

# Research Development & Grant Writing News

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## Big Changes in STEM Education Funding

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*The National Science and Technology Council just released its Federal STEM Education 5-year Strategic Plan, and we're already seeing its impact at the funding agencies.*

In the [2010 Reauthorization of the America COMPETES Act](#), the U.S. Congress tasked the Director of the Office of Science and Technology Policy with developing a 5-year Federal Science, Technology, Engineering, and Mathematics (STEM) Education Strategic Plan. That [Strategic Plan](#) was released on May 31, 2013 by the National Science and Technology Council (NSTC's) Committee on STEM Education (CoSTEM), and it presages big changes in how the Federal government funds STEM education research and workforce development. Below, we'll discuss the highlights of the strategic plan, and then we'll discuss the impacts we're already seeing at NSF and other research funding agencies as they realign their funding programs to carry out the plan.

### Background

The Federal agencies spent almost \$2.9 billion on STEM education initiatives in 2011, spread out over a number of agencies: USDA, Commerce (NOAA), DoD, Education, DOE, EPA, Health & Human Services (which includes NIH), Homeland Security, Department of the Interior, NASA, NSF, Nuclear Regulatory Commission, and Transportation. These programs ranged from internship and fellowship programs to informal education to STEM education research. A very interesting table is included as [Appendix A in the Strategic Plan](#) listing these programs by agency along with the funding for each one for 2008 through 2011.

The U.S. Congress expressed concern that despite these large investments, U.S. students continue to lag behind in STEM. One potential reason may be the fact that these investments are dispersed across so many agencies with little coordination. As a result, in the 2010 Reauthorization of the America COMPETES Act (Section 101), the Congress required that the NSTC establish a committee to coordinate Federal programs and activities that support STEM education among all Federal agencies that support such programs. In addition, the committee was tasked with reviewing Federal STEM education activities and programs to ensure that they are not duplicative, and developing and implementing through the participating agencies a 5-year STEM education strategic plan (which must be updated every 5 years). The strategic plan was required to: a) Specify and prioritize annual and long-term **objectives**; b) specify the **common metrics** that will be used to assess progress toward those objectives; c) describe the approaches to be taken by each participating agency to **assess the effectiveness** of its STEM education programs and activities; and d) **describe the role of each agency** in supporting programs and activities designed to achieve the objectives listed in a). The committee was also

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tasked with establishing and periodically updating an inventory of federally sponsored STEM education program and activities, including documentation of assessments and rates of participation by women, underrepresented minorities and persons from rural areas.

The Director of the Office of Science and Technology Policy is also required to submit an annual report to Congress that includes: 1) a description of the STEM education programs and activities for each agency for previous and current years as well as proposed programs under the President's budget request; 2) the levels of funding for those programs; 3) an evaluation of the levels of **duplication and fragmentation** of the programs and activities; 4) description of progress made in carrying out the implementation plan, including the outcome of any program **assessments** completed during the previous year; 5) a description of how the participating Federal agencies will **disseminate** information about federally supported resources for STEM education practitioners, including to teachers and administrators in schools.

In response, the Office of Science and Technology formed the [Committee on STEM Education](#) (CoSTEM), which includes representatives from NSF, EPA, NASA, NIH, NOAA, the Departments of Agriculture, Defense, Education, Energy, Homeland Security, Interior, Transportation, and the Office of Science and Technology Policy. They have been working on the strategic plan for the last 2 years, and the final plan was just released on May 31<sup>st</sup>.

## Highlights of the Strategic Plan

The entire plan is a good read for anyone interested in STEM Education policy and funding; below are highlights and excerpts from the report, focusing of aspects of the plan that are most likely to affect university faculty pursuing STEM education-related funding.

