



STEM for All: Ensuring High-Quality STEM Education Opportunities for All Students

*Science, Technology, Engineering, and Mathematics (STEM)
Education in the 2017 Budget*

“In the coming years, we should build on that progress, by ... offering every student the hands-on computer science and math classes that make them job-ready on day one.”

President Barack Obama
2016 State of the Union Address

President Obama believes that every student in the United States should be given the high-quality STEM-education opportunities that allow them to join the innovation economy, have the tools to solve our toughest challenges, and be active citizens in our increasingly technological world. That’s why the President’s 2017 Budget invests \$4 billion in mandatory spending and more than \$3 billion in discretionary spending across the Federal Government on STEM education. The 2017 Budget prioritizes three major areas for investment to support STEM education for all students:

- Expanding access to rigorous STEM courses, with \$4 billion in mandatory funding and \$100 million in discretionary funding for the *Computer Science for All* initiative, which has the goal of giving every student from preschool to high school the opportunity to learn hands-on computer science (CS). Additional investments to support course access include \$80 million for Next-Generation High Schools.
- Improving STEM teaching and supporting active learning with a \$125 million Teacher and Principals Pathways program to support teacher-preparation programs, \$10 million for a newly authorized STEM Master Teacher Corps program, and \$109 million from the National Science Foundation (NSF) to ensure that undergraduate students have the most effective learning experiences. These investments will also advance progress on the President’s 2011 State of the Union call to action to prepare 100,000 excellent STEM teachers over the next 10 years.
- Overcoming stereotypes and expanding opportunities for all students in STEM, including through a comprehensive NSF effort that will invest \$16 million to support alliances and backbone organizations dedicated to increasing diversity and successfully engaging traditionally underrepresented groups in STEM.

Expanding Access to Rigorous STEM Courses

To ensure that all students have access to high-quality and relevant STEM coursework, starting in preschool and progressing through the rest of their formative years, we as a Nation, must increase opportunities for every student to have access to a full suite of advanced STEM courses in high school. For high-school students, access to core and advanced STEM coursework is an essential part of preparing to enter the workforce equipped with relevant skills for a broad range of jobs,

and to successfully pursue STEM degrees and courses in college. Exposure to STEM education correlates with success in higher education, regardless of major.

Despite the critical importance of access to rigorous STEM courses, the most recent survey from the Department of Education's Office for Civil Rights' Civil Rights Data Collection shows that 50 percent of U.S. high schools do not offer calculus and 27 percent do not offer physics. Between 10 and 25 percent of high schools lack more than one of the core courses in the typical sequence of high-school mathematics and science education, such as algebra I and II, geometry, biology, or chemistry. 25 percent of high schools with the highest proportion of African-American and Latino students do not offer algebra II, and 33 percent of these schools do not offer chemistry.

The Nation must take action to expand the number of schools that offer core and advanced STEM courses. The President's 2017 Budget includes key investments to address the STEM course gap.

Computer Science for All

By some estimates, just one quarter of all K-12 schools in the United States offer computer-science with programming and coding. The President's 2017 Budget includes a Computer Science for All plan that builds on the momentum at the state and local level to give every P-12 student the opportunity to learn computer science. The 2017 Budget proposes \$4 billion in mandatory funding at the Department of Education (ED), available over three years, for states to increase access to hands-on computer science (CS) in P-12 classrooms. Under the program, all fifty states would be able to submit comprehensive five-year "Computer Science for All" plans, and every state with a well-designed strategy would receive funds. In addition to state-level grants, the 2017 Budget also dedicates \$100 million in competitive grants specifically for leading districts to execute ambitious CS-expansion efforts for all students—with a focus on reaching traditionally underrepresented students—and to serve as models for national replication. The Computer Science for All initiative also includes \$20 million from the National Science Foundation to invest in FY 2017 on the effort. More information on this initiative can be found in the [Computer Science for All](#) fact sheet.

