SMART REPORT
on STEM

CREATING *Pathways* FOR ALL

PROMISING PRACTICES
Ideas for creating an inclusive STEM workforce

SmartBrief

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SAVE THE DATE

Mark your calendars for SmartBrief Education's 3rd annual STEM Pathways Panel Series event on Thursday, October 20, 2016. Join us at the historic Carriage House in Washington, DC as we bring together top STEM specialists and experts from industry and education for a high-powered, interactive daylong event. We'll explore real-world ways to address the issue of students' STEM skills gaps and guide them toward careers in STEM fields. Speakers and program content to be announced soon. **Check our Education events page for the latest updates.**

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Tech Is Tech, but Teachers Are Artists

By Tanner Higgin, PhD

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From an app to an overhead projector, from a paperweight to a pencil, any tool is tech. But that's not how everyone sees it. In the hypercompetitive, boom-or-bust, move-fast world of edtech evangelism and the start-up culture in which it's embedded, tech is *now*, and apps are the great equalizers. Each new tool changes everything. All apps solve some long-lingering problem.

The problem is that if you're a teacher or an administrator looking to make a purchase for your school or district, it's tough to separate signal from noise or substance from sales pitch. You can talk to colleagues, but they're just way too busy to find everything and give it a good look. There's Google, of course, and the various app stores and aggregators, but how do you make sense of tens of thousands to millions of results influenced by just about everything *but* what works best for teachers?

This is the main problem we built **Common Sense Graphite** to solve: sorting through learning technology and evaluating the best of the best. We're a nonprofit, we're completely free to use with no biases or strings attached, and most of the editorial staff has spent time in classrooms (or still is in them!). We pride ourselves on offering some refreshing real talk and a trustworthy take.

It's been over two years now, and we have nearly 2,500 ratings and reviews of apps, games, and websites aligned to standards, including Next Generation Science Standards, where appropriate. We also have a couple hundred best-of lists curated and updated by our editors, including several on **STEM** and **STEAM**.
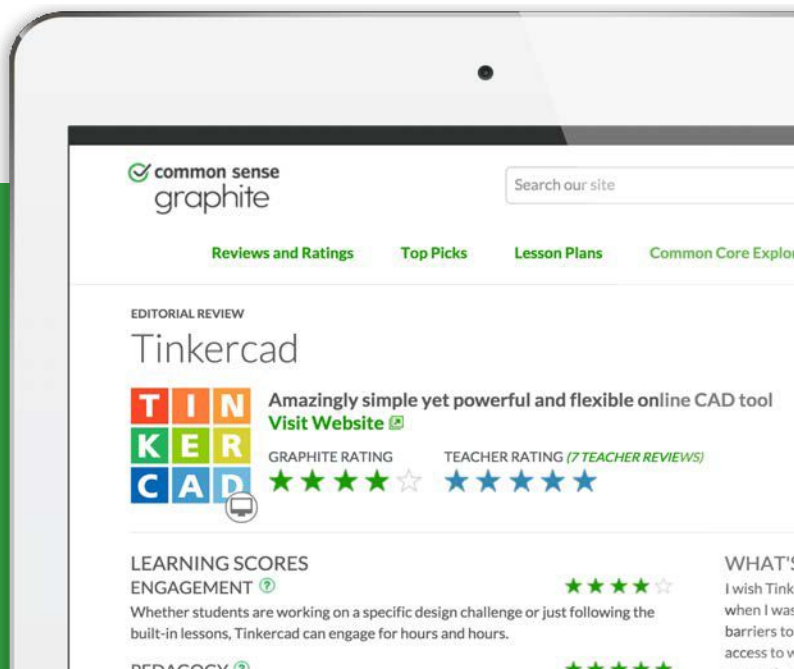
In addition to our editorial reviews, we have nearly 10,000 teacher reviews of products. Plus, teachers can take tools they've found on Graphite or resources they've found elsewhere, and use our lesson-plan-creation tool to share their best practices and activities with others. When you look at the over 2,000 lessons up on Graphite, it's clear: Teachers can make any tool great. They've been doing it with everything from Post-its to blackboards for decades.

Teachers are artists. They improvise, tinker, and create.

Teaching is too often thought of as a kind of science — that if you just get the right tool and teach in the right way, then you'll get the right result. But teachers aren't scientists or technicians (well, maybe some of them are!). Teachers are artists. They improvise, tinker, and create. They make experiences that change how students see the world. Art isn't exact; it's messy and weird. It doesn't always go as planned, and not everyone gets it.

This is why we believe no one tool will transform a classroom; transformation happens through teaching. But technology, in the hands of artists, can enhance student learning. Hopefully this message comes across in everything we do at Graphite, where we feel it's our job to make teachers' jobs a little easier.

Visit Common Sense Graphite today: www.graphite.org.

Tanner Higgin is Senior Manager of Education Content for Common Sense Graphite.

READY

MIDDLE-SCHOOL SCIENCE

MELISSA GREENWOOD
Senior Editor, Education

VISCOSITY: the state of being thick, sticky and semi-fluid in consistency because of internal friction. I've carried this eighth-grade science term with me since middle school, thanks to my teacher's connecting it to changing oil in a car. And in my family, everyone learned how to perform that task, even the youngest. So the comparison had a real-world application in my life.

And here's another:

Supersaturated substance: A substance that contains more of the dissolved material than could be dissolved by the solvent under normal circumstances. In a supersaturated substance, not all the solute will dissolve. Think about extra sugar swirling around the bottom of a pitcher of Kool-Aid. I drink more green tea than Kool-Aid these days, but I sometimes find myself saying things like: "Well, this cup of tea is a supersaturated substance."

