

Teaching our teachers  
Improving STEM  
in schools

STEM to STEAM  
Incorporating  
the arts

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**MEDIA  
PLANET**

June 2012

# STEM EDUCATION



**3**  
FACTS  
ABOUT U.S.  
STEM CAREER  
OPPORTUNITIES



## PATHWAYS TO OPPORTUNITY

**Discover why** investments in our nation's science, technology, engineering, and math disciplines were a top priority at the 2012 **Clinton Global Initiative America meeting**

PHOTO: ADAM SCHULTZ/CLINTON GLOBAL INITIATIVE



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## CHALLENGES

As the economy continues to slowly recover, investment in education becomes even more crucial to sustaining **long-term economic prosperity.**



## Reigniting STEM education

**O**ur students continue falling behind their international counterparts. Statistics don't lie.

■ **U.S. students lag behind** students in Asia and Europe in mathematics and science.

■ **International test scores show** that in science U.S. eighth-graders were outperformed by eighth-grade students in eight countries.

■ **In math, U.S. eighth-graders** were outperformed by their peers in 14 countries.

**The STEM solution**

What's the solution? We as a nation need to make science, technology, engineering and mathematics (STEM) education a top priority. STEM education is the preparation of students in competencies and skills in the four disciplines. A successful STEM education provides students with these four subjects in sequences that build upon each

other and can be used with real-world applications.

**Jobs of the future**

Most jobs of the future will require a basic understanding of math and science; 10-year employment projections by the U.S. Department of Labor show that of the 20 fastest growing occupations projected for 2014, 15 of them require significant mathematics or science preparation. National PTA recognizes the need for U.S. students to do better and expand STEM education and career opportunities to underrepresented groups, including women.

National PTA recently teamed up with FIRST Robotics so that all families can get excited about these four subjects. More than 300,000 children and young people participated in the FIRST Robotics competition which gets students involved in STEM through practical applications of what they learn.

**STEM advocacy**

Through publications, activities, and family educational program-

ming, PTA provides a forum for informing parents of issues relating to STEM education, including resources available at [pta.org](http://pta.org). State PTAs across the country actively work to inform parents about STEM education.

California PTA recently passed a resolution supporting the STEM education movement and provided a comprehensive workshop, in English and Spanish, at its convention about why STEM education is critical. In addition, California PTA's Education Commission is participating in the Sacramento State Superintendent of Educa-



**Betsy Landers**  
National PTA President

tion's STEM Taskforce.

Delaware PTA is working with the state's STEM Council to educate parents about STEM through statewide workshops and with the University of Delaware to conduct town hall meetings.

The Connecticut Parent Teacher Student Association works with the Connecticut Center for Advanced Technology on CONNverge — a statewide, grassroots initiative that engages students in mathematics and science and helps them understand why STEM education is important.

In tight budget times, even local PTAs can help provide financial assistance with STEM initiatives and learning tools. It is clear that making STEM education a priority is important, for our nation's short and long-term future. We urge families to help promote the importance of STEM in individual student success and long-term economic prosperity.

**BETSY LANDERS**

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## WE RECOMMEND



**Jennifer Eigenbrode, Ph.D.**  
NASA Goddard Space Flight Center Space Scientist, Planetary Environments Laboratory

PAGE 6

"It's the people and experiences in our life that make it rich. A STEM career can nourish both."

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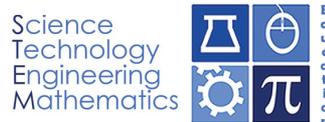
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A CEO-led national coalition committed to improving science, technology, engineering, and mathematics learning through philanthropy, advocacy, and inspiration.