The 2017 Budget also includes additional investments to help narrow STEM course gaps, including:

- [\\$500 million for Student Support and Academic Enrichment Grants](#), a new block grant at ED, authorized by the Every Student Succeeds Act (ESSA), that would provide flexible-formula grant funds to assist school districts in delivering a well-rounded education to their students through a range of locally determined activities, including support for STEM education, the arts, student-support services, and effective use of educational technology in schools. In addition, building on the [STEM Education Act of 2015](#) and the new ESSA, ED will release this year guidance to states, districts and the broader education sector his year on funding opportunities for STEM and CS.
- [Creating Next-Generation High Schools](#). Building on the momentum from the first-ever Summit on Next-Generation High Schools held last year, the 2017 Budget proposes

establishes a new \$80 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: promoting active and personalized learning for students, strengthening relationships with business and post-secondary partners, and linking student work to real-world expectations and experiences that reflect college and careers, in order to better prepare students for their futures. The 2017 Budget also supports a number of complementary investments in high-school reform at ED, including an increase in Title I to support school improvement, \$350 million for charter schools; and \$115 million for magnet schools.

- Identifying and Scaling What Works in STEM education. The 2017 Budget funds \$180 million for ED’s Education Innovation and Research (EIR) program, the successor to the Investing in Innovation (i3) program. The EIR program expands support for evidence-based initiatives to develop, validate, and scale up effective education interventions that will help States and districts meet ESSA requirements emphasizing the use of such interventions wherever possible. A portion of these funds will be reserved for the proposed Advanced Research Projects Agency - Education (ARPA-ED). Complementary investments in building evidence on effective STEM programs include the Administration’s proposal for \$83 million to support NSF’s Discovery Research PreK-12, which invests in research and development on STEM teaching and learning.
- Leveraging the disciplinary expertise of the Federal agencies. The 2017 Budget provides \$17 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 curricula in K-12 schools, and \$4 million for the Environmental Protection Agency (EPA) to invest in environmental-education grants. In addition, the 2017 Budget calls for the Department of Defense (DoD) to invest \$11 million in expanding STEM opportunities for children of military families. The DoD investments build on a multi-year record of success under the National Math and Science Initiative’s (NMSI) Initiative for Military Families.

Improving STEM Teaching and Supporting Active Learning

Abundant evidence shows that the ways in which STEM subjects are taught matter for learning. Active and hands-on, inquiry-based engagement enhances learning for students of all demographics and has especially beneficial effects on women and other underrepresented groups, likely due to a greater sense of belonging that can be achieved in active classrooms.^{1,2,3} In STEM disciplines, use of active-learning techniques by educators—both inside school and informal settings—not only improves learning outcomes, but also helps to retain students in STEM majors.

¹ For example, see the white paper “Promising Practices in Undergraduate STEM Education” (2008) by J.E. Froyd (available online at: http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_072616.pdf). See also Baldwin, Roger G., ed. (2009). *Improving the Climate for Undergraduate Teaching and Learning in STEM Fields*. San Francisco: Jossey-Bass.

² Freeman et al., 2014. “Active learning increases student performance in science, engineering, and mathematics.” *Proc Natl Acad Sci* 111:8410-8415.

³ National Research Council (U.S.), Donovan, S., & Bransford, J. (2005). *How Students Learn: History, Mathematics, and Science in the Classroom*. Washington, D.C: National Academies Press; *Journal of Educational Psychology*, 93, 579–588; *Cognition and Instruction*, 4, 137-166.

Active-learning strategies encompass a suite of practices in which students are engaged in thinking or problem solving rather than passively listening to a lecture. These strategies can be as simple as challenging students to try and figure out how solve problems on their own before being taught how to do so, or can require more dramatic changes, such as engaging students in original research or design in introductory-level college courses.

Overall, the 2017 Budget invests \$2.8 billion in discretionary funding at ED for programs to provide broad support for P-12 educators at every phase of their careers, from ensuring that educators have strong preparation before entering the classroom, to pioneering new approaches to help teachers succeed in the classroom, and equipping them with tools and training they need to implement college- and career-ready standards.