The point is, relevance in science, technology, engineering and math matters, just as changing oil in a car was relevant to at least one middle-school girl. In our cover story, we highlight promising practices, such as building relevance into STEM education that experts say can help businesses, schools, associations and others create inclusive pathways to STEM careers.

Don't miss an in-depth feature in which maker educator Patrick Waters talks with students about makerspaces and how they can help teach workforce skills to students with neurological differences. We also highlight student voices in an article about real-world learning in STEM, featuring ideas from students at New Orleans Charter Science and Mathematics High School.

We hope you enjoy this SmartReport on STEM. You never know, you may find the content popping up in your real lives as I do with those middle-school science terms. So here's to a supersaturated reading experience! **SB**

Melissa Greenwood

Melissa Greenwood
Senior Editor, Education
Mgreenwood@smartbrief.com

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CHATTER

STEMSPIRATION
Experts share ideas for getting more students interested in STEM

ASK THESE THREE QUESTIONS. What questions get a student excited to do something in STEM? Consider these: How would you like to change the world today? Would you like to make something awesomely beautiful? Do you want to blow something up? If I can't get them with those three things, then I haven't done my job right. — *Patrick Waters,* maker educator

INVENTORY STUDENTS' INTERESTS. When I see students get really excited about STEM, it's usually focusing on a project that they have an interest in or that is exciting to them. It's important to first inventory kids about their interests. If you just present science projects in one particular field, you're losing a group of students that may have an interest somewhere else. — *Barb Gruber,* aerospace educator

CONNECT STEM TO SOCIAL JUSTICE. It's easy for women to understand that if I'm a doctor or a nurse, I can save lives; whereas if I'm a computer programmer, they may ask: What am I doing? There is a lack of connection between many STEM jobs and their impact on the world. The social-justice feature is such a big motivation for girls. If we can make those connections more obvious, we can get a lot more women involved in STEM. — *Sabari Raja,* Nepris

WANT MORE TIPS FROM OUR EXPERTS? **VISIT SMARTBRIEF EDUCATION'S YOUTUBE CHANNEL.**

WHAT'S TRENDING NOW?
Summaries of editorial coverage of STEM research and trends

WHICH SKILLS ARE KEY FOR THE WORKPLACE OF THE FUTURE? Culturally agile people skilled at communicating and interested in learning will thrive in the workplace of the future, some experts say. These professionals also must be adept at resolving conflict and comfortable with analyzing data, the experts note.

READ IT HERE: Fast Company online

REPORT: SKILLED WORKERS IN SHORT SUPPLY
Companies that distribute equipment for agricultural, construction, manufacturing and other sectors are struggling to find highly skilled workers, according to a report by the College of William and Mary. The report's overview suggests updating workforce policies to support those pursuing technical careers

READ IT HERE: Central Penn Business Journal

UNIVERSITY LAUNCHES CENTER TO ADDRESS DIVERSITY IN STEM Arizona State University has created a Center for Gender Equity in Science and Technology to conduct research and develop tools and best practices to support girls and women of color in science, technology, engineering and math. The center also will be home to CompuGirls, a program that collaborates with girls in grades 8 to 12 to solve real-world problems using technical skills.

READ IT HERE: T.H.E. Journal

STEM JOBS SPOTLIGHT: GEOSCIENTIST

Geoscientists study the physical aspects of the Earth, such as its composition, structure and processes, to learn about its past, present and future.

Sparked by the needs of such sectors as energy, environmental protection, and land and resource management, geoscientist jobs are projected to grow 10% between 2014 and 2024, faster than average for all occupations.

Working conditions offer a mix of office, laboratory and fieldwork. Fieldwork involves research and investigations outdoors and can involve irregular hours and travel to remote locations.

The median annual wage was $89,910 in May 2014. Want to be a geoscientist? Most jobs require at least a bachelor's degree.

Source: Bureau of Labor Statistics, 2016-17 Occupational Outlook Handbook: Geoscientists

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PROMISING
PRACTICES

Experts highlight ways to create a inclusive STEM workforce for all.

By Melissa Greenwood

TEM JOBS are expected to grow to more than 9 million between 2012 and 2022, an increase of about 1 million jobs over 2012 levels, according to the U.S. Bureau of Labor Statistics.

STEM skills also will be more in demand in non-STEM fields if past data trends hold true. In 2010, 16.5 million college-educated individuals working in non-STEM fields said their jobs required some level of training in science and engineering.

Research shows STEM will continue permeating many areas of the future world of work, and we hope the culture is one in which individuals — regardless of socioeconomics, gender, skin color or disability — have equal opportunities for success.

But there are roadblocks to participation for some groups, including minorities, women, individuals with disabilities, military veterans and individuals from lower socioeconomic backgrounds. The persistent underrepresentation of women, African Americans and individuals with disabilities in STEM has been well-documented.

SmartBrief Education gathered a group of experts for the Equity in STEM: Taking the Challenge to Build an Inclusive Workforce event to discuss ways to remove some of these roadblocks and build inclusive pathways to STEM careers. The panelists highlighted strategies to help bridge the gap among underrepresented populations, including girls and individuals with disabilities.

Promising best practices include increasing exposure to STEM careers and the world of work, focusing on relevance in STEM and teaching technical and social skills. On-the-ground action items include makerspaces and skill-based volunteering.

