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STEM

## How to Educate for America's Future

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## A New National Education Imperative

The trends that prove American students can ensure future economic prosperity.

**E**very day in the United States, people go to work. And everyday, more and more of that work – whether it is white-collar, blue-collar, or no-collar – requires that the Americans performing it possess an expertise in science, technology, engineering and mathematics.

Over the next decade, STEM-related job opportunities in the U.S. are expected to [increase by nearly 17 percent](#), according to the non-profit coalition STEM Advan-

tage. In a country with an unemployment rate that remains [over seven percent](#), increasing the number of workers with STEM skills and education could provide a real boost, putting more Americans back to work in both the public and private sectors, increasing incomes and strengthening the American economy.

### **STEM As Stimulus**

Of the [approximately 136 million jobs](#) currently filled in America, a [growing number of them](#) – 14.9 million as of 2012, with 20.6% growth projected through 2018 – require STEM education. But these jobs don't belong exclusively to PhDs with white coats in laboratories. In fact, jobs that require workers to possess technical engineering skills, but not necessarily a bachelor's degree – occupations such as mechanics, carpenters and electricians – are available to Americans with technical training, whether they are college-educated or not.

With such a wide application of these technical skills, the nationwide job market for STEM skills provides fertile terrain for job applicants of all backgrounds. The skills necessary to take advantage of these available jobs are standardized across the country, and “do not differ from state to state,” according to Michael Cohen, President of [Achieve](#) – an independent, bipartisan, non-profit organization that advises states on a variety of academic matters.

### **Serving Through STEM**

But STEM skills aren't limited to the private sector, with opportunities for public service jobs available in every metropolitan area across the country.

In a [recent interview](#), Lt. Gen. Thomas P. Bostick, Commander of the U.S. Army Corps of Engineers, explained that the Corps – which employs more than 36,000 civilian employees worldwide – needs more STEM-skilled workers. The United States “must ensure there is a pipeline of students engaged in STEM and pre-

pared for careers in engineering, the natural sciences, and research and development,” Cmdr. Bostick said.

### **Efforts to Expand Education Are Working**

Meanwhile, the promotion of STEM subjects in classrooms from preschool to universities is already showing positive results. The National Assessment of Educational Progress reports that the amount of low-income fourth graders who were performing at or above basic levels in math [grew by 27 percent](#) in the 10 years between 2000 and 2009. Organizations, such as Project Lead The Way, Techbridge, and Achieve, are part of a national movement to encourage STEM education by establishing new curriculums, working closely to support girls and minority students, and setting new standards of achievement.

“There is lots of interest in figuring out how to establish rigorous STEM curricular pathways that will start when students are in high school and provide them an engaging pathway,” Cohen said, adding that the adoption of such changes across the country is “actually happening a bit faster than we anticipated it might.”

### **Bolstering Paychecks At Home**

American workers who possess and utilize STEM skills also make more money. Georgetown University researchers [found](#) that 8 of the top 10 college majors in terms of income were in STEM fields such as petroleum, aerospace, chemical and mechanical engineering. Additionally, the U.S. Department of Commerce Economics and Statistics Administration has discovered that employees in STEM jobs consistently earn a wage premium of up to 26 percent more than workers in non-STEM positions, a trend that has been steady over time.

### **Ensuring Broad Economic Strength**

Beyond STEM’s impact on individuals, researchers from Harvard University

discovered something that could significantly alter the future of the American economy. In a 2011 study, they found that by enhancing American students' proficiency in mathematics to the levels achieved in countries like Canada and South Korea, the United States could increase annual national income projections by 75 trillion dollars over the next 80 years.

The potential for such growth is leading states to invest heavily in STEM education initiatives. For example, the state of Connecticut recently [invested](#) \$1.8 billion in new and updated facilities at its state university in order to ensure it could meet the projected needs of the next generation of STEM students.

“There is very clearly an understanding in state government about the importance of STEM education,” Cohen said. “They all understand the very tight connection between the education level of the workforce and economic growth and development.”



# The Innovators Who Are Transforming U.S. Education

Dedicated entrepreneurs are getting American students excited about science and math.