In particular, the 2017 Budget supports effective STEM teaching by:

- Making Progress on the President’s Goal of 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 350 measurable commitments to increasing the supply of excellent STEM teachers, including recruiting and preparing more than 43,000 teachers in the first five years of the initiative alone. In addition, under this Administration, ED has 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. The 2017 Budget builds on this progress with the \$125 million Teacher and Principals Pathways program to support teacher-preparation programs and nonprofits partnering with school districts to create or expand high quality pathways into the teaching profession, particularly into high-need schools and high-need subjects such as STEM. Finally, the 2017 Budget provides \$61 million for the Robert Noyce Scholarship program to prepare new STEM teachers.
- Creating a STEM Master Teacher Corps. The 2017 Budget includes \$10 million at ED to establish a new program that responds to the President’s July 2012 call to create a national STEM Master Teacher Corps that would enlist America’s best and brightest science and mathematics teachers to improve STEM education. As part of this program, investments in the 2017 Budget will help States create leadership pathways for excellent STEM educators to improve STEM teaching and learning. Corps members will build their capacity to be leaders in the field and enhance the professional learning of other STEM teachers; identify and share promising practices in their schools, districts, and States; and help students excel in STEM subjects while taking on coaching and mentorship roles in their schools and communities.
- Supporting K-12 STEM Teachers by Leveraging Federal STEM Assets: The National Oceanic and Atmospheric Administration (NOAA) will leverage over a billion dollars of STEM assets to provide rigorous STEM education experiences for K-12 teachers. Teachers will be placed on NOAA research vessels to work side-by-side with NOAA scientists as part of their research team. By participating in this opportunity, teachers

will gain great insight into scientific practices, cross-cutting concepts, and core disciplinary ideas, which they can bring back to their classrooms.

- **Transforming Undergraduate Teaching and Learning:** The 2017 Budget proposes approximately \$109 million at NSF for a comprehensive, NSF-wide effort to improve undergraduate STEM education (IUSE). The effort supports developing and implementing systemic approaches to improve undergraduate teaching, expanding student opportunities for authentic research experiences, addressing the high failure rate for introductory mathematics, leveraging new technologies, and increasing the completion rate for women and underrepresented minorities in STEM. The NSF investments include \$75 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 2017 Budget also expands ED's First in the World fund to \$100 million. The fund identifies and expands promising and evidenced-based innovations and practices at colleges and universities across the country to improve graduation rates and other educational outcomes for all students, make college more affordable, and improve undergraduate teaching.

Overcoming Stereotypes and Expanding Opportunities for All Students in STEM

One of the greatest strengths of the American talent pool and workforce is [diversity](#). To engage the diversity of Americans more fully, access the full potential of the STEM talent pool, and provide equitable opportunities, we as a Nation must tackle the growing research on the impact of [implicit barriers and unconscious bias](#) driving interested students away from STEM.

This Administration has taken a range of steps to address these barriers and expand STEM opportunities for all students. These steps include starting the tradition of the [White House Science Fair](#), and launching and growing the [Educate to Innovate](#) initiative, which has catalyzed more than \$1 billion of private-sector investment in STEM education, and includes a number of media organizations committed to overcoming attitudes about who is capable of succeeding in STEM fields. The Administration is also working with the media and entertainment industry to help raise awareness of opportunities to ensure that representation of people working in STEM more accurately represents the diversity of Americans in STEM fields, while offering the public a more realistic image of the broad range of STEM jobs to help inspire students to consider STEM degrees. In addition, the Administration is convening Federal STEM agencies to delineate policies that would enhance training of Federal employees in mitigating the effects of bias on workplace behaviors.

The 2017 Budget builds on these efforts and expands STEM opportunities for all groups through investments including:

- **NSF Investments in Intermediary Organizations.** As part of its "Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science" (NSF INCLUDES) program, NSF, through a comprehensive R&D effort, will invest \$16 million in FY 2017 to support alliances and backbone organizations in developing new solutions to increase diversity and inclusion and successfully engage

traditionally underrepresented groups in STEM education and workforce development on an impactful scale.

- ED Investments to Expand Higher-Education Opportunities for Underrepresented Groups. ED will invest in a set of programs that have a strong focus on increasing access to STEM education, including \$108 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.