Keep reading for a deep dive into these—and other—ideas that businesses, educators and others can begin using today to help build the inclusive STEM workforce of tomorrow.

THE WORLD OF WORK

Women are underrepresented in science and engineering. What's more, in all racial and ethnic groups, more men than women work in science and engineering occupations.

"When you walk into a place and you see thousands of young people working and the majority of them are men, it becomes very clear that we really have a lot of work to do," said Kathy Hurley, author of "Real Women, Real Leaders" and co-founder of Girls Thinking Global.

Nepris CEO Sabari Raja agreed, recalling a former position as an engineer on a predominantly male team. "[T]he inclusiveness in the workforce — within the culture in a company ... matters. You don't want to feel left out," she said. "Many companies are doing a lot of things to address this, but that's something to keep in mind as well: It's not enough to get them there, but it's also important to keep them there."

There also is more to be done to boost inclusion of individuals with disabilities in STEM workplaces.

"Our workplaces really aren't set up for people with ... neurological differences to come in and be productive members," said Patrick Waters, an educator who teaches students with neurological differences at The Monarch School in Houston.

"We're not recognizing that they have special strengths and great innovative things to bring to our workforce and be a real economic driving factor," he said. But "they also have challenges, and we need to accept and accommodate those challenges to really integrate this population."

"We to have to set up a system that directly teaches ... soft skills, and we need a kind of a transition period and then recognize that transition period in their 20s to get them ready to enter the workforce at a full-time capacity."

1 TEACHING TECHNICAL AND SOCIAL SKILLS

Leadership, communications and analysis are some of the most valued skills in our economy, and 96 percent of all occupations require critical thinking and active listening, a Georgetown Public Policy Institute report shows.

"Work is not only a technical skill, especially in the STEM workplace," Waters said. "In reality, work is just as much a social world as it is a technical world. You can have all the technical skills you want, but if you're not a social creature, you're not going to last in the social workplace. You're not going to be able to work with other people, you're not going to be able to communicate with them."

Most typically developing individuals have had "a cultural experience that we've gone through; we've had other people just like us explain these cultural experiences, and we processed it in a certain way," Waters said. "For students and people with neurological differences, that hasn't happened."

"If we recognize that young people with neurological differences need that direct instruction and those soft skills, we can also give them the technical skills to go with it."

2 INCREASING EXPOSURE TO STEM

The modern world of work may seem like an elusive concept to some students. Those from low-income backgrounds and rural areas, for example, may have little exposure to the type of 21st-century STEM jobs projected for growth in the decades ahead.

"Many times, this world of workplace is such a big black box," Raja said. "They're making decisions without knowing what this world ... looks like. It's our job as teachers, as parents, as industry leaders to bring these experiences to the classroom."

Skills-based volunteering

Mentoring has its place among potential solutions to expose more students to STEM, but it may not be the best fit in terms of scalability for a large number of students and schools, Raja said. Instead, she suggests a skills-based volunteering program in which a variety of industry experts can share their stories in smaller increments of time with students.

"Not all professionals have the time to take on a mentoring relationship and work with one child for a long period of time," Raja said. "So we're losing a lot of professionals with great skills [who] can provide these inspirational moments because we're throwing everybody under the umbrella of mentoring."

> "WORK IS NOT ONLY A TECHNICAL SKILL, ESPECIALLY IN THE STEM WORK PLACE. IN REALITY, **WORK IS JUST AS MUCH A SOCIAL WORLD** AS IT IS A TECHNICAL WORLD."
> —*Patrick Waters*

Technology as a conduit

"Not everybody lives in a big city or goes to school in a big city. There are many, many rural classrooms that have absolutely no access," Raja said. "I myself come from a very small village in South India. I had no idea what STEM was or what an engineer was, so the accessibility is a huge issue, and technology is the one that can actually help bridge that gap."

Diverse exposure

There are two prongs to diverse exposure — exposure to a diverse set of people working in STEM and exposure to a diverse range of STEM jobs.

"It's often through the mentoring programs we bring one person, and ... most of the time that person may be a mechanical engineer, but this child may want to be something else," Raja said. A skills-based approach can help shift this paradigm.

"Within a short period of time, if we're able to introduce them to a diverse set of careers that has a long-lasting impact, then there is a better chance of having something put in front of them that they can actually relate to or that they can aspire toward," Raja said.

3

MAKING IT RELEVANT

Students admittedly can be a tough audience, but if you design experiences that tap into their interests, you'll likely see a dramatic change, marked by engagement, eagerness and passion.

It's that connection of taking something you're learning in the classroom and applying it to the real world; and through that process, introducing them to real people, real careers, making real products that you actually use in your everyday life, Raja said.

"One of the big things that we've seen is the lack of relevance," Raja said. Students ask: "'Why am I learning what I'm learning in the classroom? How am I going to apply this in the workforce? We see a lot of different examples, even as early as fourth and fifth grade. Girls are asking the question: Why do I need to learn math if I'm not going to be an engineer? Creating that relevance is so important to bridging this gap."

> ## "GIRLS ARE ASKING THE QUESTION: WHY DO I NEED TO LEARN MATH IF I'M NOT GOING TO BE AN ENGINEER? **CREATING THAT RELEVANCE IS SO IMPORTANT** TO BRIDGING THIS GAP."
>
> —*Sabari Raja*

Humanizing STEM

Women may be more drawn to STEM jobs that fall under the umbrella of social sciences.

