OCTOBER 2018

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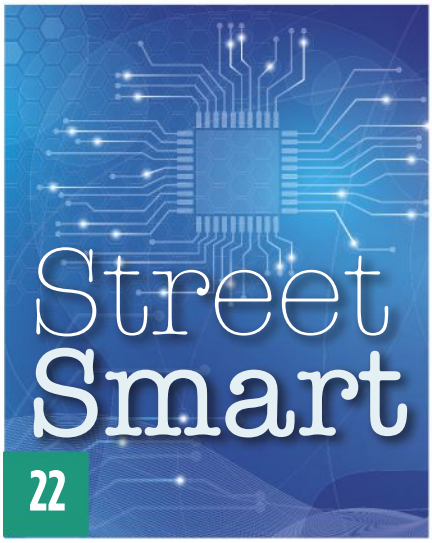

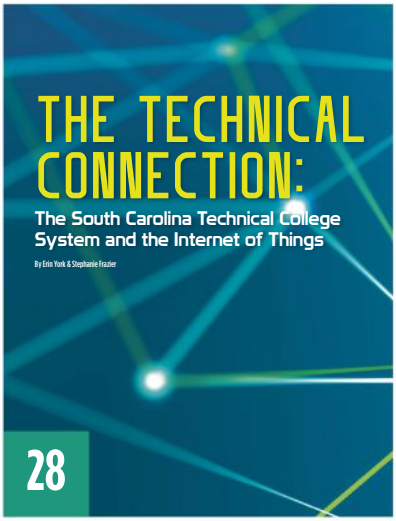

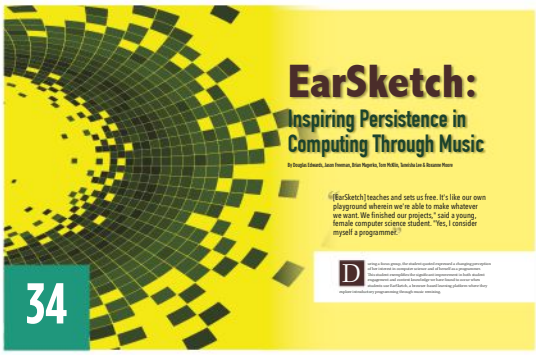

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IN THE INTERNET OF THINGS

GO TO THE SUPERMARKET, OUT FOR A RUN OR ON VACATION, AND ONE THING remains the same: devices, devices everywhere. We live in the "internet of things" and thus, the inspiration for this issue of *Techniques*. The internet of things (or IoT) is a vast network of devices, appliances, vehicles, sensors, actuators and connectivity, all of which work together to exchange and process data — making human and digital interactions, alike, richer and more accessible.

Within these pages, career and technical education (CTE) professionals explore the ways in which the IoT will open doors for new talent pipelines; enhance learning opportunities through the use of computer and mobile applications; and expand students' potential for connection with valuable industry partners. Your network is growing, and instructional pedagogy along with it. Will you be ready?

ACTE's events offer unrivaled professional development opportunities for educators, to better equip them to prepare their students for the jobs of tomorrow. One such event, the STEM is CTE Symposium, addresses access to STEM-related career paths through CTE and why it's important for all students, especially young women like Rashi Kejriwal and Shreya Santhanagopalan. Winners of the 2018 ACTE Student Trophy Design Contest, Kejriwal and Santhanagopalan expressed passion for pursuits such as engineering, 3D design and artificial intelligence.

In an interview for *Techniques*, Santhanagopalan told Managing Editor Lia Milgram, "I was brought up to love engineering tasks and figuring out solutions to difficult problems. I began to learn to code when I was in fifth grade and grew a love for it over the years." (Read the full interview on pages 40-42.)

As career and technical educators in the 21st century, it is our responsibility to equip Santhanagopalan, Kejriwal and students like them with the skills and opportunities for success in a global, connected economy. **The 2018 STEM is CTE Symposium will take place immediately following the close of ACTE's CareerTech VISION, on Saturday, Dec. 1.**

VISION is the preeminent event for career and technical educators, administrators and stakeholders. Attendees will have the opportunity to interact with leaders in business, industry and education through focused interactive sessions, informative tours and engaging networking events. A fully immersive event, VISION 2018 will take place Nov. 28–Dec. 1, in San Antonio, Texas. I hope to see you there.

LeAnn Wilson
ACTE EXECUTIVE DIRECTOR

Techniques

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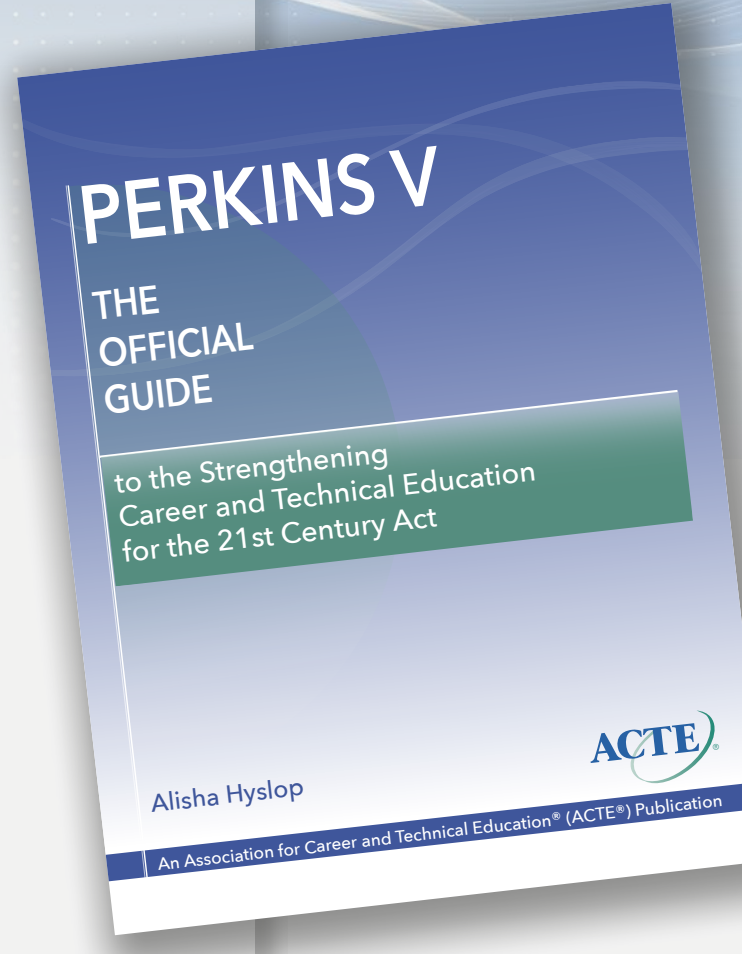

PUBLICATIONS WILL BE AVAILABLE TO SHIP THE WEEK OF OCTOBER 15.

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ACTE Recognizes Impact Award Winners

In advance of its CareerTech VISION 2018, the Association for Career and Technical Education is excited to announce the winners of the ACTE Impact Awards:

- Eli's Cheesecake (ACTE Champion for CTE Award)
- NEW Manufacturing Alliance (ACTE Business-Education Partnership Award).

The ACTE Champion for CTE Award was created to recognize education leaders, business and industry executives, celebrities and thought leaders who support and champion CTE programs as a vital part of developing a prepared, adaptable and competitive workforce.

"All of us at Eli's Cheesecake value our long time partnership with Chicago High School for Agricultural Sciences (CHSAS). We have watched so many students succeed at the school and go on to great careers in food and related fields," said Marc Schulman, president of Eli's Cheesecake. "We are honored to receive the Champion for CTE Award, which is a real tribute to the students, faculty and staff at CHSAS, as well as everyone at Eli's and our supporters of the school in industry, government and education."

ACTE's Business-Education Partnership Award recognizes best practices and provides examples for schools and businesses to aid in the development and maintenance of partnerships that support high-quality CTE. Such quality partnerships align with ACTE's goal of connecting education and careers, and will ultimately lead to improved career readiness.