**T**he new global economy demands a robust workforce, flush with technical know-how.

Unfortunately, education in the United States of America has been failing to meet this need. [According to](#) the U.S. Department of Education, American students rank 17th in science and 25th in mathematics among industrialized nations. Despite encouraging signs that lucrative STEM jobs will be greater in number and

more accessible than ever in the near future, a [national Microsoft survey](#) concluded that only 49 percent of American parents of K–12 students believe STEM education is being treated like a top educational priority.

To combat this underachievement, organizational and individual entrepreneurs are changing this status quo with ideas that are shifting the way our country educates its children in the fields of science, technology, engineering and mathematics.

Consider Vince Bertram, who was a high school principal who understood the state of STEM education in American classrooms and decided to do something about it. In 2001 and 2002, Bertram implemented the [Project Lead The Way](#) program in his Lafayette, Indiana high school.

“What we were really focused on was that we had a high percentage of our kids dropping out of school [because] students didn’t have the skills and knowledge to be successful after high school,” Bertram said. “When Project Lead The Way was implemented, we just saw a transformation of our school.”

Now, Bertram serves as the organization’s President and CEO. Project Lead The Way prepares American students to participate in the global economy by providing middle and high schools across the country with rigorous [STEM education curriculums](#). PLTW’s curriculums are created jointly by teachers, university educators, engineering professionals and school administrators. This ensures that students have access to the equipment, methodology and hands-on experiences that prepare them for continued learning.

“It fundamentally changes the classroom,” Bertram shares. “It’s not a teacher and a lecture as a disseminator of information; rather, it’s the teacher as a coach, a facilitator encouraging students.”

It's working. In more than 4,700 schools in all 50 states and the District of Columbia, Project Lead The Way is [helping students perform better](#), preparing them for both college and careers, and narrowing the achievement gap. By training both students and teachers, PLTW helps ensure there is a strong pipeline of STEM-educated students waiting to fill the jobs of the future by focusing on the teaching of real-world skills that are necessary for any occupation.

“What we really teach are problem solving, critical thinking, leadership and collaboration skills,” Bertram explains. “Those are the skills that we want students to acquire, so that they can apply those skills across any discipline, any career they choose.”

In much the same way, Linda Kekelis of [Techbridge](#) is bringing much-needed STEM education to a subset of the American student body – girls.

“We saw that there were so many opportunities for kids in our area,” explained Kekelis. “But knew that most of our students wouldn't be finding their ways to those opportunities – not because they couldn't, or they weren't smart enough, but [because] they didn't have opportunities or expectations or didn't know about options like that.”

While women consist of 48 percent of workers in all occupations, they only [represent](#) 23 percent of STEM workers in the United States. Dr. Kekelis, an expert in gender equity and teacher training, has helped Techbridge to provide 4,000 girls in grades 5-12 with after-school and summer programs, as well as the support networks to maintain their interest in pursuing science and math as a career path. What began as a single program at the Chabot Space & Science Center in Oakland, CA in 1999 is now a citywide movement, based in mentorship, to get



young girls interested in pursuing science and mathematics for the rest of their lives.

“We heard from our students that they wanted to make the world a better place, and they didn’t see how technology or engineering was compatible with that,” Kekelis said. “We started to introduce our girls to role models who could showcase career options in STEM.”

Much like her colleague in Oakland, Dr. Cordelia Ontiveros, Associate Dean of the College of Engineering at California State Polytechnic University, Pomona, has spent her career bringing STEM education to underrepresented students.

“We’ve been very successful working with our local schools and our local teachers to encourage additional numbers of Hispanic students to pursue a degree in engineering,” Ontiveros shares, adding that the number of female Hispanic freshmen at Pomona has doubled in the last two years.

Dr. Ontiveros also engages with the next generation of engineering students [through comprehensive outreach](#), including to schools that have implemented Project Lead The Way curriculums. About 100 of the 3,000 teachers trained to teach Project Lead The Way programs come from Pomona every year. Having worked with some of the largest engineering firms in the world, Dr. Ontiveros knows full well the value of a diversified engineering pipeline – and why enhancing the pipeline now will produce tangible benefits well into the future.