Data show women are more likely than men to work as psychologists or as technologists and technicians in the life sciences, with the highest participation in psychology at 70 percent. Participation also is high in biosciences and social sciences, with the exception of economics.

"If you look at life sciences, if you look at doctors and nurses, a huge percentage of them are women, because they know there is a connection to their work to actually making an impact," Raja said.

"It's an important connection for girls that we fail to make," Raja said. "We talk about that it's important to learn coding, but how are we helping them connect that to some meaningful career that's out there?"

"Really, those are the kinds of connections we're looking for," she added. The question is: "How do we take something that's so mechanical or programmatic and make it real, where you're really making a difference in people's lives?" **SB**

Melissa Greenwood is the senior education editor at SmartBrief, covering K12, higher education and Path to Workforce.

MOMENTS OF INSPIRATION

ONE MOMENT CAN change everything.

"A large percentage of girls who chose a STEM career did so because of just one thing, one person or one event," Nepris CEO Sabari Raja said. "It does not take years and years of convincing."

During the Equity in STEM event, Raja recalled a trip to Bangalore, the capital of India's southern Karnataka state, where she learned about the first female entrepreneur in biotechnology in India.

"I didn't meet her; I didn't talk to her. But somebody pointed out the company and said, "This is an amazing woman. You should look up and learn about her." That was a huge defining moment for me. I was, like, wow, she's a woman, and she's here, and she looks like me, and she's done something great, and people respect her, and she's up there," Raja explained.

Aerospace educator Barbara Gruber shared how makerspaces also can help create moments of inspiration.

"One of the things that we have done with makerspaces in Loudoun is put makerspaces in the library, which is a special place that kids go to every week," Gruber said. "While they're learning digital literacy and while they're learning research skills, they also can learn maker skills."

"Having that regular access, even if they're not directly working in the makerspace, having that visibility of projects that other kids are working on, having the 3D printer there, having any type of technology out, certainly grabs kids' attention in the library."

"In the school I was at last year, we had all this dead space, and we decided to create our makerspace there," Gruber said. "It is the first thing that you see when you walk in. Parents, community members, when they walk in, they see kids engaged in making."

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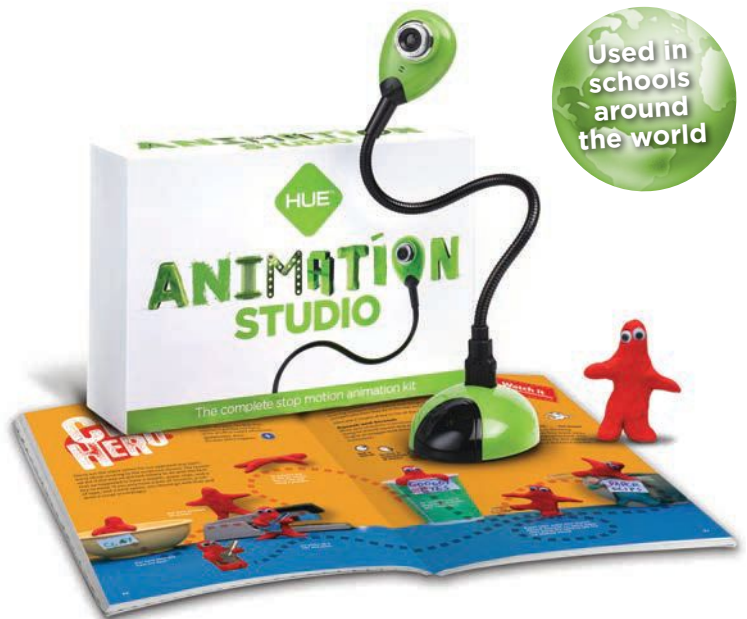
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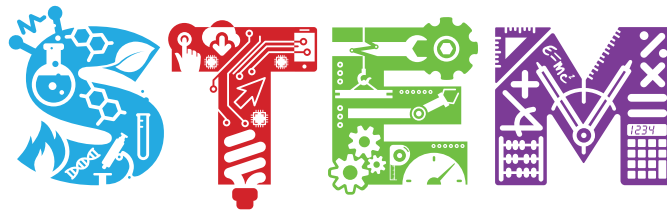
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MAKING STEAM
WORK FOR ALL

Individuals with disabilities are underrepresented in STEM. See how makerspaces can help level the playing field. BY PATRICK WATERS

NNOVATION HAS DRIVEN our country's economic prosperity. Advancements in science and technology have been an economic growth engine. Education has fueled this engine and will continue to propel our nation forward.

Students, parents, educators and allies in business and technology industries recognize the importance of a technologically literate workforce that can create and collaborate. In the past few years, the education community has begun to target underserved students — including girls, people of color and those from lower socioeconomic status — through initiatives such as private grants, nonprofit groups and government policies.

These changes pave the way for greater student access and exposure to STEM topics. The potential of STEM education cannot be overstated, as its effect on students extends from developing collaboration skills, promoting analytical and critical thinking and fostering creativity to providing pathways to economic prosperity. STEM education can benefit all students, of all learning abilities, at all levels, from all socioeconomic backgrounds, in a substantial way.

Maker education is a school of thought that strives to deliver constructivist, project-based learning curriculum and instructional units. Makerspaces allow students to discover and explore STEM topics, while allowing educators to create lasting educational experiences. Educators don't have to stop at science or engineering. Makerspaces can integrate the arts into the curriculum and make STEAM — science, technology, engineering, arts and mathematics. Makerspaces can be full high-school workshops with a bevy of high-tech tools, or as small and low tech as one corner of an elementary classroom. What defines a makerspace isn't the tools and equipment, but the learning.

