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<td>COE</td>
<td>FAA Air Transportation Center of Excellence</td>
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<td>CoSTEM</td>
<td>Committee on STEM Education</td>
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<tr>
<td>CWMD</td>
<td>DHS Countering Weapons of Mass Destruction</td>
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<td>DHS</td>
<td>Department of Homeland Security</td>
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<tr>
<td>DOC</td>
<td>Department of Commerce</td>
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<td>DOD</td>
<td>Department of Defense</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
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<tr>
<td>DOE/ED</td>
<td>DOE Office of Economic Impact and Diversity (This acronym is only used in Appendix 2, DOE inventory listings.)</td>
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<tr>
<td>DOI</td>
<td>Department of the Interior</td>
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<td>DOL</td>
<td>Department of Labor</td>
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<td>DOS</td>
<td>Department of State</td>
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<td>DOT</td>
<td>Department of Transportation</td>
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<tr>
<td>DSEC</td>
<td>Defense Science Technology Engineering and Mathematics Education Consortium</td>
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<td>DTRA</td>
<td>DOD Defense Threat Reduction Agency</td>
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<tr>
<td>EASE</td>
<td>NSF Excellence Awards in Science and Engineering</td>
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<td>ECR</td>
<td>NSF EHR Core Research</td>
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<td>ED</td>
<td>Department of Education</td>
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<tr>
<td>EDA</td>
<td>DOC Economic Development Administration</td>
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<td>EDMAP</td>
<td>USGS Educational Mapping Program</td>
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<tr>
<td>EE</td>
<td>EPA Office of Environmental Education</td>
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<tr>
<td>EERE</td>
<td>DOE Office of Energy Efficiency and Renewable Energy</td>
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<tr>
<td>EHR</td>
<td>NSF Directorate for Education and Human Resources</td>
</tr>
<tr>
<td>EM</td>
<td>DOE Office of Environmental Management</td>
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<tr>
<td>ENG</td>
<td>NSF Directorate for Engineering</td>
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<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>ETA</td>
<td>DOL Employment and Training Administration</td>
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<tr>
<td>FAA</td>
<td>DOT Federal Aviation Administration</td>
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<td>FC-STEM</td>
<td>Federal Coordination in STEM Education Subcommittee</td>
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<td>FDA</td>
<td>Food and Drug Administration</td>
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<tr>
<td>FE</td>
<td>DOE Office of Fossil Energy</td>
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<tr>
<td>FEMP</td>
<td>DOE Federal Energy Management Program</td>
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<tr>
<td>FHWA</td>
<td>DOT Federal Highway Administration</td>
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<tr>
<td>HBCU-UP</td>
<td>NSF Historically Black Colleges and Universities – Undergraduate Program</td>
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<tr>
<td>HHS</td>
<td>Department of Health and Human Services</td>
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<tr>
<td>HRSA</td>
<td>HHS Health Resources &amp; Services Administration</td>
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<tr>
<td>HUD</td>
<td>Department of Housing and Urban Development</td>
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<tr>
<td>IES</td>
<td>ED Institute of Education Sciences</td>
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<tr>
<td>IMLS</td>
<td>Institute of Museum and Library Services</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<tr>
<td>IWG</td>
<td>Interagency Working Group</td>
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<td>IWGIS</td>
<td>Interagency Working Group on Inclusion in STEM</td>
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<tr>
<td>MDA</td>
<td>DOD Missile Defense Agency</td>
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<tr>
<td>MPS</td>
<td>NSF Directorate for Mathematical and Physical Sciences</td>
</tr>
<tr>
<td>MSI</td>
<td>Minority Serving Institution</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Name</td>
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<tr>
<td>MUREP</td>
<td>NASA Minority University Research and Education Project</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NCEAI</td>
<td>National Council for Expanding American Innovation</td>
</tr>
<tr>
<td>NE</td>
<td>DOE Office of Nuclear Energy</td>
</tr>
<tr>
<td>NIFA</td>
<td>USDA National Institute of Food and Agriculture</td>
</tr>
<tr>
<td>NIH</td>
<td>National Institutes of Health</td>
</tr>
<tr>
<td>NIHF</td>
<td>National Inventors Hall of Fame</td>
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<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>NNSA</td>
<td>DOE National Nuclear Security Administration</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NPS</td>
<td>National Park Service</td>
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<tr>
<td>NRC</td>
<td>Nuclear Regulatory Commission</td>
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<tr>
<td>NSF</td>
<td>National Science Foundation</td>
</tr>
<tr>
<td>NSF-INCLUDES</td>
<td>NSF program on Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science</td>
</tr>
<tr>
<td>NSTC</td>
<td>National Science and Technology Council</td>
</tr>
<tr>
<td>ODASART</td>
<td>Office of the Deputy Assistant Secretary of the Army for Research &amp; Technology</td>
</tr>
<tr>
<td>OOSE</td>
<td>ED Office of Elementary and Secondary Education</td>
</tr>
<tr>
<td>OIA</td>
<td>NSF Office of Integrative Activities</td>
</tr>
<tr>
<td>OISE</td>
<td>NSF Office of International Science and Engineering</td>
</tr>
<tr>
<td>OMB</td>
<td>Office of Management and Budget</td>
</tr>
<tr>
<td>ONR</td>
<td>DOD Office of Naval Research</td>
</tr>
<tr>
<td>OPE</td>
<td>ED Office of Postsecondary Education</td>
</tr>
<tr>
<td>ORD</td>
<td>EPA Office of Research and Development</td>
</tr>
<tr>
<td>OSTP</td>
<td>Office of Science and Technology Policy</td>
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<tr>
<td>OUSDRE</td>
<td>Office of the Under Secretary of Defense for Research and Engineering</td>
</tr>
<tr>
<td>P&amp;R/M&amp;RA</td>
<td>DOD Personnel &amp; Readiness/Manpower &amp; Reserve Affairs</td>
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<tr>
<td>PAEMST</td>
<td>Presidential Awards for Excellence in Mathematics and Science Teaching</td>
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<tr>
<td>PAESMEM</td>
<td>Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring</td>
</tr>
<tr>
<td>PPP</td>
<td>Public-private partnerships</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
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<tr>
<td>RES</td>
<td>NRC Office of Nuclear Regulatory Research</td>
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<tr>
<td>RFI</td>
<td>Request for Information</td>
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<tr>
<td>S&amp;T</td>
<td>Science and Technology</td>
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<tr>
<td>SBCR</td>
<td>NRC Small Business and Civil Rights Office</td>
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<tr>
<td>SBIR</td>
<td>Small Business Innovation Research Program</td>
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<tr>
<td>SC</td>
<td>DOE Office of Science</td>
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<tr>
<td>SI</td>
<td>Smithsonian Institution</td>
</tr>
<tr>
<td>SMD</td>
<td>NASA Science Mission Directorate</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, technology, engineering, and mathematics</td>
</tr>
<tr>
<td>STTR</td>
<td>Small Business Technology Transfer Program</td>
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<tr>
<td>TA IWG</td>
<td>Transparency and Accountability IWG</td>
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<tr>
<td>TCU</td>
<td>Tribal College and University</td>
</tr>
<tr>
<td>TCUP</td>
<td>NSF Tribal Colleges and Universities Program</td>
</tr>
<tr>
<td>U.S.</td>
<td>United States</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
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<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
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<tr>
<td>USPTO</td>
<td>United States Patent and Trademark Office</td>
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<tr>
<td>VA</td>
<td>Department of Veterans Affairs</td>
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Introduction