"The NEW Manufacturing Alliance is thrilled to be recognized as the Business-Education Partnership Award winner from ACTE," wrote Ann Franz, director of NEW Manufacturing Alliance. "We truly believe our people — more than 100 manufacturers and educators on five different K–12 task force teams — are the reason we won this award." *www.acteonline.org/professional-development/acte-excellence-awards/*

NYC Data Science Academy Launches New Course: Introduction to Blockchain with Ethereum

A new course launched by the NYC Data Science Academy this fall, "Introduction to Blockchain with Ethereum," will introduce programmers and data enthusiasts to smart contract applications. The course begins Oct. 13. What is Ethereum blockchain? Launched in 2015, the platform enables a wide range of applications for business-to-business and business-to-consumer uses.

"We believe that blockchain technology will prove to be an important part of business applications in the near future," said Vivian Zhang, co-founder and chief technology officer of the NYC Data Science Academy. "We have an opportunity to give students a unique 'data perspective' on building smart contract applications and our new course will be a great introduction for anyone looking to get started."

The course is designed for students with a technical background; attendees will:

- Gain a deeper understanding on the core concepts of the Ethereum blockchain
- Know how to send transactions to user/smart contract accounts and investigate logs
- Get familiar with the syntax/functionality of the major contract language solidity
- Master the Ethereum blockchain data structures through web3
- Learn how to interact with the blockchain client through web3, to perform python data analysis, transaction network graph analysis and to monitor the status of the chain

"With many potential business applications on the horizon, and more challenges yet to be resolved, [blockchain with Ethereum] offers unlimited potential for those who wish to grow with the industry." *nycdatascience.com/courses/introduction-to-blockchain-technology-with-ethereum/*

Junior Chef Competition Teaches Culinary & Life Skills

At Wagner High School in San Antonio, Texas, students competed in the second annual Junior Chef Competition. Two-person teams were challenged to prepare a two-course meal from a selection of mystery ingredients; one team's dessert was made with mango sauce, pecans, cinnamon and peppers.

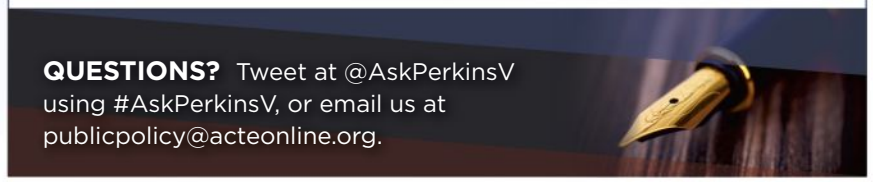
"It was a weird combination, and it tasted great!" said Bexar County Sheriff Javier Salazar, a panel judge for the competition.

Students engaged in competition learned not only culinary skills — such as proper knife skills and food service protocol — but also employability skills that promise to carry them far in life. Conceptualized by local area chef Milas Williams, the Junior Chef Competition makes valuable connections between business and community leaders and students.

"Culinary is not just about cooking," Williams said. "They will take the discipline they learn from here. You have to be able to communicate, you have to be able to have teamwork, and you have to know who can handle pressure and who can't in the kitchen." *bit.ly/2MubuZB*

Perkins CTE Reauthorized

On July 31, President Trump signed the Strengthening Career and Technical Education for the 21st Century Act (Perkins V). The new law was approved unanimously in both the House and Senate, and will take effect on July 1, 2019, with a 'transition year' through June 2020. Among other changes, the law includes a new local 'needs assessment'; defines a 'CTE concentrator'; expands uses of funds to the 'middle grades'; changes the process for state performance targets and shifts accountability indicators. The U.S. Department of Education will release a state plan guide in the coming months. ACTE has published a detailed summary of the new law and a webinar on Perkins V on our dedicated Perkins V implementation page, which will be continually updated with new resources. *www.acteonline.org/perkins-implementation/*



First-of-its-kind Career Center Opens in New Orleans

When it opened on Monday, Aug. 20, 2018, the New Orleans Career Center (NOCC) became the only college and career training provider of its kind in the city. The NOCC will present new career path opportunities for students, while supplying businesses with a skilled workforce. The first class to begin in 2018–19 includes 120 high school juniors and seniors, who are bussed from seven participating schools in Orleans Parish. The three-story, 22,600-square-foot space will house state-of-the-art technology for robust technical training.

In this first year, NOCC offers industry-based credentials for students in health care and manufacturing and hopes to expand into information technology, engineering, automotive pathways, and beyond.

"We're excited to provide a new opportunity for high school students to explore a compelling career trajectory, whether it's a traditional four-year or technical college degree path. We give them the groundwork, technical training, work-based learning and access to industry partnerships," said Claire Jecklin, executive director of the New Orleans Career Center. "We want to ensure that students graduate not only with the basics they need to earn a high school diploma but also an industry certification, increasing their chances of landing high-paying, in-demand jobs." *bit.ly/2BM4iY1*

Do You Have News?

CTE in the News is a monthly column in *Techniques* to highlight the buzz about career and technical education. If you have something exceptional (or exceptionally cool!) to share about your program, school, school district or organization, send it to techniques@acteonline.org.

STRATEGIES TO PROMOTE THE SAFE AND PURPOSEFUL USE OF CONNECTED DEVICES

By Patrick Biggerstaff

IN TODAY'S TECH-HEAVY ATMOSPHERE, YOU MIGHT BE READING THIS EDITION OF *TECHNIQUES* on your laptop, your smartphone or on any number of other personal devices. The topics discussed herein can be easily researched using your device and its embedded technologies make it possible for you to discuss your findings with peers the world over. Clearly, connected devices offer many benefits.

As career and technical educators, no matter our position or content area, we have a duty to help students engage online resources in a productive and responsible way. These standards for digital citizenship should be taught and applied to industry-specific resources as well as general applications available to the public. While there is value in helping students understand how technology has progressed over time, it is paramount that learners are taught to safely and effectively access new technologies.

Personally, I am fascinated by new and emerging technologies. I enjoy discussing breakthroughs with students and brainstorming potential applications of innovative resources. There is already much to celebrate about the accessibility and efficiencies gained via connected devices, and I look forward to seeing what the future holds.

Yet, for all of its many benefits, the improper or excessive use of technology can be harmful. In addition to highlighting positives, it is important that teachers help students understand and appreciate the potential dangers one faces when accessing technology. In the following sections, I present three challenges along with related strategies for helping students learn to engage digital resources in a safe and productive way.

Challenge #1: Don't overdo it.

Online resources are designed to "hook" the end user. Many of us experience the frequent urge to search, tweet, post, message or react to online media. While these activities can make us feel like connected multitaskers, they often serve to distract us from more important activities like work, sleep and exercise. Our attraction to online activity may be due, in part, to the fact that websites and applications use algorithms that encourage continued engagement. Programs analyze individuals' unique search history and auto-play content that is likely to appeal to those users. Virtual environments also offer stimulation by allowing users to engage, acknowledge and/or broadcast the posts and opinions of others.

Strategy

Discuss the use of algorithms, and acknowledge that these operations are used by companies to keep visitors on their sites. Talk to students about opportunity costs — the potential rewards

> "Leadership matters in education, because student outcomes are affected by the relevance of learning opportunities that schools provide. Given the increased accessibility of online resources, educators have an obligation to prepare students for digital citizenship."

forgone by choosing one alternative over another — and encourage them to consider other things they might enjoy or accomplish if they chose to reallocate some of their time. Self-imposed time limits can help individuals maintain their sense of connectedness while at the same time freeing up their schedule to pursue other passions.

Challenge #2: Proceed with caution.

Some sources are not to be trusted. Digital connectivity provides almost immediate virtual access to people and information. While there are many kind and reputable people in the world, users should always be wary of misinformation and dangerous individuals.

Strategy

Student access to technology can be managed by program instructors. Many teachers work to identify the devices and applications that are currently used in industry and, when possible, they provide opportunities for students to employ said resources under strict supervision. For example, a health science teacher might have students chart patient information in a cloud-based system, as an agriculture education instructor might have his students use drone technologies to survey and map areas of crop infestation.

When students are given the freedom to explore online content independently, they should be encouraged to search only relevant and reputable resources. Web access on school devices may be governed by firewalls and/or teacher supervision in an effort to safeguard students from dangerous content. Still, personal devices often make it possible for students to access resources without restriction. No matter what protections are in place, students should be taught to evaluate sources for safety, relevance and reliability. Whenever possible, this instruction should take place prior to the students going online.