Educators need to design these spaces to reach a diverse set of learners, particularly populations underserved in STEM subjects, including students with neurological differences, learning differences and special needs. Makerspaces provide a number of benefits and opportunities for typically developing students, and it just so happens that the type of learning makerspaces promote best is also the type of learning that students with learning challenges need most.

I designed the STEAMworks program, a makerspace explicitly designed for students with neurological differences, at The Monarch School in Houston in 2013 with input and help from my students. The STEAMworks program has delivered a broad range of maker experiences: building and learning 3D printing and design, computer-assisted design, entrepreneurial woodworking, high-school physics, computer coding and integrated arts projects. Students—and teachers—can approach learning in innovative ways, which integrate learning to educate the whole child.

What follows is a Q&A with some of the students in STEAMworks.

What do you enjoy about making?
Logan: I enjoy the building and making the engineering shenanigans I get into every day.
Chris: I enjoy making cutting board because I feel proud. People are buying my art.
Cameron (adult learner): I feel accomplished afterward. I enjoy making something that will go into the community and be liked and used.
Brett (former student): I really enjoyed putting the space together and making it look nice and clean. I felt excited, tired because it took a while. You were teaching mathematics and also how to measure. I learned how to work power tools properly and safely. I learned how a 3D printer works and operates. There was planning for our future. I think of our classes as a happy time because of the friendships I made.

What types of projects have you built here?
Julian: I did robotic fingers, which is so fun to make I keep on making them! Right now, I'm making a space colony and what it looks like on the planet Mars. *jazz hands*
Chris: I've built cutting boards, robots, rockets, 3D-printed candy bars.
Laura: I've made two robots — a shooter-bot and a robo-gator—3D prints, a car safe for an egg, a bridge, and am working on a STEAM fair project!

What skills have you learned in the makerspace?
Julian: Basically, listening to the teacher … being happy, smiling, mak-

ing tons of stuff, like Mindstorms, things like that.

Cameron: I've learned teamwork, scroll saw, sanding machines, clamping, hand tools, all sorts of stuff. Patience.

Jordan (adult learner): I've learned how to safely use power tools and how to be part of a production team.

Chris: Safety. I've learned a lot of stuff, but there's so many things I can't name them. I learned to program in Scratch.

Brett: I also learned a little bit of executive functioning, and that came in play when we planned out how we wanted our makerspace to look like.

How could these skills help you in the future?

Logan: I could build a house. I learned planning skills. I learned how to safely use tools.

Cameron: I can get a successful job in these areas.

Laura: I could be an architect, as well as possibly making robotic parts for animals that lost their legs!

How do you practice and improve your relationship-development skills and capacities?

Logan: We worked on two-person projects and collaborative efforts. Mr. Patrick has coached me during class.

Cameron: I can now get my point across if I need help.

Chris: We work as a team to get it done!

Laura: I ask for feedback and how I can make what I'm making better.

How do you practice and improve your self-regulation (emotional modulation) skills and capacities?

Julian: Breathing in and out, calming myself down while I work. Sometimes I make small objects out of scraps. I draw. I watch the 3D printer.

Cameron: I learn to stay focused and calm.

Jordan: I work on staying focused and slowing down.

Laura: Let my imagination go wild!

How do you practice and improve your academic competence/professional competence skills and capacities?

Logan: By using strategies and skills to get a head start on work, writing papers and reflections.

How do you practice and improve your executive-function skills and capacities?

Julian: We plan out our projects; we make our projects and work together, and we reflect after class.

Cameron: We wait till the class comes in; we talk about our work schedule, then we work on it step by step. And that's how I do it at Starbucks, my job outside of Monarch. **SB**

Patrick Waters teaches at The Monarch School in Houston. He was the NAPSEC Educator of the Year in 2015.

3 REASONS WHY TEACHING, LEARNING COMPUTER SCIENCE **IS CRITICAL** By Melissa Moritz

EACH DECEMBER, educators and students across the US celebrate Computer Science Education Week . It's a great time to consider how, as a nation, we can build a strong community of computer scientists in which every student has the opportunity to be a part.

Computer scientists use technology to solve some of society's biggest challenges, designing solutions to make our lives and work easier. Across our country, computer scientists are building the next big innovations that will alter the ways in which we create, communicate, do business and spend our leisure time.

Computer science is a gateway to the future, but there are other reasons it's critical that every student has the chance to engage in this important area of learning. Here are just a few to consider:

1 For our young people to succeed in an increasingly global, knowledge-based economy, they must be equipped with knowledge and skills that go beyond mastery of foundational academic subjects.

When students have the chance to study computer science, they can develop skills such as persistence, problem-solving, critical thinking, creativity and collaboration — skills they will need to thrive in school, life and any profession they choose.

Importantly, computer science is not limited to coding or programming, although these are essential components of a robust education in computer science. Students also learn how to analyze data, work with algorithms, develop hypotheses, test solutions, conduct research and engage in abstract thinking.

Computer-science education can provide students with a strong understanding of how their classroom studies relate to real-world challenges and opportunities, as well as exposure to next-generation approaches to learning and instruction.

2 Ensuring that all students have access to rigorous course work in STEM subjects—including computer science—is a matter of equity.

The ability to design, code, program, troubleshoot and demonstrate computational literacy is rapidly emerging as a necessary skill for today's students. Yet, a large majority of our public schools don't offer computer-science classes, and access is particularly limited for minority and low-income students. More than three-quarters of US high schools do not offer computer-science courses. Only 26 states allow students to count computer science toward high-school graduation.

