



## Investing in America's Future: Preparing Students with STEM Skills

### *Science, Technology, Engineering, and Mathematics (STEM) Education in the 2016 Budget*

*“America thrived in the 20th century because we made high school free, sent a generation of GIs to college, trained the best workforce in the world. We were ahead of the curve. But other countries caught on. And in a 21st century economy that rewards knowledge like never before, we need to up our game. We need to do more.”*

**President Barack Obama**  
January 20, 2015

President Obama strongly believes that the United States must equip more students to excel in science, technology, engineering and mathematics (STEM). That's why the President's 2016 Budget invests more than \$3 billion, an increase of 3.6 percent over the 2015 enacted level, in programs across the Federal Government on STEM education. The 2016 Budget includes critical investments in a number of areas that will benefit students:

- Supporting more STEM-focused high schools, with a new \$125 million competitive program at the Department of Education (ED) to help communities across America launch Next-Generation High Schools that will be laboratories for cutting-edge STEM teaching and learning.
- Preparing excellent STEM teachers, with \$100 million in the 2016 Budget for high-quality teacher preparation within ED's new Teacher and Principal Pathways program with a priority for STEM teacher preparation programs that make progress on the President's goal of preparing 100,000 excellent STEM teachers.
- Improving undergraduate STEM education, with the National Science Foundation (NSF) investing \$135 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 a decade.
- Investing in breakthrough research on STEM teaching and learning, with up to \$50 million for the Advanced Research Projects Agency - Education (ARPA-ED), allowing ED to support high-risk, high-return research on next-generation learning technologies, including for STEM education.

In addition, with the overall number of STEM programs already reduced by 40 percent over the past two years, the Budget continues to reduce fragmentation of STEM education programs across the Government. It also focuses investment on the five key areas identified in the Federal STEM Education 5-Year Strategic Plan: K-12 instruction; undergraduate education; graduate education;

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broadening participation in STEM education and careers by women and minorities traditionally underrepresented in these fields; and STEM education activities that typically take place outside the classroom.

## **K-12 Education**

The President's 2016 Budget includes investments to improve STEM education in K-12 schools, with a priority on supporting more inclusive STEM high schools and more rigorous STEM courses, training and supporting excellent STEM teachers, and scaling effective STEM programs.

### *Expanding Access to Rigorous STEM Courses*

- **Creating Next-Generation High Schools:** The President has called for a whole-school transformation of the high school experience in order to provide students with challenging and relevant academic and career-related learning experiences that prepare them to transition to postsecondary education and careers. The 2016 Budget establishes a new \$125 million competitive program at ED to help communities across America have the resources to launch Next-Generation High Schools that will be laboratories for cutting-edge STEM teaching and learning. These schools will showcase the tenets of high school reform that the President has championed – to personalize learning for students, strengthen relationships with business and post-secondary partners, and link student work to real-world expectations and experiences that reflect college and careers, to better prepare students for their future. By placing a strong focus on projects designed to improve readiness for college and careers in STEM fields, the Administration will continue its efforts to address the equity gap in STEM education; currently, a quarter of high schools with the highest percentage of African-American and Latino students do not even offer Algebra II, and a third fail to offer any chemistry. In addition, the Administration will convene a Summit on Next-Generation High Schools later in the year, and bring together the growing community of elected officials and leaders in education, business, and philanthropy committed to advancing high school reform. The Budget also supports a number of complementary investments in high school reform at ED: \$556 million in School Improvement Grants, to expand the use of evidence-based approaches to turning around our lowest-performing schools; \$92 million for Magnet Schools, which will include a priority for STEM; and increased support for teacher training under an expanded Advanced Placement program that will also improve access to other accelerated learning options, such as early-college high schools.
- **Giving more students access to 21<sup>st</sup> century STEM courses and curriculum:** Building on the announcements in December 2014 by the Administration and private-sector partners to expand computer science education in K-12 schools, the 2016 Budget requests more than \$60 million for NSF's STEM + Computing Partnerships program, which specifically focuses on support for computer science education with teacher training, new curriculum, and partnership efforts. The 2016 Budget also provides \$15 million for the National Institutes of Health (NIH) to invest in the Science Education Partnership Award (SEPA) program, leveraging the expertise of the biomedical research community to support innovative curriculum in K-12 schools, and \$4 million for the Environmental Protection

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Agency (EPA) to invest in environmental education grants. In addition, the Department of Defense (DOD) will invest \$3 million in expanding STEM opportunities for children of military families. The DOD investments will build on a multi-year record of success under the National Math and Science Initiative's (NMSI) Initiative for Military Families. In the Initiative, DOD, NMSI, and private sector investments have helped more than 75 military-connected public high schools prepare more students for college and career by improving access to and successful completion of Advanced Placement (AP) courses, with those schools showing, on average, a 67 percent increase in passing math, science, and English AP scores.