Science, technology, engineering, and mathematics (STEM) are the foundation for discovery and technological innovation. STEM skills are increasingly important for all Americans to succeed in the workplace and in their everyday lives. To develop these skills, the Nation must engage in a collaborative effort to ensure that all Americans have access to high-quality STEM education throughout their lifetimes. This effort is especially important for those who are historically underrepresented and underserved in STEM. A well-prepared and diverse STEM workforce is essential to maintaining global leadership as it galvanizes the ingenuity of Americans to accelerate tomorrow’s breakthroughs and strengthen our economic and national security.

To this end, in December 2018, the National Science and Technology Council (NSTC) Committee on STEM Education (CoSTEM) released Charting a Course for Success: America’s Strategy for STEM Education,1 a five-year STEM education strategic plan, hereafter referred to as the Strategic Plan. This Strategic Plan serves as a “North Star” to the broader STEM education community to chart a course for collective success. Federal agencies engaged in STEM education are now implementing the Strategic Plan, under the guidance of CoSTEM and its Federal Coordination in STEM Education (FC-STEM) Subcommittee.

This progress report describes ongoing efforts and implementation practices across the Federal Government as it works to accomplish the goals and objectives of the Strategic Plan. This report also compiles budget information from all Federal agencies that have investments in STEM education during Fiscal Year (FY) 2019. Additionally, this document is meant to fulfill the requirements under the America COMPETES Reauthorization of 20102 that the Office of Science and Technology Policy (OSTP) must transmit a report annually to Congress at the time of the President’s budget request providing an update on the STEM Education Federal portfolio performance and an inventory of Federal STEM education investments.

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Five-Year Federal STEM Education Strategic Plan

The Strategic Plan presents a vision for a future where all Americans will have lifelong access to high-quality STEM education and the United States will remain the global leader in STEM literacy, innovation, and employment. It serves as a “North Star” for the broader STEM community as it charts a course for the Nation’s success and is responsive to the requirements of Section 101 of the America COMPETES Reauthorization Act of 2010.

The Strategic Plan focuses on three overarching goals:

- **Build Strong Foundations for STEM Literacy** by ensuring that every American has the opportunity to master basic STEM concepts and to become digitally literate.

- **Increase Diversity, Equity, and Inclusion in STEM** and provide all Americans with lifelong access to high-quality STEM education, especially those historically underserved and underrepresented in STEM fields and employment.

- **Prepare the STEM Workforce for the Future**—both college-educated STEM practitioners and those working in skilled trades that do not require a four-year degree—by creating authentic learning experiences that encourage and prepare learners to pursue STEM careers.

The Strategic Plan is further organized around four pathways, representing a cross-cutting set of approaches to improve STEM education that will help fulfill its vision and achieve its three goals:

- **Develop and Enrich Strategic Partnerships** – Strengthen relationships between educational institutions, industry, and community organizations to leverage resources for the purpose of providing the student with meaningful learning opportunities.