[www.changetheequation.org](http://www.changetheequation.org)



The Department of STEM Education at the University of Kentucky offers innovative and flexible undergraduate and graduate programs and research opportunities. Check out our latest offerings, from project-based instruction to the See Blue™ Mathematics Clinic, at <http://education.uky.edu/STEM>



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# Adding STEAM to STEM

**Question:** Can the arts help to prepare students for the careers of tomorrow?

**Answer:** Yes, in addition to STEM education, the arts are being incorporated into STEAM programs.

STEM has been instrumental in pushing America to the forefront of better preparing children for the careers in the new information economy. But a piece of the puzzle has been missing—the addition of the arts.

## Creativity unlocks thinking

Incorporating the arts in what is called STEAM makes subjects easier to grasp for some students—especially those defined as possessing a level of creativity. Indeed, the arts have earned a role in developing coursework to move the U.S. back to the lead in areas such as



**COLLABORATION** Participants at the CGI America 2012 meeting work together to create innovative solutions in STEM.  
PHOTO: PAUL MORSE/CLINTON GLOBAL INITIATIVE

math achievement, science education and innovation. With arts in the mix, art and art based training can help young people understand the way the world works. Some educators even call adding the arts the “magic” that can happen when creativity is injected into STEM.

Recently, the National Education Association proved it believes in STEAM when it announced its grant agenda for the next six months in art and science that earmarks monies for projects incorporating the arts. According to Bill O’Brian, senior adviser for Innovation programs at the

NEA, these efforts are expected to continue and that the government community of artist and scientist agree these are smart projects to fund. A paper issued last year by the National Science Teachers Association (NSTA), called “Reaching Students Through STEM and the Arts,” stated, “Teachers of science, technology, engineering, and mathematics (STEM) are discovering that by adding an ‘A’—the arts—to STEM, learning will pick up STEAM.”

## Corporate support

AutoDesk, the 3D design software firm best known for AutoCAD, has long discovered the arts can be injected into its very scientific world. There’s a STEAM Workshop zeroing in on technology in the classroom and a curriculum development displaying why art must be a component in STEM.

STEAM was also a major focus at this year’s CGI America meeting, a premier gathering of hundreds of business, nonprofit and government leaders to commit to take action to solve some of our country’s most pressing problems, held June 7-8 in Chicago. The phrase “Put an ‘A’ in STEM and you have ‘STEAM’” took shape in actual commitments made at the meeting. For example, Time Warner Cable and 826 National are partnering to bring science into after school creative writing programs around the country. Thanks to several commitments made at the CGI American meeting, President Clinton stated that nearly 150,000 students will gain access to STEM education opportunities.

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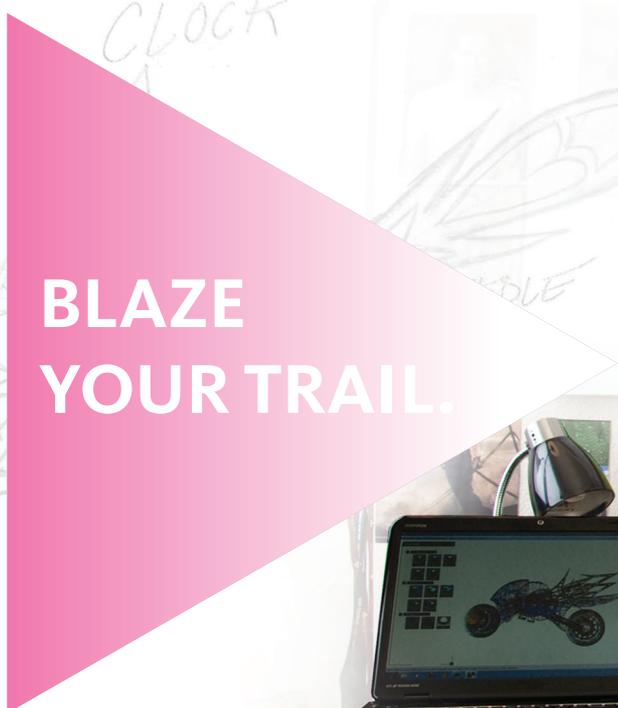
## NEWS IN BRIEF

### Talk centers on STEM education at Clinton Global Initiative

The consensus at this year’s CGI America was that we have to improve STEM education in the U.S. in order to compete in the 21st century economy. The conclusion that kept coming to the surface and was summed up in the closing plenary was – “we need more inspiration.” There is a strong desire to engage students in the excitement of discovery, in the everyday experience of science and math, and in the thrill of the possibilities that math and science hold for us an individual’s, for our country and for the planet. As President Clinton puts it, the goal is to put these “ideas into action.”