- The plan specifies **five priority areas** for STEM education investment, along with specific goals for each priority area:
  1. Improve P-12 STEM instruction (*100,000 new K-12 STEM teachers by 2020 and support existing STEM teacher workforce*)
  2. Increase and sustain youth and public engagement in STEM (*50% increase in number of U.S. youth who have an effective, authentic STEM experience each year prior to completing high school*)
  3. Improve undergraduate STEM education (*1 million additional students earning degrees in STEM fields over the next 10 years*)
  4. Better serve groups historically underrepresented in STEM fields (*increase the number of underrepresented minorities graduating with STEM degrees in the next 10 years and improve participation of women in STEM areas where they are underrepresented*)
  5. Design graduate education for today's STEM workforce (*provide STEM graduate students with basic and applied research expertise, options to acquire specialized*

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*skills in areas of national importance and mission agency's needs, and ancillary skills needed for success in a broad range of careers)*

- **Two coordination strategies** will be implemented for organizing Federal investments in STEM education in order to reduce fragmentation and duplication:
  - Build new models for leveraging assets and expertise – establish a coordinated, coherent portfolio of STEM education investments across the Federal Government, designating **initial lead and collaborating agencies** within certain priority areas, developing joint solicitations or MOUs, consolidating programs, and using new funding strategies such as performance partnerships that encourage agency collaborations.
  - Identify, use, and share evidence-based approaches – create and use common metrics, evidence guidelines and evaluation practices; develop complementary program goals; create a shared understanding of evidence-based STEM education practices.
- As part of the first coordination strategy, above, the following agencies have been designated as **lead agencies for the priority areas** as follows:
  - Improving P-12 STEM Instruction will be led by the **Department of Education**. It will invest \$80 million in support of the 100,000 new STEM-ed teachers goal and \$35 million for the launch of a **pilot STEM-ed Master Teacher Corps**. It will also create **new STEM Innovation Networks** to better connect school districts with local, regional, and national STEM resources, and will **collaborate with all the Co-STEM agencies** to ensure that Federal scientific assets are utilized in the improvement of P-12 STEM education.
  - Improving delivery of undergraduate STEM teaching and learning through evidence-based reforms will be led by **NSF**. NSF will initiate a **new \$123 million program aimed at improving retention** of undergraduates in STEM fields, expand and enhance its **graduate fellowship programs** (with an additional \$325 million), and use a common infrastructure at NSF to reach more students and **offer a set of opportunities** that address national needs and mission-critical **workforce needs for the CoSTEM agencies**.
  - Improving informal STEM education to ensure that materials are aligned with classroom learning will be led by the **Smithsonian Institution**. The Smithsonian will receive \$25 million and will work with NSF, ED and other CoSTEM agencies and other science partners to disseminate relevant, evidence-based materials and curricula, on-line resources, and employ delivery and dissemination mechanisms to reach more teachers and students inside and outside the classroom.
  - The other CoSTEM agencies will continue to be key players in the re-organized effort. All CoSTEM agencies will be invited to participate. This may be through direct

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support, provision of expertise and content, mobilization of talented STEM role models and mentors, or by exposing students to real-world learning opportunities at Federal STEM facilities. **Lead agencies** will be responsible for convening other CoSTEM agencies, helping facilitate review and revision with collaborating agencies and tracking progress toward achieving priorities.

- In support of the five priority areas, the plan described the following **strategies**:
  1. Improve STEM Instruction – increase coordination among STEM-teacher preparation, support, and recognition efforts within existing and proposed programs. Continue research on teacher learning and STEM teacher development. Encourage appropriate connections to local and state policy, standards, and assessments.
  2. Increase and sustain youth and public engagement in STEM – develop coordinated programs inside and outside of school, platforms, and infrastructure to provide desired audiences with STEM experiences enabled through government assets, including but not limited to materials, facilities, and skilled STEM professionals. Collaboration among all agencies will be critical for better understanding the current baseline of engagement activities and their outcomes and furthering a focused and impactful government investment in engagement.
  3. Enhance STEM experience of undergraduate students – Use internship, scholarship, and fellowship programs, research experience opportunities, initiatives to create and test innovative instructional approaches and materials, faculty professional development, and research on STEM learning. In addition, efforts to broaden participation in STEM will be critical to reaching the number of needed graduates, and the resulting diversity will enhance innovation in STEM fields.
  4. Better serve historically underrepresented in STEM fields – CoSTEM agencies will work with relevant stakeholder communities, including faculty, administrators, and students from Minority-Serving Institutions (MSIs) given that approximately 10% of the funds invested by Federal agencies on this priority are focused on these institutions. Agencies will consider emphasizing education at critical transition points from P-12 to postsecondary education and from postsecondary education to the STEM workforce, when students from groups traditionally underrepresented in STEM often drop out of the STEM pipeline. As part of this focus, agencies will work to create more common definitions and consistent categorization of programs that serve underrepresented groups as either a focus or an emphasis. This may also include improving access to and increasing coordination across, programs for Minority-Serving Institutions.
  5. Design graduate education for tomorrow's STEM workforce – CoSTEM agencies will coordinate to improve access to, and efficacy of, government-funded graduate fellowships. Over time, CoSTEM agencies may also consider addressing improvements to a broader range of Federal approaches to graduate student support. There is growing