### *Recruiting, Preparing, and Supporting Excellent STEM Teachers*

- Preparing 100,000 Excellent and New STEM Teachers over a 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 230 organizations formed a coalition called *100Kin10*. These organizations have made over 250 measurable commitments to increase the supply of excellent STEM teachers, including recruiting and preparing more than 43,000 teachers in the first five years of the initiative. In addition, last year ED announced more than \$175 million in STEM-focused five-year grants under the Teacher Quality Partnership Grant program, which will support more than 11,000 new teachers in high-need schools. To build on a growing set of public and private investments, ED is proposing \$139 million in the 2016 Budget for its new Teacher and Principal Pathways program, \$100 million of which would support high-quality teacher preparation with a priority for STEM teacher preparation programs that recruit and train effective STEM teachers for high-need schools. Finally, the National Science Foundation will continue its \$60 million-per-year investment in the Robert Noyce Scholarship program to train new STEM teachers.
- Strengthening STEM Teaching and Learning: To support innovative STEM teaching and the critical role of partnerships, ED's 2016 Budget provides more than \$200 million in the Math and Science Partnerships program, a \$50 million increase over 2015 enacted levels. This expansion, coupled with targeted program reforms, would build on the previous success of the program in giving educators the ability to engage in innovative STEM teaching and would also allow for better leveraging of local resources and assets to encourage comprehensive STEM education reform. The enhanced program would focus on strategic partnerships of school districts, businesses, universities, museums, Federal agencies, and other educational entities to transform how a district delivers STEM education so that students are engaged in learning experiences that inspire curiosity, that help connect students to the real-world experiences of STEM professionals, that give students project-based making and learning experiences, and that give students, especially girls and under-represented minorities, the access and supports to succeed in rigorous math and science coursework. The expanded Math and Science Partnership program will also create a national, online community of STEM educators in a STEM Virtual Learning Network.

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*Investing in testing and scaling effective models*

- Identifying and Scaling What Works in STEM education: The Budget funds ED's Investing in Innovation (i3) program at \$300 million, a \$180 million increase over 2015 enacted levels, to develop and test effective practices and provide better information to States and districts on what works in K-12 education, including a priority for strategies that improve student success in STEM subjects. The i3 program has built a strong record in expanding effective STEM programs. For example, one recipient of a Validation grant, the National Math and Science Initiative's College Readiness Program, has helped enroll more than 6,300 students in college-level AP courses in Colorado and Indiana, with the number of passing scores on math, science, and English AP exams increasing in the first year. In Colorado, 246 more students passed their AP exams, an increase of 39 percent, and in Indiana, 448 additional students earned passing scores, a 66 percent increase. Complementary investments in building evidence on effective STEM programs include the Administration's proposal for \$90 million to support NSF's Discovery Research K-12, which invests in research on teaching and learning STEM.
- Making the STEM fields more inclusive: NSF is proposing \$15 million for a new INCLUDES program that will develop and test strategies and build partnerships to enhance the participation of those who have been traditionally underserved or underrepresented in STEM fields.