- **Engage Students where Disciplines Converge** – Draw on knowledge and methods across disciplines to solve complex, real-world problems in STEM using innovation, creativity, and initiative.

- **Build Computational Literacy** – Design integrated approaches to teaching and learning computational thinking and promote the expansion of digital platform use.

- **Operate with Transparency and Accountability** – Develop and apply metrics that assess implementation progress in meaningful ways.
Figure 1. Schematic illustrating the organizational structure of the Federal STEM Education Strategic Plan released in December 2018. The Strategic Plan’s vision is supported by three aspirational goals. Four pathways contain objectives to guide efforts by the Federal government and wider STEM education community to realize the Strategic Plan’s vision and goals.
Federal Implementation Efforts: August 2019 to May 2020

The NSTC coordinates science and technology policy across the Federal agencies aimed at accomplishing multiple national goals. The work of the NSTC is organized under committees that oversee subcommittees and working groups focused on different aspects of science and technology. Together they implement the Federal STEM Education Strategic Plan.

Efforts of the Committee on STEM Education (CoSTEM)

CoSTEM is the highest level interagency body in the Federal government devoted to STEM education. It oversees coordination of Federal STEM education programs. CoSTEM also convenes the broader STEM community through stakeholder meetings and events to gain valuable input to guide its work. In FY 2019, CoSTEM developed an implementation structure to support work toward the goals and objectives of the Strategic Plan.

Efforts of the Federal Coordination in STEM Education Subcommittee (FC-STEM)

FC-STEM serves as a forum for discussion and policy coordination to facilitate implementation of the Federal STEM Education Strategic Plan and advises CoSTEM and the OSTP Director on the development and progress of interagency work in STEM education across Federal agencies. FC-STEM also facilitates implementation of the Strategic Plan through interagency working groups (IWGs). The IWGs are organized by the Strategic Plan’s four pathways and have laid a foundation for interagency efforts to implement action items. A fifth IWG, the Interagency Working Group on Inclusion in STEM (IWGIS), was chartered by the NSTC in response to Section 308 of the 2017 American Innovation and Competitiveness Act.3

The interagency collaboration of FC-STEM empowers agencies to improve STEM education by sharing best practices, leveraging the expertise and resources of Federal partners, and coordinating activities in support of common educational goals. FC-STEM agencies are also working together to maximize the impact of their efforts within the broader STEM education community.

FC-STEM Priorities. FC-STEM, as a collective body, developed priorities to accomplish its goals in support of the Federal STEM Education Strategic Plan. The first of these priorities is working with the Office of Personnel Management and other Federal agencies to better understand existing hiring authorities that could help participants in STEM work-based learning programs transition into permanent Federal employment. FC-STEM then examined current authorities across Federal agencies and proposed ways to increase their use and flexibility through regulatory, administrative or legislative processes. This work directly supports the third goal of the Federal STEM Education Strategic Plan, “Prepare the STEM Workforce for the Future.”

FC-STEM’s second priority is to determine the feasibility of a single, searchable, user-friendly online resource for STEM education-related Federal activities, resources, and funding opportunities. The study includes a stakeholder analysis to inform the development of an online site in support of broader dissemination of Federal STEM resources.

FC-STEM Assessment. FC-STEM agencies shared how they assessed the impact of agency specific STEM education programs. Mechanisms for data collection varied greatly across programs depending on goals and needs, as did methods for evaluating effectiveness. These included annual program

3 https://www.congress.gov/114/plaws/publ329/PLAW-114publ329.pdf
assessments, focus groups, pre- and post-surveys, interviews, artifacts, expert input, portfolio analysis, longitudinal tracking and assessment, data analysis, qualitative analysis, research studies, participant listening sessions, third party evaluations, etc. Early analyses of the results found that STEM engagement, interest, identity, and pursuit of advanced degrees in STEM increased as a result of participation in the programs. Some program assessments found gaps in target audiences so direct efforts were instituted to reach these audiences. Assessments are used to guide revisions and refinements to programs and solicitations.

**Efforts of the Interagency Working Groups (IWGs)**

Five IWGs support FC-STEM as it implements the Strategic Plan and have brought together members who represent the Federal government’s foremost experts in STEM education. Four of the IWGs—Computational Literacy, Convergence, Strategic Partnerships, and Transparency & Accountability—concentrate their efforts on one of each of the four pathways outlined in the Strategic Plan. A fifth IWG, the Interagency Working Group on Inclusion in STEM (IWGIS), was chartered by the NSTC in response to Section 308 of the 2017 American Innovation and Competitiveness Act.⁴

The five interagency working groups coordinate to ensure they produce complementary efforts that further the goals and objectives of the Strategic Plan. A model of the relationships between these groups is shown in Figure 2. The sections that follow provide an overview of the foci for each IWG, highlight some of the actions agencies are taking that support the work of the IWG, and provide an overview of the work that the IWGs have prioritized to pursue collaboratively.