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## INSPIRATION



## QUESTION &amp; ANSWER



**Edie Fraser**  
CEO,  
STEMconnector

### ■ What role does STEM education play in driving our economy forward?

→ STEM means everything to our U.S. economy and our national intelligence and leadership. We have 3.7 million jobs with openings now that demand STEM skills. There just is not enough supply in computer science and in engineering and other areas. Fill the supply demand gap! Engage HR folks to work on what jobs are needed, and link with education folks. Offer mentorships and internships. We will advance our U.S. economy if we fill existing demand.

### ■ Why is it an ideal time to pursue a STEM career?

→ STEM equals jobs. It's easy to pursue careers now as the jobs are demanding, whether in health IT, food technology or mobile applications. Jobs are in every sector. Careers are strong in STEM—from large companies and organizations, to entrepreneurs. Women and minorities can step up to the new opportunities.

**EDIE FRASER**

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The high rate of unemployment among recent college graduates has become a national source of angst. **Yet for STEM graduates, the outlook is considerably rosier.**



# A positive outlook for STEM job growth

**According to the U.S. Bureau of Statistics, in the next five years STEM jobs are expected to grow 21.4 percent, compared with 10.4 percent overall job growth.**

Fifteen of the 20 fastest growing fields are going to be in STEM areas in the next several years — although only 16 percent of bachelor's degrees will be given out in these fields.

### Diverse talent

According to Dr. Bev Watford, Associate Dean Academic Affairs, College of Engineering, Virginia Tech, one of the main challenges in getting students to persist beyond the first year of STEM education is convincing them that there is real-world application for the skills they are acquiring. There is also the issue of diversity.

Robert Simpson, Provost of Kettering University in Flint, Michigan, agrees that STEM diversity is critical. He says, "Diversity and inclusion facilitate innovation and creativity, making STEM learning

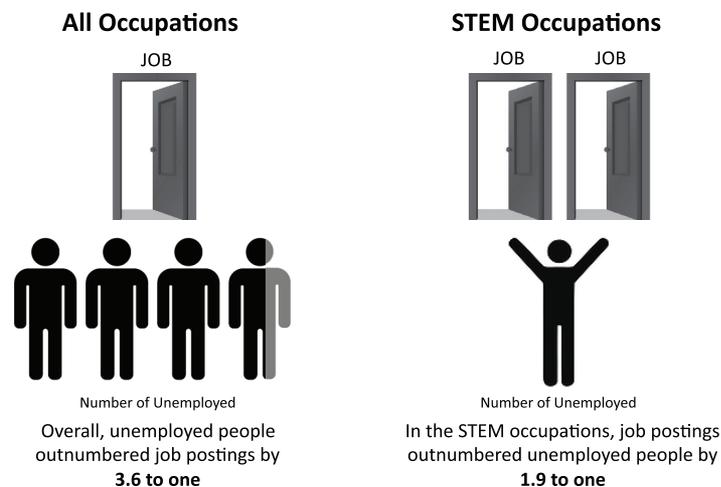
and work environments richer and more engaging than they otherwise would be."

In the late 1980's, Dr. Watford

discovered that the National Science Foundation was funding programs to bolster high school students' interest in STEM. "That

was a wake-up call," she says. "I knew that what I wanted to do was mentor and encourage students—especially women and underrepresented minorities—to pursue STEM-based education and persist to develop careers."