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evidence that opportunities for professional development of students to learn a broader range of skills that are important in STEM fields (e.g., communication) and to participate in applied work on authentic problems and challenges of government and the private sector are important components of graduate education. Some universities are encouraging students to set and meet more ambitious goals for their research, education, and service; giving students greater autonomy earlier in their career; connecting students to real-world problems at a regional, national, and global level; and involving students in the design of university curricula, research initiatives, and collaborations with external partners. The CoSTEM agencies can continue to benefit from understanding the effectiveness of innovative practices that universities are incorporating in their graduate education to promote those practices in graduate education more broadly.

### Impacts at the Agencies

It will take some time to see how these changes play out at the agencies, but we are already seeing impacts in terms of funding programs disappearing and new programs being announced. Regarding the impact of designating lead agencies for specific priorities, the strategic plan states,

*Designation as a lead agency does not narrowly define an agency's role in STEM education. It does not mean that NSF, for instance, will abandon its efforts in areas other than the improvement of undergraduate STEM education, or that no other agency will have any role in undergraduate education. It means instead, that NSF may request additional funding and resources to support an increased role initially in leading the improvement of undergraduate STEM education. Similarly, while ED is the initial lead for P-12 instruction, it will also play a strong role in supporting engagement activities and building bridges between in-school and out-of school learning to increase the effectiveness of both. The other CoSTEM agencies will be key collaborators, working with the lead agencies to find ways to build on their existing investments in STEM education, and leverage the passion and expertise of their staff and other STEM professionals who will continue to provide access to STEM content and Federal assets that can be used in formal and informal learning environments.*

### National Science Foundation

At NSF, PIs have been noticing since the beginning of the year that some long-running STEM education-related programs that normally release solicitations each year such as [TUES](#) and [REESE](#) had not issued solicitations as expected. The other shoe at least started to drop with the April release of NSF's budget request, which included a description of [Catalyzing Advances in](#)

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[Undergraduate STEM Education \(CAUSE\)](#) (\$123.08 million was requested to fund CAUSE).

According to this description, CAUSE is an NSF-wide initiative that will focus on undergraduate STEM education and will build a portfolio through collaboration among all of the NSF directorates, informed by input from the STEM disciplines and education research.

CAUSE will be created by consolidating three Division of Undergraduate Education Programs ([STEP](#), [WIDER](#), and [TUES](#)) and several STEM-focused programs from other directorates ([TUBE](#), [NUE](#), [OEDG](#), and [CCE](#)). **That means that new funding for all of these programs will be discontinued by 2014** (note that the NSF website doesn't yet reflect these changes).

CAUSE will support three investment areas:

- **Foundational research.** Focuses on core research questions such as how learners move towards expertise in a discipline, that are foundational to improving teaching, learning, engagement and retention.
- **Design-based research.** Supports iterative approaches to design, implementation, analysis, and revision, including prototyping and building and refining models.
- **Scale-up and effectiveness studies.** Focuses on scaling up efforts on learning and learning environments, broadening participation, workforce preparation, and employing emerging technologies.

Over the next couple of years, we can expect to see a number of new program announcements and solicitations in support of these investment areas; the first CAUSE solicitation is expected to come out in December 2013. NSF states that funding will be available for individual investigators, research teams with expertise cutting across one or more STEM disciplines and STEM education research, and discipline-based education research and the social and behavioral sciences.

In a related development, NSF recently announced a new [EHR core program](#) (ECR)—up until then, EHR had only funded projects through solicitations. This program funds *core research proposals* (max 5 years, \$1.5M) to study foundational STEM research questions, and *capacity building proposals* (max 3 years, \$300K) to support groundwork necessary to advance research in STEM learning, STEM learning environments, workforce development, and broadening participation in STEM.