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⁴ [https://www.congress.gov/114/plaws/publ329/PLAW-114publ329.pdf](https://www.congress.gov/114/plaws/publ329/PLAW-114publ329.pdf)
Develop and Enrich Strategic Partnerships (Strategic Partnerships IWG)

Participating Agencies: DOC, DOD, DOE, DHS, DOI, ED, NASA, NSF, OSTP, SI, and USPTO

Description: Partnerships among Federal agencies, educational institutions, employers, museums, and other community organizations leverage resources and expertise across STEM education ecosystems to maximize the impact of educational efforts. These connections broaden and enhance the education of today’s learners by providing authentic STEM experiences, seamless career and educational transitions, and opportunities for diverse mentorship.

Investment: From the Federal STEM Inventory in Appendices 1 and 3, 104 programs with a total FY 2019 investment of $1.88 billion directly or indirectly supported the Strategic Partnerships Pathway under the Federal STEM Education Strategic Plan. These investments are found in DOC, DOD, DOE, DOL, DOT, ED, EPA, HHS, NASA, NSF, SI, USDA, and VA.

Actions Taken Toward Implementation:

To advance strategic partnership objectives, the Strategic Partnerships IWG engaged in discussions with partners and stakeholders. IWG members participated in the 2020 STEM Learning Ecosystems Community of Practice forum to gain a greater understanding of existing ecosystems models. The IWG finalized a definition for STEM education ecosystems that will unify agency efforts to build partnerships to support education across the spectrum from early childhood to careers. An output of this effort was a definition that can be used across Federal agencies in future programming, such as grants and contracts.

Federal definition for STEM Education Ecosystems: STEM education ecosystems consist of multi-sector partners united by a collective vision of supporting participation in STEM through the creation of accessible, inclusive STEM learning opportunities spanning all education stages and career pathways. A STEM education ecosystem continuously evaluates its activities and adapts as needed, plans for the long-term, and communicates its work to build broad support and advance best-practices.

Agencies use a variety of mechanisms to establish partnerships, including grants, cooperative agreements, interagency agreements, memoranda of understanding, or other formal or informal agreements. Many of these are arrangements are ongoing, but some new ones were launched in 2019.

Many agencies support work-based learning (WBL) at their facilities through scholarship, internship, and fellowship programs. IWG members participated in an FC-STEM cross-agency group to discuss best practices for effective virtual internships. As a result, many agencies were better prepared to quickly adapt students and mentors to a virtual experience. The IWG also examined models that could be used to engage multi-sector partners in WBL and began discussing these across agencies. The IWG engaged SBIR/STTR Program Managers to discuss models for providing internships for students, teachers, Veterans, and underrepresented groups through supplemental grant awards and other mechanisms.

Engage Students where Disciplines Converge (Convergence IWG)

Participating Agencies: DOC, DOD, DOE, ED, NASA, NSF, OSTP, SI, and USPTO

Description: When incorporated into STEM teaching, learning, and assessment, real world STEM challenges engage students by drawing on knowledge and methods from across disciplines by promoting initiative and creativity. To encourage transdisciplinary learning, the IWG established a plan to review existing efforts to: (1) support STEM educators and students through upskilling, resourcing,
and providing a forum to share best practices; (2) support the dissemination of effective transdisciplinary STEM education practices and programs to attract a more diverse and inclusive community of participants; and (3) expand support for STEM learners to study transdisciplinary problems through internships, fellowships, scholarships, and other experiential learning opportunities.

**Investment:** From the Federal STEM Inventory in Appendices 1 and 3, 95 programs with a total FY 2019 investment of $2.22 billion directly or indirectly supported the Convergence Pathway under the Federal STEM Education Strategic Plan. These investments are found in DOC, DOD, DOE, DOT, ED, EPA, HHS, NASA, NSF, SI, USDA, and VA.

**Actions Taken Toward Implementation:**

The Convergence IWG compiled current research, model programs, and best practices available to support educators and students in transdisciplinary STEM learning and opportunities. This information sharing and collection included DOC, DOD, ED, OSTP, and USPTO providing Federal STEM education updates and agency opportunities in convergence at stakeholder convenings, such as the multi-sector 2020 STEM Learning Ecosystems Community of Practice meeting. Preliminary analysis revealed challenges faced by districts, schools, and teachers to implement formal STEM education that integrates across disciplines.

Informal and extracurricular learning environments provide additional opportunities to incorporate convergent STEM practices, but also highlight challenges related to equity and access. The IWG developed a series of survey questions to gather additional information from stakeholders through a Request for Information. Using existing literature and insight from current research experts, the IWG identified various pathways to convergence in STEM teaching, learning, and assessment. Identifying several methods of transdisciplinary learning used in the field enabled flexible planning and adaptation towards more convergent and transdisciplinary STEM education, regardless of where one falls on the continuum. In this way, the IWG showcased how transdisciplinary STEM education can be accessible and feasible for all.

As part of the Convergence pathway’s “Make Math a Magnet” objective, some agencies are integrating mathematics and statistics into STEM training and making datasets accessible for STEM educators to use in applied contexts. For example, the U.S. Census Bureau’s Statistics in Schools program strives to make Federal data more accessible by providing classroom-ready math activities for teachers to educate students about the value and everyday use of statistics. This program is capitalizing on the 2020 Census in order to increase awareness and recruit educational partners. In another example, NOAA’s National Marine Sanctuaries Program gives students advanced STEM experiences as they compete in building and operating underwater robots.