## STEM OPENS DOORS



If you were unemployed in the past three years, you probably faced stiff odds. On average, unemployed people outnumbered online job postings by well more than three to one. Yet if you have a strong background in science, technology, engineering or math (STEM), your odds may have been very different. Across the STEM fields, job postings outnumbered unemployed people by almost two to one.

SOURCE: CHANGE THE EQUATION VITAL SIGNS REPORT, "STEM HELP WANTED"

### Support and success

There are several factors that drive success. First, administrative and faculty support is critical. Also, Dr. Watford suggests that corporate and industry support is absolutely necessary, as is having an inclusive STEM culture with a positive identity. Provost Smith notes that for Kettering, it is important to build a pipeline of highly capable high school students before college.

Dr. Watford says, "We focus on creating a positive identity. We collaborate with industry. Students are interested in innovation and entrepreneurship. We are showing them that by mastering STEM, they can solve the big problems."

**NICOLE GRAY**

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Inventing the next generation  
of scientists and engineers.



## INSPIRATION

# AN OPEN INVITATION FOR HIGH SCHOOL STUDENTS TO 'GET THEIR GENIUS ON'

**Question:** How can we achieve global sustainability through education and innovation?

**Answer:** By inspiring students to engage in STEM careers so that they can help change and improve the world around them.

**During his teen years, a prestigious high school expelled Pete because he had difficulty reading and spelling.**

At that time, dyslexia was not recognized. In a new school, a perceptive headmaster saw Pete's spark of genius and gave him the confidence he needed. Pete went on to earn a scholarship to Princeton University and a ride to the Moon as Commander of Apollo 12.

In November 1969, he became the third man to walk on the Moon. After many years as an explorer, Pete's entrepreneurial spirit took flight. He founded four companies dedicated to the commercialization of space travel. Why? So that one day all of us might have the chance to leave the Earth's atmosphere.

## In loving memory

Unfortunately, Pete's pursuit was cut short with his passing in 1999. However, his legacy continues through Nancy Conrad, the wife of late astronaut Pete Conrad, who founded the Conrad Foundation in the memory of her husband. The Conrad Foundation honors the legacy of Apollo 12 astronaut, Charles "Pete" Conrad, and his four-decade pursuit of innovation and



**A LIVING LEGACY** Peter Conrad's legacy goes beyond the stars and the moon — his mission inspires generations to come.

PHOTO: CONRAD FOUNDATION

"It is important to leave a great country for our children. It may be even more important to leave great children for our country."

NANCY CONRAD

entrepreneurship. His story is nothing short of inspirational. The Conrad Foundation's programs combine innovation and entrepreneurship to transform education worldwide.

## Engaging students

The Conrad Foundation's Spirit of Innovation Challenge invites teams of high school students and their coaches (teachers, parents) to Get Their Genius On, during its annual competition. Using science, technology, engineering and math

skills, teams develop innovative products to help solve global and local problems to support global sustainability. As part of the program, the Conrad Challenge matches participants with world-renowned scientists, engineers and entrepreneurs as mentors to assist with advanced academic and business principles.

## How it works

Student teams compete for awards and recognition, including a chance to attend the annual Innovation Summit where they will present their products and vie for seed grants, patent support and commercial opportunities.

The Conrad Challenge is free and available to students from all socioeconomic levels. The Spirit of Innovation Challenge gives teachers an exciting and dynamic way to teach STEM by providing a way for teachers to give context to content. This program engages students to go beyond the textbook and truly understand how what they are learning can be applied to something with large-scale social impact. The Spirit of Innovation Challenge is not just a program, it is a movement to support the next generation with skill sets to drive the economy of tomorrow.

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## 3

### TIPS FOR ENGAGING WOMEN AND GIRLS IN STEM

**1** Teach girls that curiosity is a good thing! Every time they learn something new, their brain forms new connections and they become smarter.