Continued Investments on Priorities in the STEM Strategic Plan

The 2017 Budget continues to target investment on the five priority areas identified in the Federal STEM Education 5-Year Strategic Plan, building on the inter-agency collaboration that has helped reduce the number of STEM programs by forty percent over the past three years.. In addition to investments focused on improving P-12 instruction, undergraduate education, and broadening participation in STEM education, the Budget includes investments for graduate education and workforce training, education activities that typically take place outside the classroom, and educational innovation.

The 2017 Budget's STEM-workforce and graduate-level STEM-education investments include:

- Strengthening American Cybersecurity. With a \$70 million investment in the "CyberCorps: Scholarship for Service" (SFS) program, NSF will support cybersecurity education at higher-education institutions to prepare and train experts to respond to cybersecurity challenges. Of the \$70 million, \$25 million will be invested in laying the groundwork for SFS alumni to be available over the course of their careers to serve the Federal government, including by helping to respond rapidly to cybersecurity challenges.
- Preparing Graduate Students for Careers in High-Priority STEM Fields. The President's 2017 Budget includes \$10 million for the Computational Sciences Graduate Fellowship (CSGF) at the Department of Energy (DOE) to continue training new graduate students in high-performance computing (HPC), thereby supporting a pipeline of future DOE leaders in HPC and equipping graduate students with the skills to help solve the nation's complex science and engineering problems. The 2017 budget also includes \$66 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.
- Continuing Support for Major Graduate Training Programs. The 2017 Budget provides \$332 million at NSF for the Graduate Research Fellowships Program and \$59 million for the NSF Research Traineeship Program to support thousands of outstanding graduate-student researchers who will be tomorrow's innovative leaders in a range of careers. Graduate students can access additional STEM opportunities in the Federal agencies under the Graduate Research Internships Program (GRIP), which has a number of Federal agencies and national laboratories as partners. The 2017 Budget also includes \$473 million

for the National Institutes of Health (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.

Informal STEM Education

The President believes that we need to give many more boys and girls STEM experiences that engage them and show them the potential to use their STEM skills to have high-wage careers, tackle our world's toughest challenges and be engaged citizens in our increasingly technological world. That's why the President has challenged students to be "makers of things," and hosted the first-ever White House Maker Faire, led by example as the first President to ever write a line 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 2017 Budget builds on the President's leadership with key investments that include:

- Identifying Best Practices to Engage Youth in Hands-on STEM. The 2017 Budget includes \$63 million for NSF's Advancing Informal Science Learning program, focusing on 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. ED's 21st Century Community Learning Centers (21st CCLC) program will also continue to foster interagency partnerships to bring hands-on STEM-learning opportunities to high-need students during after-school and out-of-school time.
- Supporting High-Quality STEM-Education Programs at NASA. The 2017 Budget supports the NASA Office of Education's efforts to enhance coordination with other agencies and use competition to identify and fund the most effective education activities across the agency. The Budget also provides \$25 million to the competed NASA Science Mission Directorate Program which connects NASA science experts and content to learners of all ages.

Supporting 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 21st Century, the 2017 Budget provides up to \$30 million for the Advanced Research Projects Agency - Education (ARPA-ED). ARPA-ED will allow the ED to rapidly advance breakthrough innovations in education technology by creating interdisciplinary teams comprised of the nation's top experts in education, technology, and other key disciplines. ARPA-ED will identify promising new approaches being pioneered in the private sector and other Federal agencies in the areas of distance learning, intelligent tutoring systems, and real-time assessment. Applying research and development strategies learned from the Defense Advanced Research Projects Agency (DARPA), these technologies will be rapidly prototyped and

transitioned to practice, allowing the nation to expand both the quality of and access to STEM coursework for all students.

In addition, the 2017 Budget includes an increase in funding at ED for Competitive Assessment Grants, the successor to the Enhanced Assessment Grants program, which supports projects designed to spur innovation in education-assessment design and delivery and to help States address pressing needs they have identified for developing and implementing next-generation assessment systems.

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