**Build Computational Literacy (Computational Literacy IWG)**

**Participating Agencies:** DOC, DOD, ED, NITRD, NSF, OSTP, SI, USDA, and USPTO

**Description:** Federal agencies are well-positioned to help Americans of all ages and backgrounds harness the benefits of digital technology and be critical and ethical participants in the digital economy. By developing integrated approaches to teaching and learning computational thinking and supporting new digital technology-based learning environments, agencies can advance mission-critical goals like promoting cyber safety and encouraging responsible data management. In addition, federal agencies are creating internships and job opportunities for students with computational skills. For example, NOAA hired more than 75 students with strong computational skills through the Pathways program.
Investment: From the Federal STEM Inventory in Appendices 1 and 3, 75 programs with a total FY 2019 investment of $1.66 billion directly or indirectly supported the Computational Literacy Pathway under the Federal STEM Education Strategic Plan. These investments are found in DOC, DOD, DOE, DOL, DOT, ED, EPA, HHS, NASA, NSF, SI, USDA, and VA.

Actions Taken Toward Implementation:

The Computational Literacy IWG established plans to execute core objectives that encourage the use of a common definition of computational literacy, support dissemination of promising content and practices that promote computational thinking, and expand digital platform use.

The IWG assessed current agency activities in computational literacy to enhance agency coordination and collaboration and ascertain areas of potential unmet need. This assessment included identifying ways to promote the expansion of existing digital platforms across agencies that are available for teaching and learning. The IWG began a literature review and developed protocol to collect baseline data to define computational literacy and develop common metrics to better understand progress.

FC-STEM agencies worked alongside the country’s education community to promote digital literacy and cyber safety, including training future STEM workers in digital ethics and privacy. NSF committed $10 million in FY 2019 to the newly launched Data Science Corps to promote data literacy; build capacity to harness data at the local, State and national levels; and provide basic training in data science to the existing workforce across communities. NIH is preparing the next generation of researchers by incorporating computational skills and the principles of responsible data use into all of its programs for undergraduate and graduate students. ED included a computer science preference in several discretionary grant competitions in FY2019, including Education Innovation and Research (EIR) Program-Early-Phase. The DOC National Initiative for Cybersecurity Education Program, led by NIST, facilitated a National Cybersecurity Education Conference and launched the National Cybersecurity Career Awareness Week to promote cybersecurity, ethics, and safety. DOD collaborated with CYBER.ORG to promote and facilitate cyber education for students of military families. In addition, the Presidential Cybersecurity Education Award is a new recognition program led by ED in collaboration with NSF and the National Security Council as charged by President Trump’s Executive Order on America’s Cybersecurity Workforce.

Diversity, Equity, and Inclusion in STEM (Inclusion in STEM IWG)

Participating Agencies: DOC, DOD, DOE, DHS, DOI, DOS, DOT, ED, EPA, HHS, NSF, NASA, OSTP, SI, USDA, and USPTO

Description: Increasing diversity, equity, and inclusion in STEM is one of the Strategic Plan’s three central goals. When an organization’s workforce is diverse in terms of gender, race, socioeconomic status, ethnicity, physical ability, geography, etc., and provides an inclusive environment that values diversity and promotes equitable opportunities, the organization better retains talent and is more innovative and productive. Increasing equity and inclusion are fundamental prerequisites for making high-quality STEM education accessible to all Americans and will maximize the creative capacity of tomorrow’s workforce.

Investment: From the Federal STEM Inventory in Appendices 1 and 3, 125 programs with a total FY 2019 investment of $3.08 billion directly or indirectly supporting the Diversity, Equity and Inclusion Goal.

5 https://content.govdelivery.com/accounts/USED/bulletins/28a9a32
under the Federal STEM Education Strategic Plan. These investments are found in DOC, DOD, DOE, DOI, DOL, DOT, ED, EPA, HHS, NASA, NSF, SI, USDA, and VA.

**Actions Taken Toward Implementation:**

Efforts toward inclusion in STEM across FC-STEM agencies are coordinated by the IWGIS. In the past year, the IWGIS identified two priority areas.

The first priority is to develop a resource for sharing best practices for diversity and inclusion across Federal agencies. Over the last year, this priority involved gathering information about practices that are working to make measurable change on diversity and inclusion. The IWGIS worked in collaboration with other IWGs to clarify the definitions for best practices, promising practices, emerging practices, and evidence-based practices. The second priority was evaluation tools. For this effort, the IWGIS worked with the Transparency and Accountability IWG to develop evaluation tools that can be used across government to measure the reach of Federal programs into diverse populations. This joint group worked to learn how diversity is currently measured in programs. The effort also included a policy analysis on elements of the Paperwork Reduction Act with the goal of facilitating an accelerated pathway for approval of a data collection and evaluation instruments.

The IWGIS is one of the cross-cutting IWGs. Progress therefore requires coordination across all three educational pathways in order to implement activities which promote diversity, equity, and inclusion. Joint meetings are used to discuss areas of common interest and plan joint initiatives.