“There are a lot of possibilities out there for [students], Ontiveros said. “Science, technology, engineering and math are all pathways where they can help improve the world around us, make an impact on the economy, and have a very rewarding career and a very rewarding life.”

These innovators show the growth potential for American education, and ensure that American students have every door open to them as they prepare to fill the jobs that will move the country forward.



# Securing Economic Strength Through Education

A spirit of collaboration across organizations is producing significant achievements.

In the study of American progress, you consistently find a trail of teamwork. The modern approach to fulfilling the United States' long-term economic needs is no exception, as a coalition advancing knowledge in science, technology, engineering and math is proving.

This network of governmental, commercial, educational, and research organizations is vital to the [“acceleration of scientific and technological innovations”](#) that

will secure the health and longevity of the economy -- and, consequently, the American economy, said Ross DeVol, Chief Research Officer at the Milken Institute, an independent economic think tank. The United States “must utilize the knowledge assets in their possession such as universities, research centers, and most importantly, the talent that they create or attract to fuel economic growth,” DeVol said.

Companies like Chevron recognize the important role that a [robust American STEM-skilled workforce](#) will play in the increasingly competitive global marketplace – and they’re using partnerships with schools and nonprofits to make it happen. Blair Blackwell, the Manager of Education and Corporate Programs at Chevron, explained that building educational networks is an important part of the company’s greater strategy.

“On a daily basis in our business, we have to collaborate across a number of different functions to implement projects of great scale and complexity,” said Blackwell. “In many ways, we bring that same approach to our social investments in education. We recognize that expertise and resources are needed from a variety of different partners to make STEM education reform a success.”

Chevron’s measured, long-term investment in American STEM education reflects that commitment. The company has devoted [nearly \\$100 million](#) to support education initiatives over the past three years. But while massive financial investment is important to facilitate the process, it is the partnership these investments foster -- relationships that enable hundreds of thousands of students, thousands of teachers, and dozens of nonprofit organizations and practitioners to connect with one another -- that Blackwell believes is what really makes a positive impact.

“We engage in a number of ways and have moved far beyond just writing a check,” explains Blackwell. “We also bring to bear our knowledge of workforce needs and our employees regularly act as mentors to students.”

The encouragement of partnerships between a wide variety of organizations will, over the long term, help build large pools of indigenous engineering talent. Edie Fraser, the CEO of STEMConnector, is one of the people who make these types of connections possible. Less than two years ago, Fraser took on the herculean task of finding a new way of connecting the thousands of people, organizations and companies that have a vested interest in advancing STEM with each other -- and has largely succeeded, especially when it comes to the business world.

“The demand side is where we’ve got to build the action,” said Fraser. “The jobs are in STEM – what’s so exciting now is to see the companies step up in their communities and collaborate.”

STEMConnector is an organization headquartered in Washington, D.C. that supplies corporations and other organizations with the information they need to strategically invest in STEM initiatives. The organization works with [more than 6,500 business, research and education stakeholders](#) to disseminate data through networking events, newsletters, research reports and several other products. The key, Fraser says, is ensuring that the pipeline of STEM talent is “moving it up and making sure it is geared to careers.”

At California State Polytechnic University, Pomona, such focus on building bridges that connect education to careers is working. Cal Poly Pomona houses one of the largest colleges of engineering in the United States. Cal Poly Pomona, which, according to U.S. News and World Report, graduates about [1 of every 14 engineers](#) in the state of California, would not be quite as prominent if it was not bol-

stered through partnerships on all sides. To achieve such success, Associate Dean of the College of Engineering Dr. Cordelia Ontiveros works with other schools and organizations to secure a strong pipeline of STEM students, molding them into the STEM workers who will continue the American tradition of innovation. Dr. Ontiveros calls the philosophy of her university and organizations that develop interest in science and math [like Project Lead The Way](#) “perfectly aligned.”

“We think it’s a great framework for making a lot of progress,” Ontiveros said.

That need for progress has never been stronger, according to Blackwell, who has worked on social investment projects on multiple continents. “As you go out and travel the world, you find that other countries are innovating,” she said. “If we don’t continue to invest in education and invest in ensuring our students are ready to move from the education system into employment, then we’re simply going to fall behind.”

“Everybody gets that education leads to employment which leads to economic development,” she said.