### **Undergraduate STEM Education**

The focus of the President's 2016 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 a decade, including investments to:

- Transform undergraduate teaching and learning with NSF investments: The Budget proposes approximately \$135 million at NSF, an increase of almost \$30 million, for a comprehensive Foundation-wide effort to improve undergraduate STEM education, including steps to improve undergraduate teaching, expanding student opportunities to have authentic research experiences, addressing the high failure rate for introductory mathematics, leveraging new technologies, and increasing degree completion of women and under-represented minorities in STEM. The Budget also proposes \$78 million for NSF's Research Experiences for Undergraduates (REU) program to provide early opportunities for college students to conduct research, which can be especially influential in maintaining a student's interest in science, engineering, and mathematics. The Administration is also proposing over \$60 million for NSF's Advanced Technological Education (ATE) program, which invests in the education of technicians for in-demand high-technology fields, with a focus on partnerships between academic institutions and employers.
- Driving performance and innovation in higher education: ED will make a series of investments to drive performance and improve outcomes in higher education, with the

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potential to increase the number of students who complete with STEM degrees. This includes: (1) expanding the First in the World fund to \$200 million, which will support and test promising institutional innovations and practices that improve educational outcomes in college; (2) a new \$200 million Career and Technical Education (CTE) Innovation Fund to support innovative, evidence-based job training programs in high-demand fields; and (3) creation of a new ED Idea Lab, modeled on the Idea Lab at the Department of Health and Human Services, to bring forward and incubate new ideas from agency staff and external innovators on mission priorities, starting with higher education. The Department of Education will also invest in expanding higher education opportunities for under-represented groups with \$100 million in the Hispanic-Serving Institutions (HSI) STEM and Articulation program, sustained funding for Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP), and increased funding for ED's Federal TRIO Programs (TRIO) – a set of programs that have a strong focus on increasing access to STEM education.

### **Graduate Education**

The focus of the 2016 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 \$400 million at NSF for the Graduate Research Fellowships and Research Traineeship Programs to support thousands of outstanding graduate-student researchers who will be tomorrow's leaders in the innovation economy in a range of careers. In addition, these graduate students will gain valuable knowledge of STEM opportunities in the Federal agencies under the Graduate Research Internships Program (GRIP), which has a number of Federal agencies as partners. In addition, NSF is supporting \$45 million for CyberCorps to help more students meet the growing need for an expanded and capable cybersecurity workforce.
- Refocusing a Department of Energy Program to Prepare Graduate Students for High-Priority STEM Fields: The President's 2016 Budget includes \$10 million for the Computational Sciences Graduate Fellowship (CSGF) at the Department of Energy (DOE) to expand the program and strengthen connections to both relevant DOE facilities and to the challenges of exascale computing.
- Continuing support for major graduate training programs, including \$470 million for the NIH's Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants (T32 and T35 awards only), which provide funding to prepare individuals for careers in the biomedical, behavioral, and social sciences. In addition, DOD will invest over \$90 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.

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## **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 the President started the tradition of hosting yearly White House Science Fairs, challenged students to be "makers of things" and hosted the first-ever White House Maker Faire last year, led by example as the first President to ever write a line of code as part of "Hour of Code" with students, 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.

The 2016 Budget builds on the President's leadership with key investments that include:

- **Identifying best practices to engage youth in STEM:** The Administration proposes \$60 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.
- **Improving the reach of informal STEM education:** The Budget provides \$5 million to the Smithsonian Institution to improve the reach of informal STEM education by ensuring that museum materials and other National treasures are accessible to more students and aligned with what students are learning in the classroom. In addition, the Institute of Museum and Library Services (IMLS) will continue to support STEM and "making" programs in its programs with special emphasis on programs targeted for at-risk youth.
- **Supporting community-based STEM activities:** As part of its 2016 Budget, the Corporation for National and Community Service will continue to implement and expand STEM AmeriCorps, a multi-year initiative to engage AmeriCorps members in mobilizing STEM professionals to inspire young people, including underrepresented students, to excel in science, technology, engineering, and math and build the pipeline for future STEM careers.
- **Supporting High-Quality STEM Education Programs at NASA:** The Budget supports NASA's efforts to internally restructure and better integrate its STEM education programs to reach more students and teachers, with \$89 million for the Office of Education and a complementary \$20 million provided under NASA's Science Mission 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:** \$50 million for the Advanced Research Projects Agency - Education (ARPA-ED), a "DARPA for Education." ARPA-ED will allow the Department of Education to

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advance the field of education research, development, and demonstration by sponsoring the synthesis and vetting of public and private R&D efforts; identifying high-risk, high-return 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 scaling the best and most relevant R&D from other Federal agencies.