Agencies are planning to build stronger partnerships with institutions that serve underrepresented and underserved groups. NASA, NIH, NIST, DOD, USPTO, ED, NOAA, and USGS, as part of their partnership with the NSF Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES) program, have joined the NSF INCLUDES National Network, which supports broadening participation in STEM. At NSF, the Geoscience Opportunities for Leadership in Diversity – Expanding the Network (GOLD-EN) activity provides funding for projects that develop, scale, and disseminate innovative approaches to diversity and inclusion in geoscience education and research. ED recently funded the STEM Inclusion for Innovation in Early Education Center (STEMI2E2), which seeks to improve access and participation in STEM learning for young children with disabilities. STEMI2E2 will also disseminate these practices and support tools to early childhood programs, administrators, providers, families of children with disabilities, and institutions of higher education. Through a public-private partnership, the Smithsonian is helping school districts develop strategic plans to attract and retain STEM teachers from underrepresented groups, with the goal of reaching 30,000 new and existing STEM teachers by 2030. NOAA’s Educational Partnership Program (EPP) with Minority Serving Institutions is having a big impact. The EPP partner institutions graduated 60% of the African Americans who earned PhDs in atmospheric science, 55% of the African Americans who earned PhDs in environmental science and 35% of African Americans who earned PhDs in marine sciences.

Additionally, the IWGIS has met with other Federal groups supporting equity and inclusion to learn about their initiatives and share ideas, including the White House Initiative on Historically Black Colleges and Universities (HBCUs).

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7 [https://www.includesnetwork.org](https://www.includesnetwork.org)
Operate with Transparency and Accountability (Transparency and Accountability IWG)

Participating Agencies: DOC, DOD, DOE, ED, HHS, NASA, NSF, OMB, OSTP, USDA, and USPTO

Description: Across the Federal STEM education enterprise, agencies are working to: develop and apply metrics that assess progress in meaningful ways; identify and scale evidence-based practices; collect data on educational programs, such as performance evaluations, program outcomes, and participation rates for underrepresented groups; and disseminate information to external stakeholders. The complexity of Federal investments in STEM education dictates the multiplicity of approaches that are being pursued to implement the Strategic Plan, and it is an essential consideration for the interagency development of metrics, operational definitions of terms, and best practices. This complexity requires creative and flexible approaches that focus on key points of intersection between programs to help establish and enhance returns on these investments. Developing common metrics may also require consideration of available resources with the understanding that budgets vary widely across the inventory of Federal STEM education programs.

Actions Taken Toward Implementation:

As a first step to ensuring common metrics, the Transparency and Accountability (TA) IWG provided recommendations to FC-STEM for revising the survey information for the Federal STEM Education progress report. Specifically, the TA IWG provided feedback on how investments could be consistently reported across agencies and programs to indicate whether the investment directly or indirectly contributed to the goals or pathways of the strategic plan.

In addition, the TA IWG formed two subgroups to operationalize definitions of the terms ‘participant’ and ‘rural status’ that currently differ across agencies and programs. Standard definitions will lay the groundwork for common metrics by ensuring that data can be meaningfully aggregated, accurately interpreted, and readily used to compare similar programs. The TA IWG subgroups developed compendia and recommendations for STEM education ‘participant’ and ‘rural’ definitions/designations that were presented at a roundtable meeting. The purposes of the stakeholder engagements were to obtain feedback from FC-STEM agency representatives on the recommended definitions/designations for STEM ‘participant’ and ‘rural;’ discuss potential challenges/barriers to implementing proposed definitions/designations; and discuss next steps. FC-STEM accepted the TA IWG recommended definitions and agreed to establish a pilot program to explore the feasibility of implementing the designations across agencies.

FC-STEM Engagement Highlights

Interagency Engagement

FC-STEM’s structure enables agencies to collaborate with one another to maximize the impact of Federal STEM investments and activities and better serve stakeholder communities. One example of FC-STEM collaboration is an interagency expansion of NSF INCLUDES that facilitates partnerships, communication, and cooperation.

The purpose of this program is to build and scale up what works in broadening participation programs to reach underserved and underrepresented populations nationwide. ED, NASA, NIH, NOAA, NIST, and USGS initially joined this community to better understand how they can add their external stakeholder networks to the NSF INCLUDES platform and leverage opportunities to use the NSF INCLUDES program to better communicate their STEM education programs and funding resources to the public. A special
Federal agency session at the NSF INCLUDES National Network Convening in May 2019 helped to kick off the interagency expansion. DOD and USPTO became partners in 2019 and joined the agencies noted above for quarterly collaborative meetings.

**FC-STEM Convening:** To further enhance interagency collaboration in support of STEM education advancement, NSF hosted a meeting on behalf of FC-STEM in December 2019. Over 100 attendees representing DHS, DOD, DOL, DOT, ED, EPA, HHS, HUD, IMLS, NASA, NIH, NIST, NOAA, NSF, NRC, OSTP, SI, USDA, USGS, and USPTO were present. The purpose of this convening was to galvanize communication regarding partnerships and to increase understanding of the opportunities and barriers to interagency collaboration. The National Ocean Science Bowl is another area of strong interagency STEM collaboration. NOAA, NASA, DOI and DOE come together to inspire and engage over a thousand students across the country to learn about the ocean and the Blue Economy.