Challenge #3: Value your future.

Online engagement is a personal and professional risk. A survey of national news headlines is likely to find stories about people who lost employment due to questionable online behavior: Teachers, politicians, entertainers, police officers, business leaders and many others have been held accountable for their actions online.

Strategy

Stress to students that online communications are lasting; they can have short- and long-term consequences. Consider highlighting high-profile examples as well as any public cases involving young people who lost jobs, scholarships or college admission. One should take care not to post content that is aggressive, controversial or offensive.

Whether a message is intended to be personal or professional, private or public, serious or in jest, online communications have the potential to damage relationships. Furthermore, such poor behaviors can damage one's reputation and employment opportunities indefinitely.

Final Thought

Leadership matters in education, because student outcomes are affected by the relevance of learning opportunities that schools provide. Given the increased accessibility of online resources, educators have an obligation to prepare students for digital citizenship. We can, and should, promote responsible technology usage by defining, modeling and encouraging safe online activity. ■

Patrick Biggerstaff is vice president of ACTE's Administration Division and serves as director of career, technical and adult education for a large district in central Indiana. His current interests include legislative advocacy, STEM school leadership and the inclusion of CTE students with exceptional needs. Email him at patrick.biggerstaff@wayne.k12.in.us.

EXPLORE MORE

Additional insights regarding digital citizenship or CTE leadership may be gained through conversations with ACTE's affiliate partners at the Career and Technical Education Equity Council (CTEEC) and the National Council of Local Administrators (NCLA).

ACTIVITIES TO FOSTER HUMAN CONNECTION IN THE DIGITAL AGE

By Danny Rubin

EVERY DAY THE WORLD BECOMES MORE DIGITAL AND YOU MAY FIND STUDENTS PREFER TO SPEND more time in front of their screens than interacting with each other. As more schools adopt one-to-one device initiatives, making tablets available for students to use in the classroom, it's essential that students develop and retain the skills necessary it's essential that students of all ages know how to communicate with their peers and potential employers. How do we make sure our students graduate as digital natives, with the technological skills necessary to succeed in a 21st century workforce, without sacrificing a human touch?

These four activities are a great place to start.

Leverage the first five minutes of a networking conversation.

The best networkers are the people who use active listening skills to learn about others. The six most powerful words to use when networking are who, what, when, where, why and how. Encourage your students to listen closely and to ask follow-up questions using the six words.

Activity

Students pair off and identify as Person A and Person B. For five minutes, Person A is only allowed to ask questions, and Person B can only answer those questions. After five minutes, the students switch roles.

Person A asked, "How is school?" And Person B responded, "I had the toughest test of my life last week!" That's when Person A should say, "Why was it so tough?" rather than talk about themselves. It's critical for students to learn how to take an interest in someone else's life. That's a basic human connection we can't lose in our digital age.

Find a mentor.

Students should understand the value of mentorship, from which they can experience human-to-human interaction with a professional in their chosen career pathway. A strong mentor can teach the student employability and/or technical skills for success.

Here, students can learn to write an email seeking mentorship. The lesson

Subject line: Need your advice, looking for job opportunities

Hi John Doe,

[If you know the person, open with a little chit chat.] How's everything going at Big State? Are your students prepping for final exams?

[If you don't know the person, explain who you are.] My name is Danny Rubin and I'm a student at Acme High School. I came across your profile on LinkedIn and thought I'd make introductions.

I'm focused now on [the task at hand] landing a job after graduation and would appreciate the chance to ask you questions. I know you have experience with [the task at hand] and can give me some pointers to stand out and make an impact. I realize your time is valuable so please let me know what you can do.

[If the person lives near you, offer to meet in person.] I would be happy to come by your office. [If the person lives in another city or state, ask to speak on the phone.] A quick phone call would be great. Thanks so much, and I hope to hear from you.

–Danny

NOTE: Once the person meets you, either in person or over the phone, the conversation may prompt new ways they can connect you with others.

BOX 1

teaches not only relationship-building but also how to write a professional email.

Activity
Provide the template (Box 1) as a reference and encourage students to draft their own email to a real person. (Students can choose to send the email or not).

Tell success stories during a job interview.

The interview for an internship or job also provides an opportunity to maintain a human connection. Make sure your students understand that employers, like anyone else, need to be entertained. Employers don't want to interview student after student who claims to be a passionate, natural-born leader. The same ol' discussion will rock the boss to sleep.

Instead, teach your students to share stories of success rather than fall back on empty rhetoric.

Activity
Lead a brainstorming session in which each student identifies a tough moment where they rose to the occasion. Then, have them practice sharing the story out loud. Consider a brief example from my ACTE-supported book, *Wait, How Do I Write This Email?*

Question from the employer: What's your greatest strength?

Answer: I think my greatest strength is I'm resourceful. Actually, I have a great story about that. A year ago, half of our team at the nonprofit got sick with the flu. It's an eight-person team so we were down to four employees for an entire week. We also had a huge program the same weekend — a jump rope for health event with more than 250 children.

With only four of us in the office, we had to use our time and energy wisely. I handled online sign-ups and coordinated with the caterer. I directed two of my co-workers to oversee the awards presentation and music. And our fourth co-worker was our intern, Kacie. I quickly taught Kacie how to work the phones and answer questions from parents and the media. We worked hard that week, but the four of us got it done and the jump rope event was a success. So I like to think I can rise to the challenge even with limited resources or staff… and not miss a beat.

Employer thinks, 'Wow, what a strong teammate. Poised and everything.'

Storytelling will always remain a powerful way to make a human connection and prove our worth. It's essential students leave school with that understanding.

Say thank you.

Finally, we can't forget the power of a proper thank-you email — whether the interview is informational, for an internship or for a job.

A thank-you email makes the employer feel valued and underscores how the student is unlike their competition. The key is to incorporate a piece of advice the employer shared; this extra detail will prove the student listened and took the conversation to heart.

Activity
If one or more of your students has been on job interviews, they can write their email to the person(s) they met. Otherwise, have students write practice thank-you messages to someone who recently helped or offered advice in another capacity.

Consider using the template (Box 2) below so students understand how to structure the email.

The human connection matters more and more in our digital age. How we write and speak can build relationships and open doors that take our career to new heights. ■

Danny Rubin is an author and the owner of Rubin Education, a provider of learning materials for employability skills and business communication. Email him at drubin@dannyhrubin.com.

Subject line: Thanks again for your time

Hi Jane Smith,

Thanks again for meeting with me this [morning/afternoon]. I appreciate your time and enjoyed learning more about the company.

[Then include a line from your conversation.] It was helpful to learn about the technical skills I need to apply for a job at your company. [Or suggest a way you think you can contribute.] As we discussed, I'm interested in the position and feel my design skills would be a nice complement to your graphics department.

If you have any further questions, please feel free to ask.

Thanks so much, and I hope to hear from you soon.