- Supporting Teachers and Helping Prepare Them for the Digital Age: The Budget invests \$3 billion to provide broad support for educators at every phase of their careers, from ensuring they have strong preparation before entering the classroom, to pioneering new approaches to help teachers succeed and equipping them with the tools and training they need to implement college and career-ready standards. Recognizing the importance of integrating technology into the classroom, this investment includes \$200 million for an improved Education Technology State Grants program focused on providing educators with training and support to maximize the impact of expanded access to technology to provide high-quality, personalized instruction to students, while protecting their privacy. The Budget also supports a companion initiative funded at \$1 billion annually for five years in mandatory funding that will support State and local efforts to attract the best candidates to the teaching profession, especially in hard-to-fill positions such as math and science, and prepare them for the demands of the classroom, while also creating a culture of excellence and professional growth for teachers throughout their careers.
- Investing in new methods and new insights from the fields: ED’s Institute of Education Sciences (IES) will continue its support for a “Virtual Learning Laboratory” initiative, which explores the use of rapid experimentation and “Big Data” to discover better ways to help students master important concepts in core academic subjects such as STEM, and looks for opportunities to expand its use of rapid low-cost randomized control trials (RCTs). In addition, the Budget requests \$10 million at ED for school districts and researchers to partner to develop and test “non-cognitive” interventions that contribute to student success, such as academic perseverance, self-control, and social and emotional skills.

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

The President’s 2016 Budget maintains a strong commitment to the goals of the Five-Year Strategic Plan. This means:

- 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. Agency members of the National Science and Technology Council’s 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 coordinate and better align existing programs, develop joint pilot projects, and develop common data-collection strategies.

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- Agencies will focus on internal consolidations and eliminations, while funding their most effective programs. As a result, the 2016 Budget continues to reduce fragmentation, building on the substantial number of internal consolidations and eliminations that agencies began implementing in 2013.
  - Similar to the Administration’s 2015 Budget, the Administration is not requesting a transfer of funding between agencies but instead is ensuring that agencies have enough resources to continue strong interagency coordination. To support these and related activities, the Budget provides 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.

### Spotlight of Work in Action

The Department of Education’s 21<sup>st</sup> Century Community Learning Centers (CCLC) program is spearheading three inter-agency collaborations that effectively leverage the impact of multiple Federal STEM education investments. These collaborations will offer authentic STEM content and experiences, as well as opportunities to engage with STEM subject matter experts.

As part of the efforts, an existing collaboration with NASA will be expanded, and collaborations with two other Federal agencies – the National Park Service (NPS) and the Institute of Museum and Library Services (IMLS) – will be piloted. The number of participating sites will expand fivefold (from around 20 to over 100); the number of participating agencies will double from two (ED and NASA) to four; and the collaboration will benefit students nationwide. Participating sites represent broad geographic diversity and encompass rural and urban settings.

- The pilot program with IMLS will introduce students at 25 sites across 5 states to making and tinkering projects – part of a growing “Maker Movement” that is providing a powerful way to get young people interested in STEM. This program will link science museums and science youth-serving programs with CCLC sites. Participating staff will be trained by the Exploratorium, a San Francisco-based science center with a history of innovation in maker education, so they can serve as subject matter experts, providing training to their colleagues and working with youth participants.
- The Park Service pilot program introduces environmental monitoring and citizen-science programs to students in CCLC programs at schools overseen by the Bureau of Indian Education (BIE) at 11 sites in 5 states. Native Americans are the most under-represented group in the STEM fields. These programs are site-based, located in national parks, and focus on introducing students to the natural resources in their region and related science. Working with Hands on the Land, a national network of field classrooms and agency resources that connects students, teachers, families and volunteers with public lands and waterways, NPS will engage park rangers and other subject matter experts to provide professional development to CCLC staff at participating sites throughout the program, and will provide subject matter expertise to students.



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- The NASA collaboration provides students with the opportunity to solve challenges based on real mission data and experiences that occur during exploration of the solar system. NASA staff will provide face-to-face as well as ongoing online professional development to the CCLC staff. Throughout the program, both staff and students will be provided with several opportunities to interact directly with NASA scientists and engineers as they learn first-hand about engineering design and practices. In 2013, 20 CCLC sites across 3 states participated in the NASA challenges, offering 3 different engineering-design challenges; in 2015, up to 80 CCLC sites across 10 states will participate and will have the option of choosing from 6 engineering challenges.

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