Across the country, young girls and minority students are far less likely than their white, male peers to take computational courses in middle and high school. In 2015, for example, girls represented only 22% and minorities only 13% of the approximately 50,000 students nationally who took the Advanced Placement (AP) exam in computer science. In three states, not a single female student took the AP computer-science exam, and in nine states, no African-American students took the test. These numbers are discouraging when access to and successful completion of rigorous computer-science courses can help students master challenging concepts and high-tech skills that are increasingly relevant to how we live, learn and work.

All of us—whether we are educators, parents, policymakers or community or business leaders — must work together to ensure that every student has access to opportunity, which includes the chance to engage in rigorous learning that can prepare students for success in college, careers and life.

3 Students can invent their future using computer-science skills, and jobs in computer science-related fields are growing.

Technology influences nearly every aspect of our lives, and it has the power to help our children build a more productive, prosperous, safe and healthy world. Cybersecurity, network administration, coding, project management and data analytics are just some of the areas in which students can exercise the type of problem-solving skills, creativity, entrepreneurship and innovation that are advanced by training in computer science. Positions in these fields also boast average salaries more than one-and-a-half times higher than those for the average private-sector job.

We can, and must, do more to enable every student with a dream the ability to become our next great app developer, engineer or inventor. When we provide opportunities to all our students, we empower them to pursue passions that they might not have known existed.

President Barack Obama has issued a call to educators, businesses, foundations, nonprofit organizations and other partners to support computer-science education in our public schools. The good news is, momentum is building to expand educational opportunity to students through computer science. **SB**

Melissa Moritz is the deputy director of STEM at the US Department of Education

LEARN MORE ABOUT HOW TO GET INVOLVED (*links***)**

- The White House's Office of Science and Technology Policy
- US Department of Education's Office of Innovation and Improvement
- National Science Foundation
- Computer Science Education Week
- Hour of Code
- CS10K
- Exploring Computer Science
- TechHire Initiative

How does STEM prepare students for the real world? Five high-school students share their insights. Their answers may surprise you.

LIFE LESSONS

By Kanoe Namahoe

TEM CLASSES TEACH more than science, technology, engineering and math, say students from the New Orleans Charter Science and Mathematics High School (also known as Sci High) who participated in a panel discussion at ACTE's CareerTech VISION 2015. Sci High is a public charter school. Of the 425 students enrolled in 2015, 55% are female, 45% are male, 83% are African-American and 83% qualify for free or reduced lunch, according to the school.

Here are some life lessons the students gleaned from their courses:

Hands-on learning makes it stick. Classes that give students hands-on experience with the same processes and procedures practiced by real professionals increase engagement and understanding, said junior Kascie Flotte and senior Juan Rosa.

Flotte described the crime-scene labs she and her classmates run in their biomedical-science class. "It just shows the tedious work that scientists have to go through when doing lab work," she explained. "It's always hands-on. You actually feel like you're in a lab and you're doing what an actual scientist would do in a situation like that."

Rosa concurred. "We're cavemen learning how to make the wheel for the first time," he said. "It's just like we're actually making something, then trying it out. We understand what we're doing."

Play nice. Collaborative work, integral to Sci High's curriculum, lets students hone their communication skills and practice working with different groups of people, something that Flotte acknowledged is a struggle for her at times. "[It is] kind of hard because sometimes you have those people who don't really focus, so you have to learn how to communicate with different personalities," she said. She credited those experiences, though, as helping her better understand others and wrestle through difficult projects.

Senior Neal Ricks said group and partner projects took him out of his comfort zone. "If I can do something on my own, I'd rather do it on my own," he said. His A+ certification course required him to work with a partner, an experience Ricks said ultimately was beneficial. "I worked with a partner, learned how to communicate with him and collaborate."

Remain open to other careers. Sophomore Alexis Nguyen planned to be a pharmacist until she did an internship at a local children's hospital. The experience revealed some interesting surprises.

"I'm not very good at chemistry," she conceded. "Now I want to be a nurse, instead of a pharmacist. I just want to help people. Nursing is good for me."

Flotte made a similar discovery during an internship at a veterinary clinic. Even though she loves animals, she plans to pursue a pharmaceutical career. "Veterinary is not actually my forte," she explained. "I didn't really like it as much as I thought I would. You learn through experience."

Be a creative problem solver. There's more than one way to solve a problem or work through a process, said junior John Mathis, describing the work he did in his engineering class. Students are encouraged to follow their imagination as they move through the design process, to try different approaches and learn from their mistakes. Mathis said he enjoyed the freedom to be creative.

"Honestly, I think that's what interests me to be an engineer," he said. "I have more freedom to do what I want and explore."

Crush the glass ceiling. Ricks told the story of his computer-science teacher who, when she was in college, was taken aback by a professor who expressed surprise to see her in his computer-science class. The professor told her she was a rarity among computer-science students —

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—Kascie Flotte

a female and black. The field is dominated by white men, the professor said. The experience stayed with the future high-school teacher, and she passes this story on to her students, not simply for inspiration, but also to reinforce their responsibility to break through glass ceilings.

"This is why we need to get out, branch out and teach other kids," he said. "We need to teach the importance of this — that a company will hire you because 'Wow, you actually did this.' "

Focus on learning — not GPAs. STEM is not just for the students with the high grade point averages — it's for everyone, Flotte said.