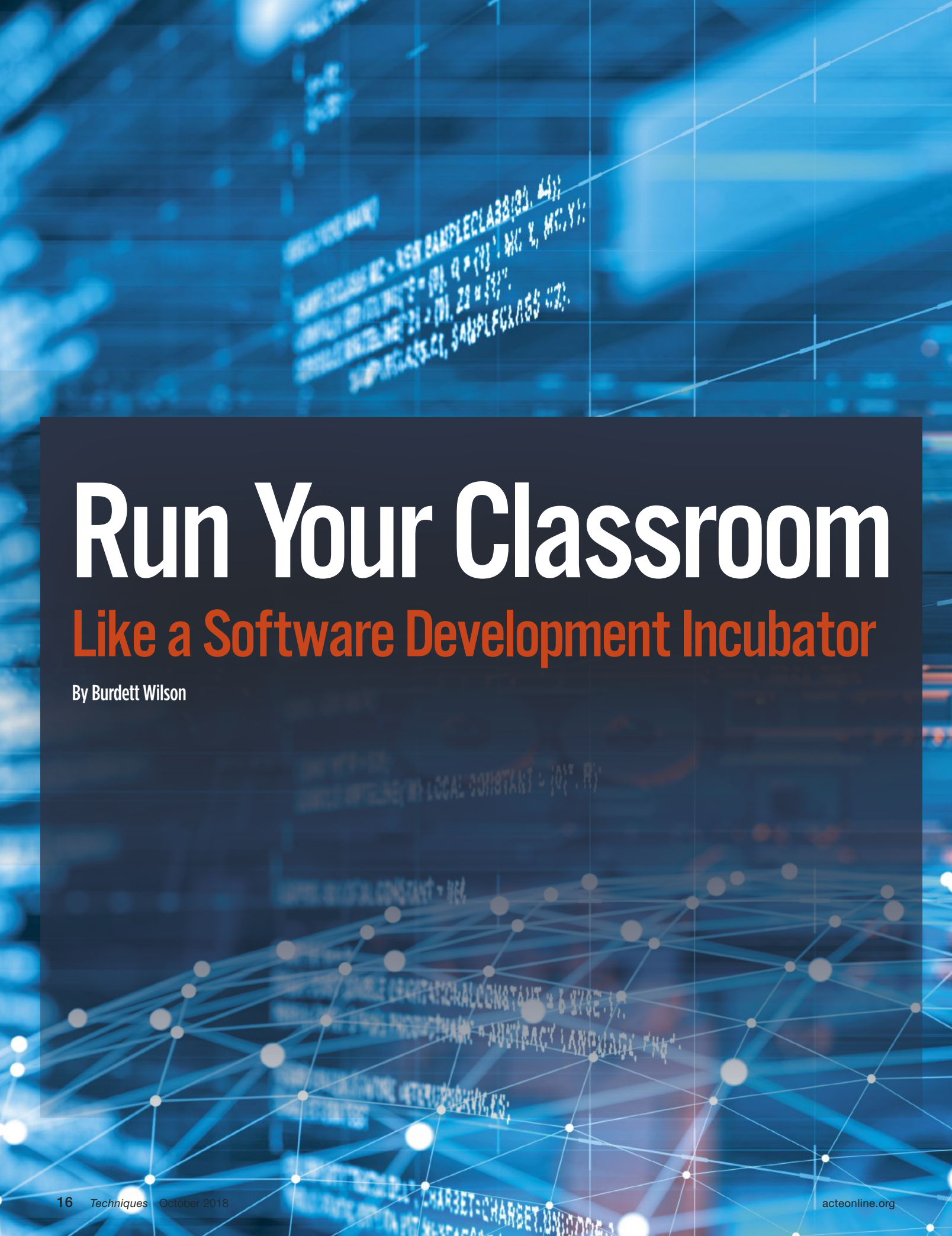
– Danny

BOX 2

Techniques

is replacing Capitol View with a new column to be unveiled in November/December.

Don't miss it!



Run Your Classroom

Like a Software Development Incubator

By Burdett Wilson

On a cold January morning, the programming teams begin to form. The team manager reviews all the current projects: The website team is designing a branding website for Silverleaf Farms; the DNA team creates zombie animations for the biology department and the playbook team is working on new plays for the Macon Tigers basketball coach.

"Team leaders, remember to follow up on all aspects of your project during Scrum meetings. As a reminder, you have one week left in the Sprint. Team leaders, please begin."

This is how the morning starts in a software development incubator. Where Agile programming teams work to solve problems by developing software for clients, this is not a software development company in Silicon Valley. It's my classroom at Macon Area Career Technical Education Center (MACTEC) in Macon, Missouri. Excited teams gather at programming tables around the room, ready to engage in student-led development meetings, taking on projects that build practical applicability. Students develop the day's learning and work plan based on requirements for projects derived not from imagination but from assessing the needs of the school or local businesses; assignments require that students work in cooperative learning environments and with project-based learning concepts to develop real-world skills.

Run Your Classroom

Like a Software Development Incubator

> "In our digital age, you can either 'program or be programmed'."
> (Rushkoff, 2010)

Train the way you work.

Five years ago, Dr. Charles Stockton, former superintendent of the Macon County R-1 School District, looked across the desk at me and asked, "Can you teach computer programming and software development?" I have thought about that question many times over the last five years as I continue to work to build a dynamic curriculum. From this meeting with my superintendent, I knew I wanted to give my students choices after graduation, whether that choice be direct to work or on to further training. Almost half of my students go straight to work in the technology industry. Many programmers work in entry-level jobs with information technology (IT) outsourcing companies such as Macon's own Onshore Outsourcing. When others choose to go on to college, MACTEC offers articulated credit agreements with three colleges, where students start ahead of their classmates.

In 2015, MACTEC computer programming became an authorized Certiport Testing Center, where students can become certified by Microsoft in programming languages like C# (C-Sharp) and Java. In the following year, we became an Oracle Academy and were featured as a spotlight success story on the academy's website. Certification testing from Microsoft and the incorporation of Oracle, an educational program to advance computer science, help validate the skills students develop.

I laugh now, having believed that, once my curriculum was put together, all I'd have to do was teach it. Change is an important premise in the Agile programming classroom. Because of the continual change in industry, my classroom cannot stop evolving.

Need

The United States is rethinking what skills workers need when they graduate from high school or technical programs. In the past, career and technical education (CTE) programs were slotted for students who couldn't succeed in regular education classrooms; no more! There's a growing body of research that demonstrates the role of CTE in preparing all students for post-school success (TeGrotenhuis, 2015).

Gone are the old days of people in rows learning to type. Business education programs provide opportunities for students along many pathways. The Missouri Department of Elementary and Secondary Education's Top 10 by 20 plan calls on educators to ensure all students in the state graduate from high school to be college- and career-ready. What's more, a study released by the Harvard Graduate School of Education (2011), *Pathways to Prosperity: Meeting the Challenge of Preparing Young Americans for the 21st Century*, challenged the excessive focus on the four-year college pathway, arguing that additional pathways need to be created that combine rigorous academics with strong technical education to equip the majority of young people with the skills and credentials to succeed in the increasingly challenging labor market.

Does it work in the real world?

In 2013 I spent the summer working for Onshore Outsourcing; CEO Shane Mayes brought me in to learn how they train local people to become software developers. Mayes began Onshore with the idea of an eight-week intensive boot camp to teach programming to potential employees with little to no experience. While there I had the opportunity to help develop boot camp curriculum and learn the Agile programming team concepts. (A recommendation for all instructors: Go out and get some hands-on experience in the local IT field. These are the places our students will be looking for jobs. If our classrooms reflect the work environment with the correct skill set, our programmers will be first in line to get those jobs.)

Another key to preparing students for the real world is a strong relationship with regional community colleges. At MACTEC I partnered with community colleges to gain articulated credit for my student programmers. We visit community colleges and sit in on college classes, so they can see how the work we do simulates the college classroom, and the college instructors help validate the rigor in my curriculum. I also help arrange meetings with the chair of the department to discuss admissions and class schedules. I want my students to have the best chance at success.

What are Agile programming teams?

An Agile team consists of five students — of varying ability levels — working on a group project. One student acts as the team lead. As a tenet of Agile programming, projects are built around motivated programmers. Self-motivated learners work on their own with little supervision and this will give you, the instructor, extra time to work with the struggling student. The Agile classroom rewards hard work and motivation; most students want to be placed in authority roles. When the motivated students and the team lead set a model example, the others will begin to perform at a higher level.

Project requirements are developed in collaboration with the software owner, or they might be assigned by the instructor. In the beginning of the year, our projects are small. For example, in the Oracle Java Fundamentals course, project requirements come from the chapter. As the year goes on and the students' skill sets become more developed, we incorporate larger, real-world projects. In these cases, the team will meet and listen to the owner and develop the requirements for the software under the supervision of the instructor.

Projects are completed in sprints. The sprint format allows students to focus on the most important parts of the project, limiting their time to accomplish goals. Deadlines keep the procrastination down by creating an atmosphere of mild pressure. It is important to help students develop an understanding of steps in the programming cycle.

Sprints are short iterations of the programming cycle.