### **Department of Education**

In response to this strategic plan, the [new STEM education plan at ED](#) includes several new and modified initiatives, described on their website and in the [budget overview](#) as follows:



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- **STEM Innovation Networks** (\$150 million requested): This program will provide competitive grants to local educational agencies (LEAs) **in partnership with institutions of higher education**, nonprofit organizations, other public agencies, and businesses to increase the number of students who are effectively prepared for postsecondary education and careers in STEM fields. Eligible partnerships will develop comprehensive plans for identifying, developing, testing and implementing evidence-based practices to provide rich STEM learning opportunities for students in participating LEAs and schools. To support the implementation of these plans, STEM Innovation Networks (STEM-INS) will employ a wide range of strategies—depending on local needs— in areas such as the recruitment, preparation, and professional development of effective STEM educators; the development and testing of teaching and learning models that enable students to successfully meet STEM-focused college- and career-ready standards; and student engagement in STEM subjects.
- The **STEM Virtual Learning Network** (approximately \$5 million). The STEM Virtual Learning Network (STEM-VLN) will create a professional learning community of STEM educators. This community, operating primarily but not exclusively online, will enable STEM educators to share innovative STEM content, effective STEM teaching strategies, and research on STEM education. The funding for the STEM-VLN will come from a set aside from the larger STEM-INS program.
- **STEM Teacher Pathways** (\$80 million requested): To support the President's goal of preparing 100,000 effective STEM teachers, this new program will provide **competitive awards** to high-quality programs that recruit and train talented STEM educators for high-need schools.
- **STEM Master Teacher Corps** (\$35 million requested): This program will enlist the country's leading science and mathematics teachers to improve STEM education across America. The Corps will recognize and reward the most accomplished STEM educators by offering them membership in a national community of talented STEM educators, opportunities to serve as instructional leaders in their schools and communities, and additional pay in exchange for their leadership and service. The President's budget provides \$35 million to pilot the program before the program is taken to scale.
- **Effective Teaching and Learning: STEM** (\$150 million). **Formerly the ED Mathematics and Science Partnerships** program (this was a formula grant, and shouldn't be confused with NSF's MSP), this program will **fund partnerships between local education authorities (LEAs) and institutions of higher education (IHEs)** that will help States improve teaching and learning in science, technology, engineering and mathematics (word is that this will be a competitive grant program rather than a formula grant). Funds will be used to support State implementation of

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comprehensive, evidence-based plans; professional development that aligns Federal, State, and local resources to promote high-quality STEM instruction; and for subgrants to high-need LEAs to support comprehensive STEM instruction in the grades and schools with the greatest needs.

- **Fund for the Improvement of Education** (\$30 million). These funds will be used to expand the Improving Mathematics Achievement and Transition to College from High School (IMATCH) program, **a joint initiative between ED and NSF**. The program will **help develop, evaluate, and scale up effective practices** that increase student achievement in mathematics during the critical transition period from the last two years of high school through the first two years of college.

### **The Smithsonian**

In their [2014 budget request](#), the Smithsonian requests \$25 million to support their role in providing inspiring STEM experiences for teachers and students. They state that the Smithsonian will work “collaboratively with federal agencies offering STEM programs so that we may: create content that takes advantage of each agency’s unique assets, create complementary materials and avoid duplication of effort, and share a centralized portal for the broad dissemination of our engagement offerings. The Smithsonian will also create a knowledge-transfer infrastructure that serves students and teachers as well as the scientists and educators who are creating these educational assets. The Smithsonian will manage these endeavors by creating a centralized oversight group that will coordinate the efforts of STEM engagement providers, including Smithsonian units, mission agencies and other non-profit collaborators. [They] will also increase the capacity of Smithsonian units that offer programs, experiences and services in the creation, dissemination and evaluation of STEM education content.” No external grant programs were mentioned.

### **More Information**

[Science Insider Article](#), “A U.S. Makeover for STEM Education: What it Means for NSF and the Education Department,” 18 April 2013.

[Science Insider Article](#), “House Panel Questions Obama’s Plan to Reorganize Science Education,” 5 June 2013.