



National Science Foundation
WHERE DISCOVERIES BEGIN



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Education Issue

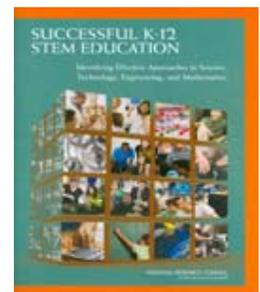
NSF AT WORK

Mapping Out Success for STEM Education: Report & Workshops

From educators to industry leaders, people agree that U.S. schools need to improve teaching and learning in science, technology, engineering and mathematics (STEM) from pre-kindergarten through high school. A STEM background is critical for both high-tech careers and citizen participation in complex societal decisions in areas such as environmental sustainability and economic competitiveness.

A report funded by NSF and prepared by the National Research Council, "**Successful K-12 STEM Education**," identifies characteristics of highly successful K-12 schools and practices. It also suggests means for widespread implementation. The **recommendations** are based on evidence gathered through an initial workshop in May 2011 as well as a review of NSF-supported STEM education and learning research.

Regional workshops are taking the findings directly to educators, school districts, and state and community policymakers. Workshops in Philadelphia, Seattle and Chicago each drew about 300 educators and policymakers. More are planned later this year in Las Vegas and Baltimore.



The report has recommendations for educators, school districts and policymakers.
Credit: National Research Council

Teachers in Urban School Districts: They Start, But Do They Stay?



A teacher recruitment and retention program in Georgia, which seeks to place excellent high-school math teachers in urban school districts, has achieved a 90-percent retention rate. The program emphasizes support and professional development for new teachers.

Attrition is a major factor contributing to teacher shortages, particularly in schools with the greatest needs, according to a 2003 **report** issued by the National Commission on Teaching and America's Future. Approximately one-third of all new math and science teachers

Teacher Andrew Zier coaches a student. *Credit: UMEP, Georgia State University*

leave teaching within the first three years, and attrition is highest in high-poverty, urban schools.

The **Urban Mathematics Educator Program** at Georgia State University, funded by NSF's Robert Noyce Teacher Scholarship Program, is helping to fill the critical U.S. need for high-quality secondary mathematics teachers who join big-city schools--and stay. To date, 33 of the 37 graduates of the Georgia program are teaching in high-need schools, and 90 percent of the graduates who began teaching in 2006-2008 have remained in teaching beyond three years.

Alice: Attracting Students to Computer Science

Alice, a 3-D software tool, helps students improve their performance in many subjects, including science, mathematics, computer programming and business. Teachers, in turn, are learning to use Alice effectively to achieve teaching and learning goals.

Alice was developed and made available by Carnegie Mellon University researchers to address the decline in the number of students interested in computer science, especially among women and other underrepresented groups. The effort has been supported by NSF, other federal agencies and several companies, including Intel, Microsoft and Google.

Rather than requiring students to write code as they develop creative ideas, Alice allows them to use drag-and-drop technology to create video games and 3-D movies. The visual approach appeals to students who otherwise might shy away from computing courses. The tool makes it easier for teachers to introduce programming skills in their classrooms and encourages students to work on problem-solving skills.



High-school students in Purdue's SPIRIT program use Alice. *Credit: Computer & Information Technology Dept., Purdue University*

NSF also supports workshops for teachers on using Alice as well as programs for students. They include Duke University's **Adventures in Alice** Programming Project and the **SPIRIT** program at Purdue University. Read an NSF highlight on **Catching the SPIRIT of Computing With Alice**.

Cracking Secret Codes: Learning and Using Math After School

Middle-grade students are using mathematics to engage in cryptography in after-school **CryptoClubs**, thanks to an NSF-funded program developed by mathematicians at the University of Illinois, Chicago. According to the developers, children's natural interest in secret messages motivates them to apply and extend the mathematics they learn in the regular school curriculum.

In a CryptoClub program, the students learn to use mathematics to encrypt and decrypt secret messages. They apply their new skills in interactive **games and other challenges**, further developing their math, reading and vocabulary abilities. In the summer of 2012, over 70 people from around the country will participate in **workshops** to become leaders of CryptoClub programs.

"Making Stuff": Bringing Materials Science to Millions

Spider silk stronger than steel. Microbes that make gasoline. Artificial organs that deliver life-saving drugs. These mind-boggling advances are transforming materials used every day by consumers and industry into innovations with new benefits for society. The four-part NOVA series "**Making Stuff**," funded by NSF and broadcast on **PBS stations** in 2011, transformed materials science into a popular, entertaining and educational public television event. More than 14.5 million people watched the series, hosted by *New York Times* technology correspondent and author David Pogue. An extensive network of 20



Children at a community

outreach coalitions across the country hosted 135 community events attended by 87,000 individuals, families and educators.

The series and events provided a behind-the-scenes look at innovations that use a new generation of materials that are stronger, smarter, smaller and cleaner than previous ones. Though our economy relies on such breakthroughs, materials science is highly technical--with roots in chemistry and physics. "Making Stuff" succeeded in demonstrating the excitement of discovery while making the underlying science accessible to a wide audience, according to an independent **evaluation** of the project.

event prepare a "smart" material that thickens in response to an impact.
Credit: WGBH Educational Foundation

DID YOU KNOW?

NSF Awards Graduate Research Fellowships for 2012

From a pool of about 12,000 applicants, NSF recently awarded 2,000 **Graduate Research Fellowships** and cited 1,835 honorable mentions. The fellowship awards provide \$126,000 for three years.