The programming cycle is defined in the first couple of chapters of every programming language book. Here, in brief:

- Requirements
- Planning/pseudocoding
- Coding/working
- Testing
- Review

When the team meets at the beginning of the class period, the team lead asks each person on the team three questions. One member of the team becomes the recorder and logs each response on a Scrum worksheet that tracks the project's process.

- What did you do yesterday?

Run Your Classroom

Like a Software Development Incubator

Do you run your classroom like a Silicon Valley incubator?

- What are you working on today?
- What do you need help on or what victories did you have?

The Scrum worksheet lists key requirements, who is responsible for what requirement and the projected due date. The due date may have to change based on how hard the requirement is to accomplish. If a requirement is very difficult or a team member needs help, more than one team member may be assigned to a requirement. Sprints have deadlines. Every Scrum meeting, every day, the student is asked, "When will the requirements be finished?" This develops another real-world skill; every boss wants to know when your work will be finished.

Big Question

How do you make sure all team members are contributing fairly? Students that work on Agile teams are monitored, primarily, by the team and, secondarily, by the instructor. Scrum meetings conducted at the beginning of every class mimic those by developers in real Agile teams. Team members that are off-task or not participating lose work points for that day based on the instructor's observation. This lack of work should be immediately pointed out in a one-on-one conversation and the instructor should work to resolve the programmer's problem(s). Do not shift or rearrange teams due to conflicts in personality. When students work on highly creative projects, they will have disagreements over ideas; students need to learn how to get along with people they don't like, and employers often require it.

Just a note: I did not say working hard but failing to accomplish the goal. If a team member is putting in effort but fail-

ing — that is good! Students learn more when a task is just a little beyond their skill set. In this case, in a cooperative learning environment, ask other team members to help a fellow programmer.

Bottom Line

I walked into my classroom one day in August 2014 and was greeted by a student from my first programming class at MACTEC, one of the first to go directly to work out of high school. He said to me, "Mr. Wilson, I am making more than my mom!" Since then I have seen many students come back, graduated students who tell me what we did right and where we can improve upon on our curriculum. This is the reason we teach — to see our students go out and create a new life away from high school. ■

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Street Smart

By Rachael Mann

> "In the next century, planet earth will don an electronic skin. It will use the internet as a scaffold to support and transmit its sensations."
> Neil Gross (Postscapes, 2018)

In May of 2018, I was invited to attend the UBER Elevate Summit and learn about projected changes in transportation, including automated smart cars both on the ground and in the sky in the form of vertical take off and landing (VTOL) aircraft. The sessions that truly fascinated me focused on the subject of smart cities and technologies and what these advances mean for transportation and pretty much every aspect of our lives. Having done extensive research over the last year around projected advances in the workforce and the implications on education, I couldn't help but think about the future of transportation and cities through the lens of career and technical education (CTE).

Smart cities use the internet of things (IoT) technology as a means to connect people to services through the use of data. Cities already use data to link information about everything happening both on the street and under it. From law enforcement to mobility, accessing data is proving useful in making cities smarter. Fortunately, it is also clear that smart cities make smart K–12 school districts.

Street Smart

The future is now.

While this may initially appear to be a future phenomenon, tomorrow is here today. With that understanding, we can no longer answer questions with bandage fixes but must focus instead on long-term solutions. Twentieth-century problem-solving measures might have stopped the bleeding but failed to prevent the cut in the first place. Too many cars? We added more lanes and soon learned that more lanes meant more cars and soon those spaces were filled as well.

Twenty-first-century problems require a different look. We have begun to ask if we even need cars: Will Uber and Lyft solve the crisis? Should we look at the crisis vertically and consider the development of flying automobiles? Or will self-driving cars be the long-term solution (Reichental, 2018)?

By utilizing public application programming interfaces (APIs), cities are now able to automate and optimize systems on the municipal grid in real time. Smart cities offer consistent access to information, immersive entertainment and sustainable energy.

Such advanced infrastructures are not only creating smart cities but also smart schools. A high school student can register for school on an app downloaded from their school's website. Parents can check grades, attendance and daily progress. During class, the teacher can interact with the students on laptops, tablets or cell phones through numerous educational applications.

The question is not if smart cities will come to fruition. Smart cities are here, and as CTE educators, we must determine how best to serve the needs of our students. We must equip them with the skill sets they need to be responsible and productive citizens in new technological societies — built, rebuilt, rebranded, and expanded every second — while also preparing them to adapt in the changing workforce.

CTE Connections

CTE educators can assist in the advancement of smart education by integrating virtual learning and augmented reality into their daily lesson plans to prepare this generation for what is on the horizon. Data-augmented lessons blend digital content in the classroom with real-world learning to support understanding of the virtual world as it connects to the physical one. Robotics, 3D printing, computer programming, digital flex-books and AR applications can join active classroom group learning with creative play to replace expensive textbooks.

For classrooms to become smart classrooms, they should be equipped with 21st-century productivity tools for accessing big data, the cloud, mobile and social applications, and technology that is still in development. Private sector technology companies such as Living PlanIT and Cisco can lead these technological education endeavors by sponsoring schools in their quest to advance lifelong learners. As more private companies join forces with education initiatives, the global community will inevitably become stronger.

That said, these strategies for education planning and financing this new direction are only part of the equation. As educators, we prepare students for the

> "Devices, digital data, algorithms, information and writing code replace managing livestock, digging sod, planting gardens, driving wagons and barn-raisings in the valiant effort to wrangle and lay claim to our suddenly cyber prairie."

jobs that exist but we also must deliver the tools that will help students with careers in their future as well. In the past, if you asked a child what they wanted to be when they grew up, you may have heard firefighter, teacher, nurse, chef or attorney. Careers could be easily defined and prepared for at an early age.

How does one answer a question for positions that don't yet have names? How does one navigate the education system in a manner that prepares a child to become a thought leader and social media influencer, an air traffic controller for automated flying cars, a remote graphic designer, web coder, chief city experience officer, or a smart city analyst?

Smart schools are understood to be organic spaces that must be imagined and reimagined. Socio-technical imaginaries will play a crucial role in adapting to the educational, familial and societal norms as they are defined and then redefined on a regular basis. The expectations of global citizens are already beginning to change as adaptive cities are learning to plan tangibly in an intangible medium. This strategy requires viewing technology that is still in various stages of development as if it already exists.

Technological urbanism is projected to reach $775 billion by 2021. IoT sensors and analytic platforms are already generating thousands of new hybrid positions. Anil Menon, global president of smart cities for Cisco, said, "Just as you had industrial engineering and computer engineering as counterparts to computer science and mechanical or electrical engineering, there will emerge new blends of technical degrees for urban engineering in different domains of utilities, mobility and city operations" (Maddox, 2018).

In a much-needed shift in an instant gratification climate, educators and students are becoming co-authors in new smart cities as they fill the role of pioneers and trailblazers on this new digital landscape. Devices, digital data, algorithms, information and writing code replace managing livestock, digging sod, planting gardens, driving wagons and barn-raisings in the valiant effort to wrangle and lay claim to our suddenly cyber prairie.

The solitary goal of education is to inspire and motivate students to be lifelong learners who are also responsible citizens. Schools must resist the urge to fall into familiar patterns and procedures, and embrace the ever-changing terrain. Sophisticated methods of collecting, analyzing and classifying data will mean seeing, hearing and knowing what the global citizens are doing to govern all aspects of the smart city efficiently and inexpensively.

By developing a social code in tandem with the technological code, we can prepare students who are confident as they take on the fluid environments in which they find themselves. Students will be equipped to positively manipulate their surroundings if they have teachers who are willing to share the knowledge and skills. By teaching students how to learn instead of what to learn, we can rest assured that we have paved the way for a brighter future. ■

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Street Smart

What Now?

The scarcity of people to fill positions in career pathways we can identify is illustrated by the human resources bottleneck on countless job boards, including the career platform powerhouse, LinkedIn. To help alleviate that burden on smart cities, author and tech enthusiast Teena Maddox identified 15 hot jobs that she believes are worthy of our students' attention and truly only the tip of the titanic tech iceberg (Maddox, 2018).