**Presidential Awards:** In late October 2019, the Excellence Awards in Science and Engineering (EASE) Recognition Event honored 230 recipients with the Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST) and the Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM). For the first time, a majority of FC-STEM members participated in a newly created Federal exhibit area through which they shared resources, answered questions, and provided breakout sessions. Recipients were able to access Federal STEM resources across many agencies. The FC-STEM leadership conducted a listening session with the awardees, in coordination with the release of the 2019 Progress Report on the Federal Implementation of the STEM Education Strategic Plan. This event provided the FC-STEM leadership team a better understanding of the impact of the Federal STEM Education Strategic Plan across the States and how the Federal agencies could better serve their communities nationwide in STEM education.

**External Engagement**

**Request for Information.** Building or refreshing STEM education resources and professional learning opportunities to meet the existing needs of the community is essential to ensure that students continue to engage in high-quality STEM education, whether accessing it remotely or in-person. FC-STEM continues to collect information from the broader STEM education community through a Request for Information posted in the Federal Register. Stakeholders have the opportunity to provide input on anticipated future changes in education; how stakeholders have used the Federal STEM Education Strategic Plan to guide their work; desired features of a Federal STEM education online resource; best practices to increase diversity and inclusion in STEM; needed training for a transdisciplinary approach to teaching STEM; expanding public-private partnerships to increase STEM learning opportunities; and existing programs that integrate computational literacy within STEM curricula. Using this process will provide significant insights to STEM agencies and can help shape future FC-STEM outputs aligned to stakeholders’ needs.

**STEM Education Advisory Panel.** The STEM Education Advisory Panel was established by Congress in October 2017 under the authority of the American Innovation and Competitiveness Act and the Federal Advisory Committee Act. This diverse group of STEM education stakeholders has provided recommendations and advice to CoSTEM regarding the implementation and reporting of the Federal

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9 [https://www.govinfo.gov/content/pkg/FR-2020-09-04/pdf/2020-19681.pdf](https://www.govinfo.gov/content/pkg/FR-2020-09-04/pdf/2020-19681.pdf)
10 [https://nsf.gov/ehr/STEMEdAdvisory.jsp](https://nsf.gov/ehr/STEMEdAdvisory.jsp)
STEM Education Strategic Plan. A panel meeting was held virtually in April, and panelists provided valuable suggestions regarding what features and resources might be provided in a Federal online STEM education resource. They also shared recent adjustments made by their respective organizations in response to shifting to distance learning. The panel recognized the increased role of parents as educational aides during this transition and suggested providing more resources targeted towards parents in the future.

Public-Private Partnerships. The Administration recognizes that the responsibility of providing high-quality STEM education is shared among public and private partners, and the development of the country’s future STEM workforce can be augmented by expanding public-private partnerships.

Many Federal agencies have ongoing public-private partnerships to leverage non-governmental entities’ strengths in providing STEM education opportunities to stakeholders. In 2019, DOD awarded a cooperative agreement to a consortium of 18 organizations, the Defense Science, Technology, Engineering, and Mathematics Education Consortium (DSEC), to improve STEM literacy and develop diverse and agile STEM talent. This consortium serves K-16 students and educators through meaningful formal and informal STEM learning experiences and helps to connect participants to the DOD STEM workforce and DOD careers. This consortium amplifies the reach, visibility, and outcomes of DOD STEM efforts and serves as a force multiplier.

USPTO launched a major initiative aimed at expanding invention, innovation, and entrepreneurship in the United States. The new National Council for Expanding American Innovation (NCEAI), comprised of representatives from industry, academia, and government, will help guide the USPTO in developing a comprehensive national strategy to build a more diverse and inclusive innovation ecosystem by encouraging participation demographically, geographically, and economically. To advance innovation and entrepreneurship, the USPTO partnered with the National Inventors Hall of Fame, a nonprofit organization, to design, develop, and execute preK-12 STEM and intellectual property education programs for 180,000 students and 20,000 teachers annually nationwide.

To help Veterans transition from military service to civilian employment, the VA entered into participation agreements with various training providers to deliver accelerated learning programs in high-need technology fields. The VA incentivized these partners with a “pay-for-performance” model that paid these institutions incrementally based on the progress and success of their Veteran students.

NSF, in partnership with The Boeing Company, developed the EHR Core Research: Production Engineering Education and Research (ECR: PEER) program to transform engineering and technical education for the Nation’s manufacturing workforce. The program supports foundational research associated with the design, development, and deployment of new online curricula for students and professionals. In FY 2019, eight awards, totaling over $10 million dollars, were made using Boeing funding. At the end of FY 2019, the ECR: PEER program hosted a Principal Investigators meeting. Representatives from institutions gave presentations about their projects and group discussions identified challenges and best practices associated with teaming with industrial partners, effective online education practices, and evaluating student learning. The Boeing Company, as part of its Women Make Us Better and Women in Leadership Initiatives, also partnered with the NSF INCLUDES program to support the re-entry of women and women Veterans in the STEM workforce.

The FAA Air Transportation Center of Excellence for Unmanned Aircraft Systems partnered with five universities to conduct STEM outreach for K-12 students and educators. The objective of this program was to expand the potential STEM outreach approaches of the FAA that use unmanned aircraft systems as the central learning platform. These unique approaches by the five university partners were tailored to their community needs in locations across the country and offered activities in both formal and informal education settings.

