



## Preparing Americans with 21<sup>st</sup> Century Skills

### *Science, Technology, Engineering, and Mathematics (STEM) Education in the 2015 Budget*

“Teachers and principals in schools from Tennessee to Washington, D.C., are making big strides in preparing students with skills for the new economy – problem solving, critical thinking, science, technology, engineering, and math. Some of this change is hard...But it’s worth it – and it’s working.”

-President Barack Obama  
January 2014

President Obama strongly believes that the United States must equip many more students to excel in science, technology, engineering and mathematics (STEM). That’s why the President’s 2015 Budget invests \$2.9 billion, an increase of 3.7 percent over the 2014 enacted level, in programs across the Federal Government on STEM education. The 2015 Budget includes critical investments in a number of areas that will benefit aspiring students:

- Recruiting, preparing, and supporting excellent STEM teachers, with \$40 million to support the President’s goal of preparing 100,000 excellent STEM teachers over the next decade and \$20 million to launch a pilot STEM Master Teacher Corps.
- Supporting more STEM-focused school districts, with an investment of \$110 million to create new STEM Innovation Networks to better connect school districts with local, regional, and national resources to transform K-12 STEM teaching and learning. The Budget provides \$150 million for a new program to redesign high schools to focus on providing students with challenging, relevant learning experiences that will help them gain the knowledge and skills they will need to succeed in today’s economy, including in STEM fields.
- Improving undergraduate STEM education, with the National Science Foundation (NSF) investing \$118 million to improve retention of undergraduate STEM majors and improve undergraduate teaching and learning in STEM subjects to meet the President’s goal of preparing 1 million more STEM graduates over the next decade.
- Investing in breakthrough research on STEM teaching and learning, with approximately \$50 million for the Advanced Research Projects Agency for Education (ARPA-ED), through which the Department of Education (ED) would support high-risk, high-return research on next-generation learning innovations and technologies, including for STEM education.

In addition, the Budget proposes a fresh reorganization of Federal STEM education programs to enable more strategic investment in STEM education and more critical evaluation of outcomes. This proposal reduces fragmentation of STEM education programs across Government, and

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focuses on efforts around the five key areas identified by the Federal STEM Education 5-Year Strategic Plan: K-12 instruction; undergraduate education; graduate education; broadening participation in STEM education and careers by women and minorities traditionally underrepresented in these fields; and education activities that typically take place outside the classroom.

### **K-12 Education**

The President's 2015 Budget includes investments to improve STEM education in K-12 schools, with a priority on excellent teachers, rigorous courses, and regional partnerships that enable school districts to partner with local employers, museums, universities, and others. The Department of Education (ED) will lead this effort with \$320 million for the STEM Innovation Initiative with inter-related investments that include:

- **STEM Innovation Networks:** The Budget invests \$110 million to help school districts, individually or in consortia, build strategic partnerships – STEM Innovation Networks – with businesses, universities, museums, Federal science agencies, skilled volunteers, and other educational entities to transform STEM teaching and learning by developing coordinated plans to promote student inspiration, achievement, and preparation in STEM subjects; improve STEM instruction; and build regional networks of support for STEM education. The competitive grant program will support approximately 10 partnerships in its first year, building on promising models such as the partnership between the Ohio STEM Learning Network, the Cleveland Metropolitan School District, GE, and MC2High School. The Budget also provides support for a STEM Virtual Learning Network, a national, online community of STEM educators. The networks will complement the Department of Education's continued \$150 million investment in the Math and Science Partnerships program.
- **Preparing 100,000 Excellent STEM Teachers over the Next Decade:** In his 2011 State of the Union address, the President called for a new effort to prepare 100,000 STEM teachers over the next decade with strong teaching skills and deep content knowledge. Answering the President's call to action, more than 150 organizations have formed a coalition called [\*100Kin10\*](#). These organizations have made over 150 measurable commitments to increasing the supply of excellent STEM teachers; hiring, developing, and retaining excellent STEM teachers; and building the *100Kin10* movement. *100Kin10* has launched two Funds totaling over \$50 million provided by a broad range of foundations and philanthropists under a unique "funding marketplace" through which funders have access to a registry of high-quality projects. To build on these private-sector investments, ED is proposing \$40 million in the 2015 Budget to support evidence-based STEM teacher preparation programs to recruit and train effective STEM teachers for high-need schools.
- **STEM Master Teacher Corps:** The Budget also includes \$20 million to launch a pilot of the STEM Master Teacher Corps, a new effort enlisting some of America's best and brightest science and math teachers that will help improve instruction in their schools and

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districts, and to serve as a national resource for best practices in math and science teaching.