"It's not about being smart — it's about learning," she said, crediting her teachers for emphasizing the value of the learning process. "It's not about quizzes and grades. Those are still important, but it's mostly about learning. I feel like we lose that in grades."

Flotte said students tend to avoid pursuing STEM because they think it's only for the superscholar. She encourages schools to dispel this myth.

"You don't have to be ridiculously smart," she said. "You can do it, just like anybody else. It's empowering." **SB**

Kanoe Namahoe is the editor of SmartBrief on EdTech and SmartBrief on Workforce.

Q&As with panelists from Equity in STEM:

TAKING THE CHALLENGE TO BUILD AN INCLUSIVE WORKFORCE

SCHOOL/BUSINESS PARTNERSHIPS

Parents can be the best source of information, speakers and volunteers who model what's going on in the community, according to aerospace educator Barbara Gruber. Also look to businesses in your attendance zones to do partnerships. That helps you know what businesses need in the future.

GOOD NEWS FOR GIRLS IN STEM

Gender inequality has led to a missing perspective in STEM. But there is a lot of good news for girls, says education expert and author Kathy Hurley. Through her work with the Partnership for 21st Century Skills, girls are doing some fantastic projects that even five or 10 years ago were mostly geared toward boys.

MAKER EDUCATION

Educator Patrick Waters says making in education takes the act of making something cool and awesome to the next level by then asking students to examine the product: What can we learn from this? How can we improve it? How can we re-engineer it to do something different? How can we make this stronger, faster, more awesome than it already is? Makerspaces also give you an opportunity to design a space that meets the needs of a variety of students — boys, girls, 18-year-olds, 9-year-olds, someone interested in writing, someone interested in animals, someone interested in computer programming, and more.

SOFT SKILLS

The message Waters shares with students is: You will gain technical knowledge through failure, and failure is OK. You are going to mess up as you learn to build and put those experiences together. Those mess-ups mean you're doing it right. It's your brain trying to work through the problem in front of you. And it's not just important to know how to do something with your hands; it's important that you communicate — collaborate with the people around you. Technical skills open the door to the job, but your soft skills — the things you're not always confident about right now — are the skills that are going to keep you the job.

SKILLS-BASED VOLUNTEERING

Even if people don't have 20 hours to give for mentoring, they do have skills that can inspire a student, says Sabari Raja, co-founder of ed-tech startup Nepris. Skills-based volunteering is one way to help people and companies get involved who do not want to commit to traditional, long-term mentorship models. Let's not put everybody under the mentoring bucket. If you have 30 minutes to give and you have skills to share, you can connect to a classroom to share them because it often doesn't take much to get someone inspired, and kids need diversity of exposure.

STEM: DOING SOMETHING YOU LOVE

Raja recommends telling girls: Don't decide early that you are not good at STEM fields: I'm not going to be an engineer. I don't want to be a scientist. But really be open to what STEM is. You can get into a STEM job and do things that you love — if you want to change the world or you want to change the environment — you want to work on energy or you want to work on fashion.
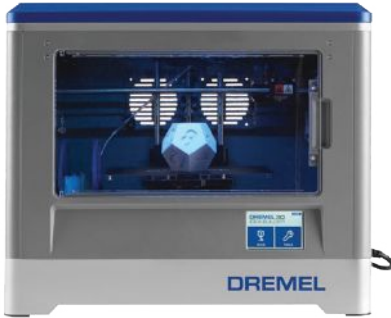

BREAKING DOWN BARRIERS

Many students have a preconceived notion of what a STEM job is, Raja says. Relevance and accessibility are key to changing their minds.

MOMENTS OF INSPIRATION

Sometimes all it takes is one thing to inspire students, particularly girls, to enter STEM fields, Raja says.

TECH**SHOWCASE**

DREMEL DREAMS

Dremel Dreams, from power-tool manufacturer Dremel, aims to promote hands-on STEM learning through 3D projects. The program is included with the purchase of the **Dremel 3D Idea Builder** printer and includes 3D-specific lesson plans, design software and hardware, and customer support. ▶ **See it in action**

GEOGEBRA

GeoGebra is a math application for K-20. Virtual reality provider **zSpace** has partnered with GeoGebra, and students can now build and manipulate virtual 3D objects in zSpace's virtual reality tabletop . ▶ **See it in action**

NEPRIS

Nepris is a cloud-based platform designed to connect students and teachers to industry professionals in STEM and STEAM fields. Schools have used Nepris for activities such as project mentoring, virtual field trips and Shark Tank events, where students pitch ideas to entrepreneurs. ▶ **See it in action**

STEAM CARNIVAL

STEAM Carnival, produced by **Two-Bit Circus,** is a touring carnival designed to let children have fun with science, technology and art. The carnival features hands-on games, immersive experiences, stage shows and lab demos, among other activities. The 2016 event is set to make stops in Dallas; Seattle; Charlotte, N.C.; and Chicago. ▶ **See it in action**

A roundup of tools & services that support STEM education.