**Conclusion**

Since the release of *Charting a Course for Success: America’s Strategy for STEM Education* in December 2018, significant steps have been taken to implement the Strategic Plan.

Interagency working groups, comprised of participants from FC-STEM agencies, have improved collaboration, coordination, and dissemination of Federal STEM education efforts. In many cases, input was gathered from internal and external stakeholders regarding evidence-based practices in order to integrate these practices and disseminate them for broader reach. FC-STEM understands the importance of stewardship of STEM education funding to ensure the uniqueness and effectiveness of Federal programs that meet the needs of diverse populations.

The goals and pathways outlined in the 5-year Federal STEM Education Strategic Plan have provided a course toward a future in which all Americans will have lifelong access to high-quality STEM education and the United States will remain the global leader in STEM literacy, innovation, and employment.
Appendix 1. FY 2020–Enacted Inventory of STEM Education Investments

Below is a list of STEM education investments and funding levels provided by OMB’s 2020 data call on Federal STEM education programs. Programs were included if they had any funding in FY 2019 or FY 2020.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Sub-Agency/Office</th>
<th>Program Name</th>
<th>FY 2019 Actual ($, millions)</th>
<th>FY 2020 Estimated ($, millions)</th>
<th>FY 2021 President's Budget ($, millions)</th>
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Appendix 2. Summary of FY 2020 STEM Education Investments

This table provides a summary of all inventory data from Appendix 1 by agency including total number of investments and FY2020 estimated budget.

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<th>Agency</th>
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<th>FY 2020 Estimated Budget ($, millions)</th>
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<td>Department of Health and Human Services</td>
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<td>Department of Homeland Security</td>
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<td>Environmental Protection Agency</td>
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<td><strong>Grand Total</strong></td>
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<td><strong>3,680.7</strong></td>
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FY 2020 Number of STEM Education Investments Per Agency

- CNCS: 90.2
- USDA: 128.6
- DOC: 42.9
- DOD: 241.0
- ED: 427.6
- DOE: 155.7
- HHS: 785.5
- NASA: 147.6
- EPA: 6.6
- DOT: 145.2
- DOI: 0.5
- DOL: 40.0
- DHS: 6.0
- SI: 1
- VA: 2
- CNCS: 1
- NSF: 25
- USDA: 16
- DOD: 11
- ED: 10
- DOE: 33
- HHS: 43

Figure 3. This pie chart depicts the information provided in the table above in the “Number of Investments” column.

FY 2020 Estimated Budget ($, millions)

- CNCS: 90.2
- USDA: 128.6
- DOC: 42.9
- DOD: 241.0
- ED: 427.6
- DOE: 155.7
- HHS: 785.5
- NASA: 147.6
- EPA: 6.6
- DOT: 145.2
- DOI: 0.5
- DOL: 40.0
- DHS: 6.0
- SI: 5.2
- VA: 103.6
- NRC: 16.0
- NSF: 1,338.5

Figure 4. This pie chart depicts the information provided in the table above in the FY2020 Estimated Budget column.
Appendix 3. Agency STEM Education Investment Alignment to Goals and Pathways

The information in the table below shares how each individual agency’s investment aligns with the goals and pathways identified in the Strategic Plan. This information was collected by FC-STEM.

FC-STEM agencies were asked how investments aligned to the Federal STEM Education Strategic Plan goals and pathways. A “D” indicates that the major outcome of the STEM investment contributes directly to, or progress towards the attainment of the goal or pathway. An “I” indicates that the major outcome of the STEM investment contributes indirectly to the attainment of the goal or pathway, or the investment outcome supports the goal or pathway or progress towards the goal, but is not a stated goal or objective of the investment. A blank indicates that the anticipated outcomes of the investment are unlikely to contribute, directly or indirectly, to achieve the goal or pathway.

<table>
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<th>Sub-Agency/Office</th>
<th>Program Name</th>
<th>Goal: Build strong foundations for STEM literacy</th>
<th>Goal: Increase diversity, equity and inclusion in STEM</th>
<th>Goal: Prepare the STEM workforce for the future</th>
<th>Pathway: Develop and enrich strategic partnerships</th>
<th>Pathway: Engage students where disciplines converge</th>
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## Appendix 4. Agency STEM Education Implementation Actions Alignment to Pathways and Objectives

### GOALS FOR AMERICAN STEM EDUCATION

- **Build Strong Foundations for STEM Literacy**
- **Increase Diversity, Equity, and Inclusion in STEM**
- **Prepare the STEM Workforce for the Future**

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<td>Increase Work-Based Learning and Training through Educator-Employer Partnerships</td>
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<td>Blend Successful Practices from Across the Learning Landscape</td>
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<td><strong>Engage Students where Disciplines Converge</strong></td>
<td>Advance Innovation and Entrepreneurship Education</td>
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<td><strong>Build Computational Literacy</strong></td>
<td>Promote Digital Literacy and Cyber Safety</td>
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<td>Make Computational Thinking an Integral Element of All Education</td>
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<td>Expand Digital Platforms for Teaching and Learning</td>
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