Machine Learning Scientist

"As cities increasingly leverage IoT deployments and are able to collect more data about weather [and] traffic from their assets in the field and mine it with third-party applications, data scientists are needed to analyze and create more value from that data and bridge data silos. The machine learning scientist is central to improving quality of life for citizens and enabling new revenue stream for the cities," said Remy Marcotorchino, director of marketing and market strategy for Sierra Wireless.

Developer

The rise of IoT will require more software, platform and database developers. While these positions already exist, smart cities will make the demand for this skill set far greater.

Cybersecurity Analyst

Smart cities depend on connection and visibility of their people and processes. From the private rights of individuals to celebrities and political officials, cybersecurity will play an integral role in the societies under development. On an even larger scale, should a city's power grid be taken down, its very survival could be at risk without the preventative measures of the cybersecurity analyst.

Industrial Network Engineer

The industrial network engineer is the individual responsible for choosing the right technological solutions for a city based on the needs of its citizens and the community as a whole.

Alliance/Partnership Manager

Similar to the industrial network engineer, the alliance partnership manager helps choose the best IoT technology to meet the needs of the smart city they serve. Additionally, this role will help form strategic partnerships in the private sector when funding is short.

Virtual Reality Specialist/Evangelist

Virtual reality (VR) will help operators and technicians, and may even assist in public safety in medical emergencies. VR can optimize the functionality of smart city services while significantly reducing the cost-benefit structure.

Chief City Experience Officer

By connecting physical and digital infrastructure in a meaningful way, a chief city experience officer ensures the well-being of their citizens. With the changes to come in augmented and virtual reality, much of this position will focus on easing people into a calm, adaptive state as opposed to a radical and abrasive one.

Autonomous Driving Scientist and Data Specialist

I know from my own professional experience that this role is an asset to every smart city and one that is already in demand. When I attended the Uber Elevate event earlier this year, presenters spoke about the autonomous cars on the ground and VTOLs in the sky. Specialists and scientists in this field are responsible for creating more accessible and comfortable vehicles that are also crash-proof.

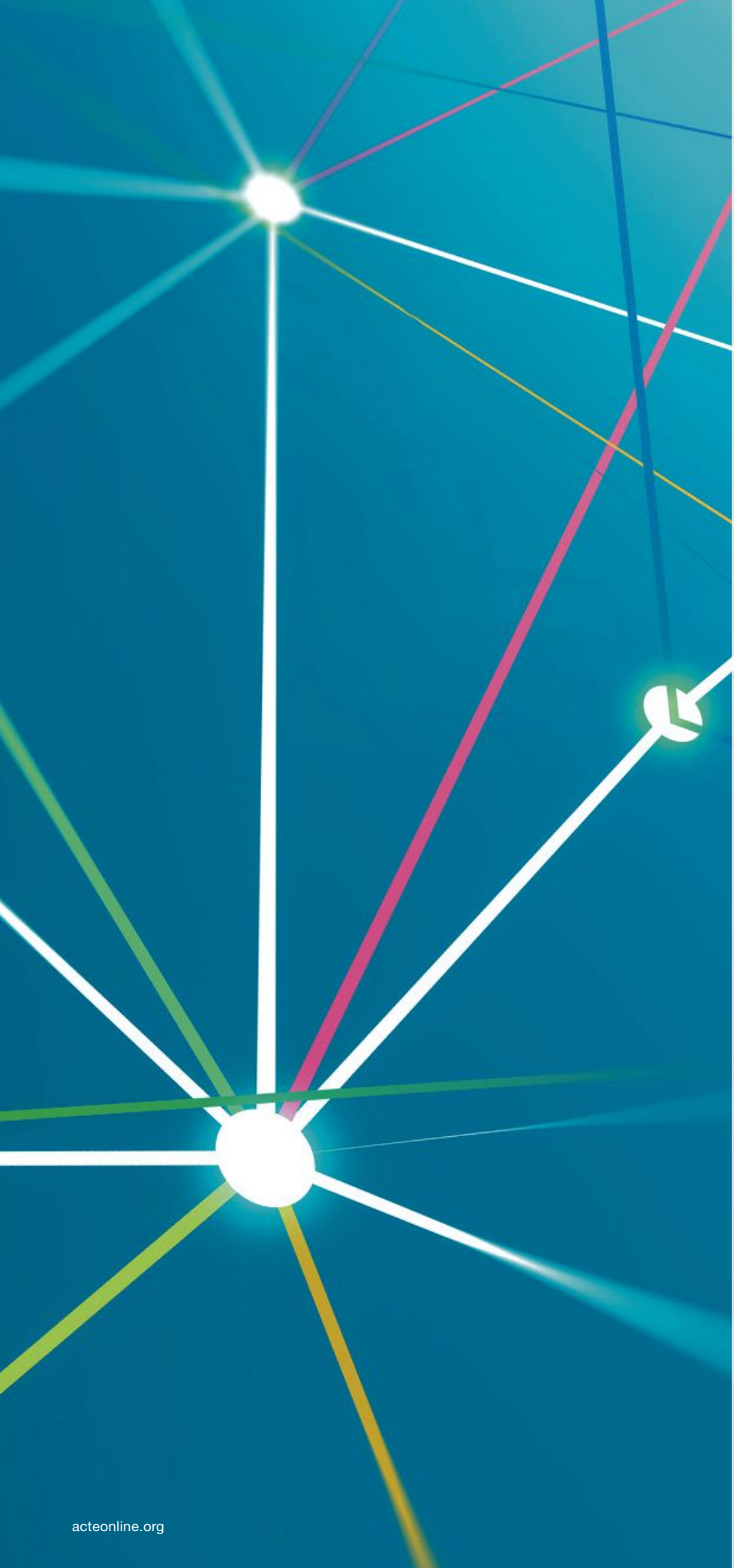
Network Reliability Engineer

Communication must be safe to be effective. A network reliability engineer's sole focus is to make sure the network is... well, reliable! Protecting cities from cyber threats is what will keep the city smart and help it continue humming right along.

THE TECHNICAL CONNECTION:

The South Carolina Technical College System and the Internet of Things

By Erin York & Stephanie Frazier



Chappell. McKinney. Maury. Davis. These names belong to four career and technical education grant administrators at colleges within the South Carolina Technical College System (SCTCS). The SCTCS has supported workforce development efforts across the state for more than 50 years. Comprised of 16 peer institutions, the SCTCS prepares students for employment in a wide variety of content areas. Regardless of whether students land a job at a renowned international company such as Boeing or BMW, or a smaller, locally owned business, the SCTCS is committed to equipping students with the skills necessary to keep them competitive in a global economy. In large part, this competitiveness is facilitated through an emphasis on connectivity — both inside and outside of the classroom — as the internet continues to strengthen our ability to create dynamic learning experiences and opportunities for students.

At their respective colleges, Chappell, McKinney, Maury and Davis support innovative strategies for utilizing the internet and technology to create connectivity for students. These colleges vary in size, demographics, the programs they offer and, certainly, in the technologies they use; however, each models programs that could be used at technical and community colleges across the country. Let's unravel their stories.

THE TECHNICAL CONNECTION:

The South Carolina Technical College System and the Internet of Things

Piedmont Technical College

Piedmont Technical College (PTC) serves approximately 6,000 students in credit programs each year. The main campus, located in Greenwood, South Carolina, sports a series of pristine white buildings and is home to the state's only funeral services program. When the chance to build an interactive, online video library for the program presented itself in 2016, the college was ecstatic. Caroline Chappell, Piedmont's grants administrator, worked with funeral services program director, David Martin, and faculty to bring the dream to life.

The college utilized Carl D. Perkins funds to purchase upgrades to the existing embalming lab, including a GoPro camera and a movable hanger that allowed for the embalming process to be filmed, edited and uploaded into the video library. According to Martin, before the creation of the online video library, very few supplemental materials existed for students in the program. Aside from what they learned in the embalming lab, the students relied primarily on a single textbook.

Martin went on to explain that, not only is PTC's program the only one in the state, it is one of only 56 funeral services programs in the entire world. The college has worked to make connections between other schools, business and industry, and even other countries that do not have access to formalized funeral services training. When industry contacts like the Dodge Chemical Company, the leading manufacturer of embalming fluids, use the college's lab, they add their own videos to the library for the PTC students to access.