**2** Praise girls for their effort rather than their intelligence. Love of hard work, love of a good challenge and the ability to learn from mistakes are at the heart of all scientific contributions.

**3** Girls tend to skew lower on spatial skills than boys, so encourage girls to play with construction toys (found in the "boys" aisle) to help them become more confident engineers, architects and builders.

**SOURCE: WHY SO FEW? WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (AAUW 2010)**

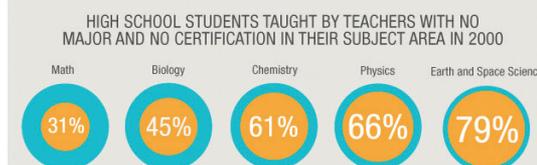
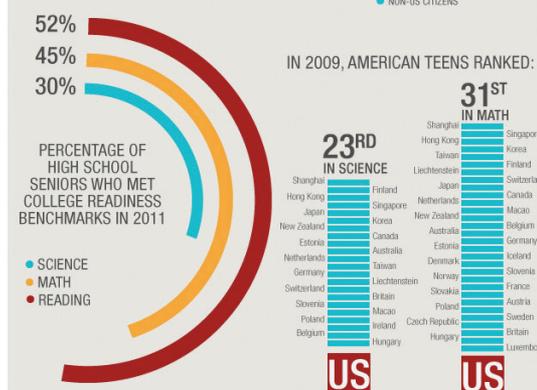
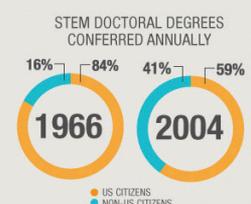
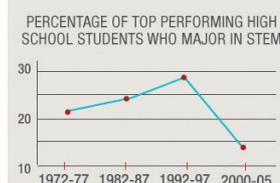
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## american STEM EDUCATION

SCIENCE • TECHNOLOGY • ENGINEERING • MATH

Reinvigorating interest in STEM subjects has been on the national agenda since the publication of "A Nation at Risk" in 1983. Falling achievement in STEM subjects across all levels of education has prevented the United States from upholding our status as the global technological powerhouse we were during the mid-20th century. The current demand of STEM jobs in America greatly outweighs the supply of capable workers, and it is up to our generation of teachers and students to close that gap before the U.S. can no longer compete with other innovators around the world.

The Soviet Union successfully launched Sputnik 1 on **OCTOBER 4th, 1957**  
This launch led directly to the creation of NASA in July 1958, when Congress passed the National Aeronautics and Space Act, and sparked interest in STEM subjects across America.



"The federal government should promote the creation of at least 200 new highly STEM-focused high schools and 800 STEM-focused elementary and middle schools over the next decade."

The Council of Advisors on Science and Technology, 2010



"We want to prepare 100,000 new teachers in the fields of science and technology and engineering and math. In fact, to every young person listening tonight who's contemplating their career choice: **If you want to make a difference in the life of our nation, if you want to make a difference in the life of a child, become a teacher. Your country needs you.**"

President Obama, 2011 State of the Union Address

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sources: nsf.gov | cpst.org | nasa.gov | usatoday.com | nces.ed.gov | nrcg.org | act.org | whitehouse.gov | neta.org | rutgers.edu

## INSIGHT



## QUESTION &amp; ANSWER



**Keith J. Peden**  
Senior Vice President,  
Human Resources  
and Security,  
Raytheon Company

■ **What role does STEM education play in driving our economy forward?**

➔ International testing data shows U.S. students lag behind their global peers in math and science, which are the academic cornerstones of engineering and technical innovation. According to the Department of Commerce, STEM job growth is outpacing non-STEM job growth by more than 300 percent. While this presents a great economic opportunity, it is also a unique educational challenge, as ACT data shows only 17 percent of U.S. 12th grade students are proficient in math and interested in STEM. The rankings are a concern for students, our economy and our national security.