The President's Budget makes other investments to support ED's STEM Innovation Initiative:

- Redesigning high schools to teach real-world skills: The President has called for a comprehensive effort to rethink the high-school experience, challenging schools to scale up innovative models that personalize teaching and learning so students receive the rigorous and relevant education needed to graduate and transition into postsecondary learning and careers. The Budget provides \$150 million for a new program to redesign high schools to focus on providing students with challenging, relevant learning experiences that include partnerships with colleges, employers, and other entities designed to enhance instruction and deliver opportunities students need to gain the knowledge and skills that will help them succeed in today's economy, including in key STEM fields. Additional resources would be provided through the Opportunity, Growth, and Security Initiative.
- Identifying and scaling promising STEM education practices: The Administration proposes over \$100 million to support NSF's Discovery Research K-12, which supports research on teaching and learning STEM, and dedicates a portion of ED's Investing in Innovation (i3) program to developing, validating, or scaling effective interventions or strategies with promise in STEM education. In addition, in partnership with the Department of Education, the National Institutes of Health (NIH) will invest \$15 million in the Science Education Partnership Award (SEPA) program, leveraging the expertise of the biomedical research community to support K-12 schools.
- Helping more military-impacted students get access to rigorous STEM courses: Since 2011, the Department of Defense (DOD) has partnered with the National Math and Science Initiative (NMSI) to expand access to Advanced Placement courses in 40 military-connected public high schools. With additional investments by private-sector partners, 31 additional schools are now participating in the NMSI's Initiative for Military Families. Through this strategic public-private partnership, since 2011 those 71 schools have seen, on average, a 67 percent increase in passing math, science, and English AP scores - more than nine times the national average, while African-American and Hispanic students saw an 80 percent increase and young women experienced a 62 percent increase in passing math and science AP scores. Building on this success, DOD will continue to work to bring this AP program to additional schools and communities.

### **Undergraduate STEM Education**

The focus of the Budget's undergraduate STEM education investments is on supporting the President's goal to increase the number of well-prepared graduates with STEM degrees by one million over the next 10 years, including investments to:

- Transform undergraduate teaching and learning with NSF investments: The Budget proposes \$118 million at NSF for a consolidated program to implement evidence-based

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instructional practices, expand the evidence base, and support research on how new technologies can facilitate adoption and use of new approaches to instruction. The Budget also proposes \$75 million for NSF's Research Experiences for Undergraduates (REU) program to provide early opportunities to conduct research, which can be especially influential in maintaining a student's interest in science, engineering, and mathematics.

- Improve STEM education at community colleges: The Administration proposes over \$60 million for NSF's Advanced Technological Education (ATE) program, which centers on education of technicians for high-technology fields, with a focus on partnerships between academic institutions and employers.

### **Graduate Education**

The focus of the 2015 Budget's graduate STEM education investments is on preparing highly-skilled scientists and engineers who will support American innovation. Key investments in this goal include:

- Enhancing NSF's efforts to train tomorrow's workforce: The Budget provides \$333 million to support thousands of outstanding graduate-student researchers who will be tomorrow's leaders in the innovation economy in a range of careers. The Budget provides \$7 million at NSF for a new program to spark innovation in graduate education by providing awards to universities to explore new approaches to training graduate students.
- Continuing support for major graduate training programs, including the NIH's Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants, which provide funding to prepare individuals for careers in the biomedical, behavioral, and social sciences. In addition, the DOD will invest over \$80 million in the Science, Mathematics and Research for Transformation (SMART) Scholarship and the National Defense Science and Engineering Graduate (NDSEG) programs to meet key national security workforce needs.

### **Informal STEM Education**

The President believes that we need to give many more boys and girls engaging STEM experiences that show them the potential of these high-wage careers. That's why he hosted the first-ever [White House Science Fairs](#), recorded a video urging students to try [an hour of code](#) and [connect a million minds](#), challenged students to [be "makers of things"](#), and [called on the Nation's 200,000 Federal scientists and engineers](#) to volunteer in their local communities and think of creative ways to engage students in STEM subjects.

In addition, later this year, the Administration will host its [first-ever White House Maker Faire](#), which will include commitments by leading organizations to help more students access the tools and skills necessary to design and make just about anything and pursue careers in design, advanced manufacturing, and related STEM fields.