Dedrick Dentt, funeral services program faculty, hopes to film unusual embalming cases, and to make videos on preparing a body for embalming and organ and tissue retrieval — for upload to the library. "You can't film everything," he explained. "However, we want our students to be prepared for any case they may come across once they graduate."

The funeral services program at PTC is competitive and accepts up to 30 students per year. Students apply from all over the world and may be placed on a waiting list; currently more than 100 individuals fill the waiting list. The video library adds another element to PTC's program that is unique and forward-thinking. Much like a medical school, the college has the latitude to keep and use cadavers for student learning (and filming) as long as they are needed, whereas other schools with funeral services programs often must return them after a set period of time.

At this time, PTC handles around 90 cases a year. For accreditation purposes, students are required to complete at least 10 cases before they graduate. Cohorts are limited to 15 students and two cohorts cycle through the program every year. Martin and Dentt prioritize students' abilities to complete all their embalming requirements and leave the program ready for the workforce.

"Perhaps our video library will also be able to help funeral directors and embalmers on the road," Martin said. He also hopes to add snippets of film that showcase a diverse range of religions and their funeral services. "We have barely scratched the surface of what we will be able to do with this initiative," he laughed at the end of the interview. But Chappell, Martin and Dentt grew serious again when they concluded that the expansion of the online resources they are able to offer their students remains at the top of their to-do list when they envision the future.

Spartanburg Community College

Less than an hour from Piedmont, Spartanburg Community College (SCC) also places emphasis on connectivity. SCC's Director of AIM and Student Disability Services, Leila McKinney, and Student Disabilities Coordinator, Joshua Holmes, helped forge a tech collaboration between the college and the South Carolina School for the Deaf and Blind (SCSDB). For over 20 years, SCC and the School for the Deaf and Blind have helped students transition from high school to college. Every year, as at least 15 SCSDB students enroll at Spartanburg Community College, SCC and the Office of Disability Services work diligently to maintain a nearly perfect record of student retention. But such a symbiotic partnership was not born overnight.

Holmes and McKinney reach out to students early, during their time in high school. They have found that fostering those relationships is paramount to the partnership's success. Additionally, once students make the leap from high school to college, the office works intensively with those students to ensure they receive the resources they need to succeed.

Holmes and McKinney have used Perkins funds to purchase a DaVinci screen reader and magnifier. They use both an embosser and a Braille printer to convert documents to Braille form for students in-house. On every single SCC campus, students have access to screen reader technology: Job Access with Speech (JAWS) licenses make computer navigation accessible for students with vision loss. Students are permitted to take a video phone or a portable magnifier to class and SCC also partners with the Commission for the Blind, which offers mobility services, so students can go on an orientation tour of the campus.

Helping students see there are options beyond traditional stereotypes can change their entire perspective on the world, Holmes expressed. Beyond technology offered by the Office of Disability Services, they strive to make students' goals realistic and attainable, and keep students up to date on their rights to accessibility and accommodations.

When Holmes and McKinney spoke about the future of their program, they shared that they hope to keep introducing new technological options to their students through Perkins grant funds. They also hope to magnify the worlds of the students that they serve, helping them to understand all of the options open to them.

Technical College of the Lowcountry

Farther south, the waves of the Atlantic Ocean wash up on Beaufort, the town home to the Technical College of the Lowcountry (TCL); yet, the students enrolled in TCL's cosmetology program are doing far more than spending lazy days at the beach. Libby DeLoach, the director of the program, utilizes a digital learning environment for her students in addition to the classroom setting and salon.

In 2016, DeLoach approached Elaine Maury, Perkins grant administrator, about using funds to purchase a new and innovative technology called Pivot Point L.A.B. (Learn About Beauty) that launched that year. She knew that students entered her program with a variety of different learning styles, from aural to visual to verbal and kinesthetic. She also knew that leading industry technologies were often too expensive for students to purchase. Thanks to grant money, TCL secured the digital learning environment, and students saw only a $40 increase in their tuition.

Now, the program's use of L.A.B. is going into its third year, and students and faculty alike cannot imagine life without it. "It's Monday morning. You're in class. Tell your students to break out their devices, and they immediately perk up," DeLoach explained. Students can use the digital environment in a variety of ways: They can view slide shows that accompany each chapter, access Smart Notes, study diagrams and even play games. "Take the chapter on nail theory," Maury chimed in. "You can match pictures with terms and get a score. It gives studying an element of fun."

When the coastal town of Beaufort experienced hurricanes where residents had to evacuate, cosmetology students took tests, completed assignments, watched videos and kept up with their studies remotely using L.A.B. Students in TCL's cosmetology program range in age 17–60. Many of them have jobs and families. The ability to stay on track with their coursework, to reach graduation, is vital for these students juggling multiple priorities.

DeLoach's motto is "do not settle." She wants state-of-the-art technology and the highest standards for her students who will graduate into an immensely competitive field. They must be exposed to technology and develop an understanding of branding, social media and the skills to run a successful business. L.A.B. integrates the technical side of the industry with marketing and self-motivation, DeLoach shared. "Instagram is huge right now, and it's free. It'll give them a leg up. L.A.B. can help them learn how to do this."

L.A.B. also allows for students who have learning disabilities to download the textbook, take tests in a multitude of ways,

and enlarge or print the content. DeLoach explained that one challenge for many older students is the lack of technological inclination, but the younger students are often willing to help. One other challenge, accommodating students without reliable access to internet or devices, is addressed by the installation of computer labs on campus for students.

"After students graduate, they will have access to the program for another year," Maury added. "If they need a refresher, they can find it."

There are two sides to cosmetology: artistry and business. DeLoach wants her students prepared for both. She finds that integrating L.A.B. into her program gives her the tools she needs to teach her students. Her future goals include continuing to educate and empower her students and to help them create their identity and have a lasting impact in the industry.

"We reached a point where we would either lose touch or move forward with new technology," DeLoach said. "Remember my motto. Don't settle. And we didn't."

Denmark Technical College

Administrators at Denmark Technical College (DTC) are working hard at not settling. The only historically black college in the SCTCS is home to a cybersecurity program that helps everyone become a little more connected. The access to and modality of education opens many doors in the Deep South.

Five years ago, the U.S. Department of Energy gave $13 million to historically black colleges and universities (HBCUs) to start a cybersecurity consortium. DTC was selected as the only two-year college in the effort. With grant funds from the Department of Energy as well as Perkins, Program Director Ronald Williams overhauled the old cybersecurity and computer technologies lab with the help of Tia Wright-Richards, dean of business, computers and related technology, and Tiffany Davis, grants and contracts coordinator. Hardware purchases included new computers, servers and firewalls. Instructional supplies, such as Raspberry PIs, also made their debut on campus. DTC introduced a cybersecurity certificate where students could choose to enter the workforce after completing the 30-hour program or transfer to a four-year school in the consortium to continue their education.

When Williams, Wright-Richards and Davis thought through the program, they realized they also hoped to create a pipeline for K–12 students in their service area. The Raspberry PI camp for middle school students and FINCH robot camp for high school students manifest that goal. "We serve up to 20 students at each camp," Williams shared.

One program graduate is now in pursuit of his Ph.D. and another is interning at Lawrence Livermore Academy in New Mexico. DTC has partnered with many colleges in the state of South Carolina as well as nationally, including Norfolk State University, Voorhees College, Claflin University, Benedict College and Allen University. "We look at students who haven't ever heard of a STEM program, and then see them graduate from our program. There's a significant impact," Wright-Richards shared.

The program has not been without its challenges. A location in an impoverished area of the state presents difficulty for placing students at internships and retaining program faculty. Nevertheless, the team has persevered and continues to dream big.

"We are in the process of applying for additional funding," Williams revealed. "We want to offer additional online classes and coursework on topics like secured coding. We want software and information assurance." They also hope to continue building their K–12 pipeline, to offer national certificates, and to build the program from a certificate into a degree. Above all, the team dreams of seeing their students succeed.