PASCO

PASCO Scientific's Wireless Sensors are designed to connect directly to devices. The sensors are compatible with Windows, Mac OS, iPad, Chromebook and Android operating systems. The line currently includes wireless sensors for pH, temperature, pressure and force/acceleration.
▪ **See them here**

LABQUEST STREAM

LabQuest Stream, from Vernier, is a wireless and USB interface designed to collect data from multiple platforms and devices, including smartphones, Chromebooks and computers. The device is compatible with more than 50 Vernier sensors as well. ▪ **See it action.**

ACTIVWALL

ActivWall, from Promethean, is an interactive widescreen display. The display supports multiple users and can be divided into individual learning spaces for group collaboration. Users can share content to ActivWall from their mobile devices. The system comes with Promethean's LaserView Technology and works with ActivInspire and ClassFlow. ▪ **See it action.**

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MAKE STEM AN EXPERIENCE. STEM applications are like riding a bike: Educators could show students video upon video and assign articles to read about riding a bike, and students still would not know how to ride a bike until they do it for themselves. Although students can do research, watch videos and have thoughtful conversations about real-world situations, until they actually experience something, they likely will never fully understand it. *Read more.*

INCLUDE CAREER EXPLORATION. If students learn at a younger age what it takes to work in a specific career — early-childhood education, business, journalism or STEM — they can form opinions and decide what they would like to do earlier in their lives. College and career readiness shows students how to implement and use their 13 years of schooling and skills in a career. *Read more.*

ADD ROBOTICS. Robotics strategically attracts students to math, science and problem-solving. For students to design, construct, operate and apply their learning, they must understand physics, programming, mechanics and ratios, as well as the advanced disciplines that may feel boring in core curriculum classes. The benefit of robotics in the classroom is that it celebrates failure (the idea of try, try and try again), and the lessons learned in perseverance build confidence in today's and tomorrow's learners. *Read more.*

INCORPORATE SOFT SKILLS. Research increasingly shows that students leave college without the essential social-emotional skills required to thrive in a business setting. Though employers have always valued collaboration, patience and communication, traditional education systems seem to sidestep their importance. Conventional academic subjects, such as language and math, remain critical; however, the case for cultivating essential life skills and character traits early in a child's educational track gains more supporting evidence as the business community struggles to find qualified candidates who work well with others, are honest and respectful, and communicate effectively. *Read more.*

LET STUDENTS LEAD. By turning learning over to the learner, students develop student agency — their own interest and ability to learn about the work around them, and to solve the problems they encounter. What better preparation is there for a career than the ability to identify what needs to be learned and then learn it? *Read more.*

MODERNIZE CURRICULA AND RESOURCES. It's the responsibility of school districts and local governments to provide the best possible resources to help students receive the training they need to succeed in their chosen programs of study. It's becoming a necessity for schools to modernize their curricula, classroom materials, technology and facilities to meet the demands of the workforce and to train students. *Read more.*

EXPAND DUAL-ENROLLMENT, DUAL-CREDIT OPTIONS. One hallmark of excellent programs is the establishment of articulation agreements, which connect classes at different institutions to create a comprehensive learning experience. Though these connections take different forms, one common setup allows students to take high-school classes through a local community college, which prepare them for that institution's specific CTE program that they plan to enter. They can use that degree in the workforce, or they can use it as a steppingstone in a two-plus-two program to pursue a degree at a four-year college. *Read more.*

Path to Workforce is a SmartBrief Education original content and event series. It's our vision of college and career readiness, encompassing K-12, adult learners, career changers and other nontraditional students.

CELEBRATE DIVERSITY. STEM has never been as important as it is right now. It is a unique entity; everyone agrees it plays a vital role in the nation's success. Sadly, even though the importance of STEM is well known — from its significance in education to product development — there are still major shortfalls. Disparities in the numbers of minorities and women in STEM are one such area, well established in research. But there are some phenomenal organizations supporting women and minorities in STEM. *Read more.*

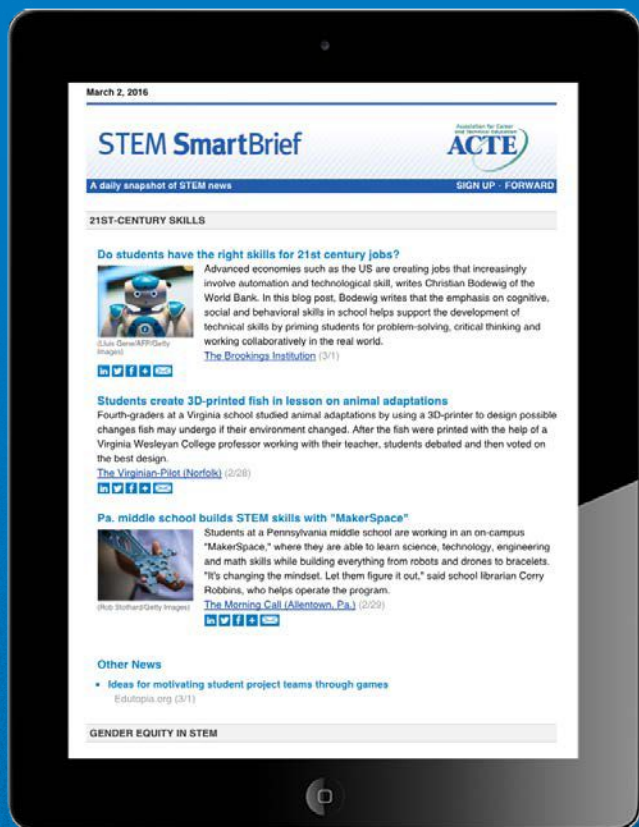These tips have been edited for length and clarity. Want more Path to Workforce tips? *See our online archive.*
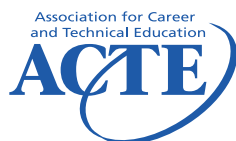
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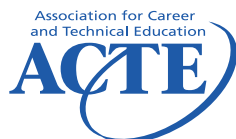
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