The 2015 Budget builds on the President's leadership with key investments that include:

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- Identifying and scaling best practices to engage youth in STEM: The Administration proposes \$55 million for NSF’s Advancing Informal Science Learning program, focusing on the research and model-building contributions of the program to better understand effective means and innovative models for engaging today’s young people and adults in science outside of school settings. In addition, ED will identify further opportunities to leverage the 21<sup>st</sup> Century Learning Centers program to bring more students access to effective and engaging STEM activities outside of the traditional school day.
  - Leadership by the Smithsonian Institution and the broader museums and library community: The Budget provides an additional \$10 million to the Smithsonian Institution to improve the reach of informal STEM education by ensuring that materials are aligned with what students are learning in the classroom. In addition, the Institute of Museum and Library Services (IMLS) will prioritize support for STEM and “making” programs within existing IMLS funding streams, with special emphasis on at-risk youth.
  - Supporting High-Quality Informal STEM Education Programs at NASA: The Budget supports NASA’s efforts to internally restructure and better integrate its STEM education program to reach more students and teachers, with a unified \$89 million program under the Office of Education and a complementary \$15 million provided under NASA’s Science Directorate to competitively fund the best application of NASA Science assets to STEM education goals.

### **Supporting Innovation and Next-Generation Learning Technologies**

Building on the President’s [Strategy for American Innovation](#) and the Administration’s commitment to tackle the [Grand Challenges of the 21<sup>st</sup> Century](#), the Budget provides support for:

- ARPA-ED: approximately \$50 million for the Advanced Research Projects Agency for Education ([ARPA-ED](#)), a “DARPA for Education.” ARPA-ED will allow the Department of Education to support high-risk, high-return research on next-generation learning innovations and technologies. It will advance the field of education research, development, and demonstration by sponsoring the synthesis and vetting of public and private R&D efforts; identifying breakthrough development opportunities; shaping the next wave of R&D; investing in the development of new education innovations and technologies, learning systems, and digital learning materials; and identifying and transitioning the best and most relevant R&D from other Federal agencies.
- Virtual Learning Lab: In addition, ED’s Institute of Education Sciences (IES) and NSF will collaborate on a “Virtual Learning Laboratory” initiative, investing to support rapid experimentation and use of “Big Data” to discover better ways to help students master important concepts in core academic subjects such as STEM.

These investments in next-generation learning technologies will complement the Administration’s ConnectED initiative. The President has called on the Federal Communications Commission to take steps to connect 99 percent of American students to the digital age through

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next-generation broadband and high-speed wireless in their schools and libraries. The Budget proposes \$200 million at the Department of Education for the ConnectEDucators program to ensure that students receive the full benefit of this connectivity by providing professional development to teachers in school districts across the country to help them make effective use of these new resources. The Opportunity, Growth, and Security Initiative would dedicate an additional \$300 million to this effort, providing a total of 100,000 teachers in 500 school districts across the country with access to professional development.

### **Making the Most of Our STEM Education Investments**

The President's 2015 Budget maintains a strong commitment to STEM education and supports the core principles of the 2014 Budget proposal and the goals of the Five-Year Strategic Plan, while making important changes that reflect valuable input from the STEM education community. This means:

- The Administration is not requesting a transfer of funding between agencies. As a result, some agencies have had a portion of their STEM education funds partially restored compared to the 2014 Budget proposal. This means, for example, that funding is provided to NASA, NIH, and the National Oceanic and Atmospheric Administration to ensure that the K-12 STEM education community can take advantage of these agencies' respective areas of expertise.
- Agencies will focus on internal consolidations and eliminations, while funding their most effective programs. As a result, the 2015 Budget continues to reduce fragmentation, building on the substantial number of internal consolidations and eliminations that agencies began implementing in 2013 and 2014.
- Agencies will coordinate their STEM education investments through implementation of the [Federal STEM Education Five-Year Strategic Plan](#), looking for opportunities to build the evidence base, share what works, and leverage each other's expertise and resources. Federal agencies, working together through the Committee on STEM Education (CoSTEM), have convened working groups focused on each of the five priority areas identified in the Five-Year Strategic Plan, and are working to develop joint pilot projects, joint administration of programs, and common data-collection strategies. A recent example is NASA's [partnership](#) with Department of Education's 21<sup>st</sup> Century Learning Centers program, and the Department of Education's and NSF's [common guidelines for education research](#).
- To support these and related activities, the Budget provides tangible support for the work agencies are doing to implement the Five-Year Strategic Plan, with a focus on building and using evidence-based practices and developing new interagency models for leveraging assets and expertise.