■ **Why is it an ideal time to pursue a STEM career?**

➔ Our nation ranks 23rd among developed nations in the number of science and engineering graduates despite tremendous growth in the STEM job sector. In fact, by 2014, the U.S. government projected 2.5 million new jobs will be created in STEM fields, where annual salaries average \$77,000 compared to an average annual salary of \$43,000 for non-STEM jobs. Who wouldn't want to enter a creative field that's rife with opportunity and financial reward?

KEITH J. PEDEN  
editorial@mediaplanet.com



**Question 1:**  
What's the biggest hurdle you've faced in your career?

**Question 2:**  
What message do you have for other women who are considering a career in STEM?

**Annette Moore**

NASA Johnson Space Center,  
Information Resources Directorate,  
Deputy Director/Deputy Chief  
Information Officer



**While working at NASA Headquarters,** I had a less than positive experience as a result of one individual's misconception of my capabilities and worth. The worst experience in my career opened many doors for me. I now understand that every experience in life provides opportunities to learn and grow.

**Your insight, perspective, creativity, and ability to build** and nurture relationships provide the basic tenants of what is needed to achieve the next level in STEM. Women have an amazing ability sparked by their natural intuitiveness which allows them to push and redefine the boundaries. This is exactly what is needed.

**Jennifer Eigenbrode, Ph.D.**

NASA Goddard Space Flight Center,  
Space Scientist, Planetary Environments  
Laboratory



**Life recently threw a major curveball** at me that I wasn't expecting — I developed a hidden disability in which I have significant allergic reactions to chemicals off-gassing from most office, cleaning, and personal hygiene products. Needless to say, my activities are much more restricted, but I have managed to keep my career rolling forward with the help of others at NASA and at home.

**It's the people and experiences** in our life that make it rich. A STEM career can nourish both. The biggest rewards usually come when we dare to be creative — think out of the box, accept challenges, and strive to understand others. Above all, never take to heart an opinion of someone who judges you based on who you are or what you look like. It's what we do that matters.

## Closing the gap: Professional development

**The need to further develop STEM education stretches beyond improving math and science scores of American students; it is a matter of national security and a cornerstone for America's economic development.**

"Many of the nation's governors see STEM as essential to the economic future of their states," said Arthur Levine, president of The Woodrow Wilson National Fellowship Foundation, which recruits accomplished career changers and college graduates in science, technology, engineering, and mathematics to prepare for math and science teaching positions in national schools.

**STEM teacher shortage**  
Woodrow names fellows in three

states with a fourth to come soon. The goal is ultimately to involve eight states across the country. In our information economy, math, science, and technology trained employees are essential to staff today's fastest growing industries and replace dying industrial era businesses.

Still, there aren't enough science and math teachers graduating from universities. There's also a dearth of STEM teachers in urban and rural markets. "We are working to turn that around," said Levine. Woodrow Wilson recruits high ability people who commit to teaching for three years in high need schools. They receive a \$30,000 stipend to attend a graduate teacher education program and their progress is closely monitored and measured.

**Creating new jobs**

According to international testing data, U.S. students fall behind global peers in math and science, but Raytheon is doing its part to reverse this trend. "According to the Department of Commerce, STEM job growth is outpacing non-STEM job growth by over 300 percent. This presents a great economic opportunity, but a unique educational challenge, as ACT data shows only 17 percent of U.S. 12th-grade students are proficient in math and interested in STEM," said Keith Peden SVP Human Resources at Raytheon.

He added that, by 2014, the U.S. government projected 2.5 million new jobs will be created in STEM fields, where annual salaries average \$77,000 compared to an average annual sal-

ary of \$43,000 for non-STEM jobs. "Who wouldn't want to enter a creative field that's rife with opportunity and financial reward?" he added.

Raytheon engages students through its MathMovesU program, which aims to increase students' interest in math and science education through hands-on, interactive activities. "As good corporate citizens, we all need to support the work of teachers as a critical component of our collective prosperity," Peden said.



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# STEM EDUCATION

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