The highly competitive program provides support to graduate students who have demonstrated the potential to be high-achieving scientists and engineers. It also aims to broaden the participation of underrepresented groups in science and engineering. The ranks of NSF fellows include numerous individuals who have made transformative breakthroughs in science and engineering research, many who have become leaders in their chosen careers, and some who have been honored as Nobel laureates. The program is celebrating its 60th year in 2012.

The Chemistry of Soap: Resources for Educators

As early as we remember, we were told to wash up--with a dollop of soap from a bar, a jar or a plastic dispenser. But how does this remove those pesky soils and microbes and get us squeaky clean? This **video** and **lesson plan** explain that soap molecules break the surface tension and surround particles of dirt, grease and bacteria, so they can be washed down the drain.



Soap bubbles. *Credit: John M. Sullivan, Univ. of Illinois/ Technical Univ. of Berlin*

The "Chemistry Now" series of **videos** and **lesson plans**, available for use by teachers and students, was produced by NSF, **NBC Learn** and the **National Science Teachers Association**. The series explains the science of dozens of objects we see and use in our everyday lives--from cheeseburgers to flowers to nylon.

FACES OF NSF RESEARCH

Scientist-Educator Empowers Hispanics in Science

Award-winning biologist Lilliam Casillas-Martínez is passionate about microbiology and the education of low-income students, particularly females, in science. She loves to introduce students to her research through educational activities at the Cabo Rojo salterns in southwestern Puerto Rico.

The salterns are an estuary surrounded by natural mats teeming with microbial activity. The mats feed a series of artificial salt ponds with seawater, where students examine how microorganisms survive hypersaline conditions and high solar radiation.

In addition to serving as mentor, role model and source of support for students at the University of Puerto Rico, Humacao, Casillas-Martínez used an NSF Research for Undergraduate Institutions **grant** to establish an outdoor laboratory at the salterns to give her students hands-on experience. She considers her research at the **Cabo Rojo Salterns Microbial Observatory** one of her proudest accomplishments.



Lilliam Casillas-Martínez.
Credit: Lilliam Casillas-Martínez

More than 100 Puerto Rican undergraduate students have received training in emerging fields



Examining microbes.
Credit: Lilliam Casillas-Martínez

such as geomicrobiology and metagenomics, empowering them to apply to graduate programs outside Puerto Rico. The students actively participate in outreach as well. The laboratory is known for participating in science fairs, open houses and the development of workshops for local high-school teachers.

By translating her passion for education into hands-on research activities, Casillas-Martínez has helped inspire numerous students to pursue research in emerging fields of microbiology. She recently received the 2012 Carski Foundation Distinguished Undergraduate **Teaching Award** for her efforts and will deliver the Carski Award

lecture at the American Society for Microbiology 2012 meeting in June.

NSF IN THE NEWS

'Earth: The Operator's Manual' Chronicles Conservation Solutions Around Globe (*PBS NewsHour*) Penn State scientist Richard Alley visits diverse communities in this public television series funded by NSF.

Floating Classroom Transports USF Students Through Skype (*ABC Action News*) Scientists conducting research aboard the ocean-drilling vessel JOIDES Resolution are beamed live into marine science classrooms in Florida.

LearnLab Explores Teaching and Learning (*U.S. News & World Report*) The Pittsburgh-based NSF Science of Learning Center seeks to find out how children learn and what are the best ways to teach them.

THE RIPPLE EFFECT

Video: Inspiring Students To Study Engineering

"**Engineering a Difference**," a video documentary produced by NSF and US Media Partners, shows that engineers have the power to change lives and make a positive difference in the world. The video follows three teams of engineering students and professional engineers as they work with communities in Ghana, Kenya and Nicaragua to build critical infrastructure. The teams--participants in the Engineering Without Borders program--develop a clean water supply, electricity and a bridge to help isolated communities thrive. The video, aimed primarily at inspiring student audiences to study engineering, was recently awarded a Silver Telly, the highest honor in the international **Telly Awards** competition.

Fish and Fossils: Hands-on Fun at USA Science & Engineering Festival

Whether it's controlling a robotic fish or designing spaceship shock absorbers, a hands-on experiment builds excitement while conveying science and engineering principles.

At the **USA Science & Engineering Festival Expo**, held April 28-29 in Washington, D.C., **14 NSF grantees** engaged thousands of visitors in examining fossils, taking a robot for a walk, creating seismic waves and other activities. Visitors to NSF's corner also climbed into a Doppler on Wheels tornado-chasing vehicle, watched a glass-walking performance and viewed a sound-and-light show. The **Spelbots** team from Spelman College captivated audiences with humanoid robots that kick a soccer ball, dance and respond to touch.



NSF exhibit at the 2012 Science & Engineering Festival. Credit: NSF

NSF Fellow Helps NYC Robotics Team Take First Place

High-school students from the It Takes a Village Academy in Flatbush, N.Y., may have the



Academy students celebrate their win. *Credit: Adriana Groisman, FIRST*

fastest, most agile 'bot in New York City. The teens--many of them recent Haitian immigrants who survived 2010's devastating earthquake--teamed up with graduate student Zachary Nishino to take first place in the New York City FIRST® Tech Challenge. Nishino, a teaching fellow in NSF's **GK-12 program**, helped his team beat 63 others with a strong, maneuverable robot that proved to be the quickest to unload batons.

Read an NSF highlight on **NSF Fellows Help Brooklyn Robotics Team Win Challenge**.



*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. Its Fiscal Year 2012 budget is \$7.0 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. Each year, NSF receives more than 50,000 competitive requests for funding, and makes about 11,000 new funding awards. Contact NSF's **Office of Legislative and Public Affairs** for more information or for permission to reuse newsletter images. Editor: Amber Jones.*



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