Conclusion

Arthur C. Clarke (1973), famed British science fiction writer, coined his third law and reminds us, "Any sufficiently advanced technology is indistinguishable from magic." Piedmont, Spartanburg, Lowcountry and Denmark merge the internet with their CTE programming to create magical moments for students in their respective service areas. They are working to bring students, faculty and industry closer together. While strategies exist throughout the state, these colleges offer unique examples based on their size, student demographic and area of emphasis. The self-produced online video library, partnership with the

School for the Deaf and Blind, cosmetology lab, and cybersecurity program all strengthen the state's technical connection with the rest of the world. They are shining beacons of light in the Palmetto State. ■

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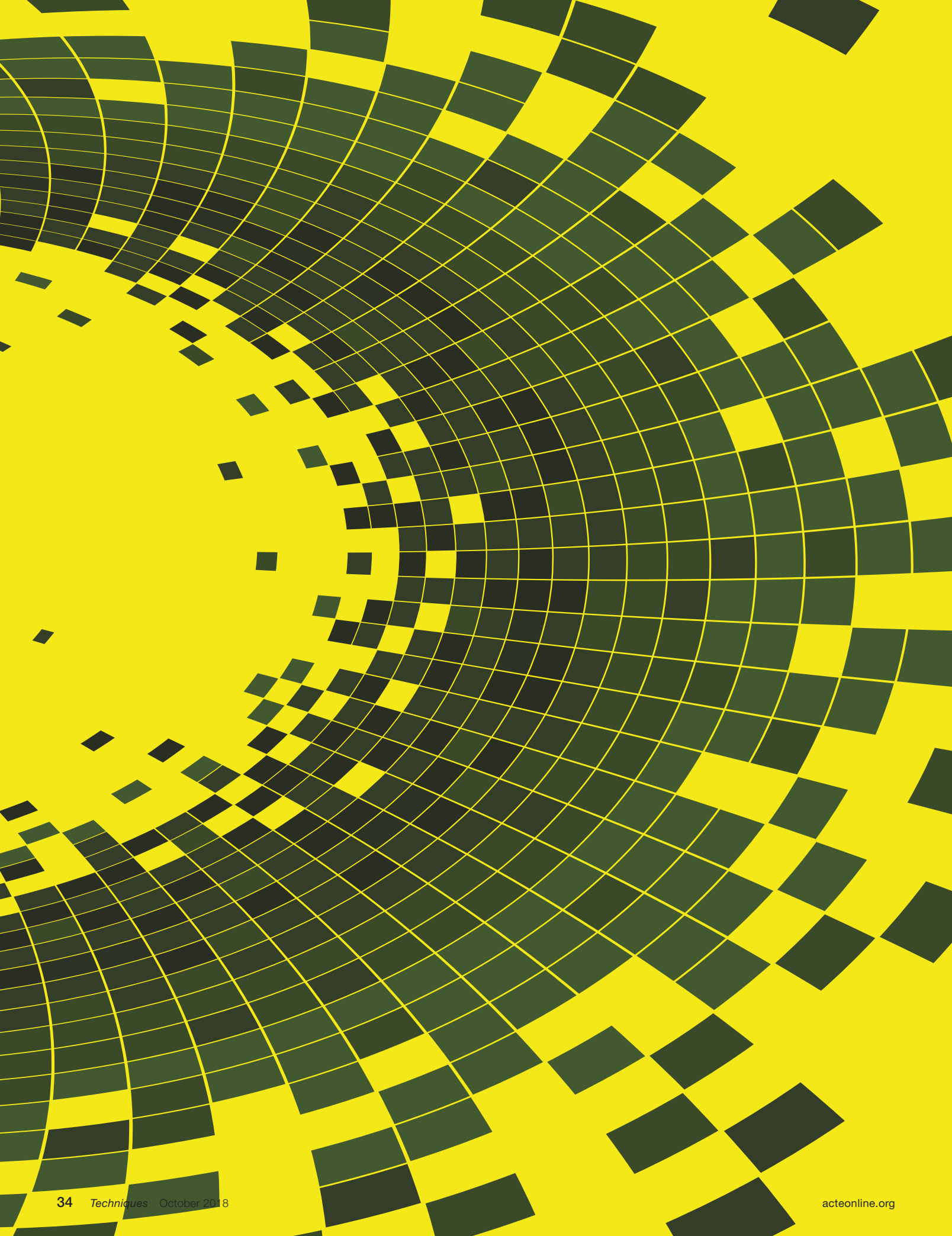

EarSketch: Inspiring Persistence in Computing Through Music

By Douglas Edwards, Jason Freeman, Brian Magerko, Tom McKlin, Taneisha Lee & Roxanne Moore

> "[EarSketch] teaches and sets us free. It's like our own playground wherein we're able to make whatever we want. We finished our projects," said a young, female computer science student. "Yes, I consider myself a programmer."

During a focus group, the student quoted expressed a changing perception of her interest in computer science and of herself as a programmer. This student exemplifies the significant improvement in both student engagement and content knowledge we have found to occur when students use EarSketch, a browser-based learning platform where they explore introductory programming through music remixing.

EarSketch:
Inspiring Persistence in Computing Through Music

Audio engineer Young Guru, who created many of the sound samples in the EarSketch audio library, reviews a student's project.

EarSketch engages students by enabling them to learn computing creatively through personal expression and music. Students learn elements of computing and mix music samples. They write Python or JavaScript code to algorithmically create music in popular genres including but not limited to trap, dubstep, hip-hop, rock and pop. Coding concepts (e.g., loops, lists, and user-defined functions) mix musical samples, beats and effects to develop tracks that students can access and modify anywhere with a broadband internet connection.

The computational thinking in which students engage while coding their music provides experience with a core skill necessary to succeed in a growing high-tech sector, and also for careers across many other domains; yet, computing is often seen by students as uncool, and approaches to teaching it may be uninspiring (Hewner & Knobelsdorf, 2008; Mahmoud, 2005). African American and Latino students, as well as women, are vastly underrepresented in computing courses as compared to their male Caucasian and Asian counterparts based on demographic data from the Advanced Placement Computer Science A exam (Ericson, 2018).

The integration of music into introductory computing education presents unique opportunities to engage students and to broaden participation in the field. Students dedicate an enormous portion of their daily lives to music listening and sharing, and these activities play a crucial role in forming their cultural and social identity (Abrams, 2009). A recent survey of high school students using EarSketch reinforced the prevalence of music in students' lives: 59.8 percent of students reported spending three or more hours per day listening to music (McKlin et al., 2018). Additionally, the rise of consumer-facing music software and apps (e.g., GarageBand and Magic Piano) has made computer-based music creation a ubiquitous practice — even for users without prior training in music or music technology.

In addition to music's potential use as a hook to engage broad student populations in computing, pedagogical connections between the two disciplines abound. Many musical concepts, structures and processes map easily and naturally to computational thinking. For example, the abstraction of code segments into functions parallels the repetition — with variation — of sections of music like the chorus or bridge of a song. Our work with EarSketch leverages this tremendous potential of combining music and coding and embraces two overarching design priorities:

- EarSketch provides an immediate opportunity to act (Carroll, 1998) and to be musically expressive, even for students (and teachers) who have no previous background in either music or computing. Anyone can quickly begin making compelling music in EarSketch with just a few lines of code and audio loops from an included library of 4,000 sound samples.
- EarSketch is perceived to be authentic (Guzdial & Tew, 2006; Lee & Butler, 2003; Shaffer & Resnick, 1999) by students in both the computing and music domains. Its interface design and underlying functionality borrow heavily from standard music production and software development tools and practices. EarSketch uses JavaScript and Python programming languages, which are pervasive in both industry and education, and provides students with audio samples, created by two music industry veterans, that serve as the musical building blocks for students' compositions.

The EarSketch Learning Environment

The EarSketch learning environment is a free browser-based application that allows students to begin making music through code in a single class period. In the EarSketch code editor, students write code in Python or JavaScript using text or a blocks-based visual code editor (Bau, 2015). Regardless of language or editor chosen, they use the same application programming interface (API) to create music. The use of industry-standard programming languages emphasizes the real-world dimension of authenticity. It also emphasizes the transferability of skills to other computational domains and to other educational and career contexts.

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> "My students are a lot more confident, and many of them have signed up for AP Computer Science when they would not have before. Because now they feel like, 'Yeah, I can do this. I'm not afraid of programming. I'm not afraid of writing language'."

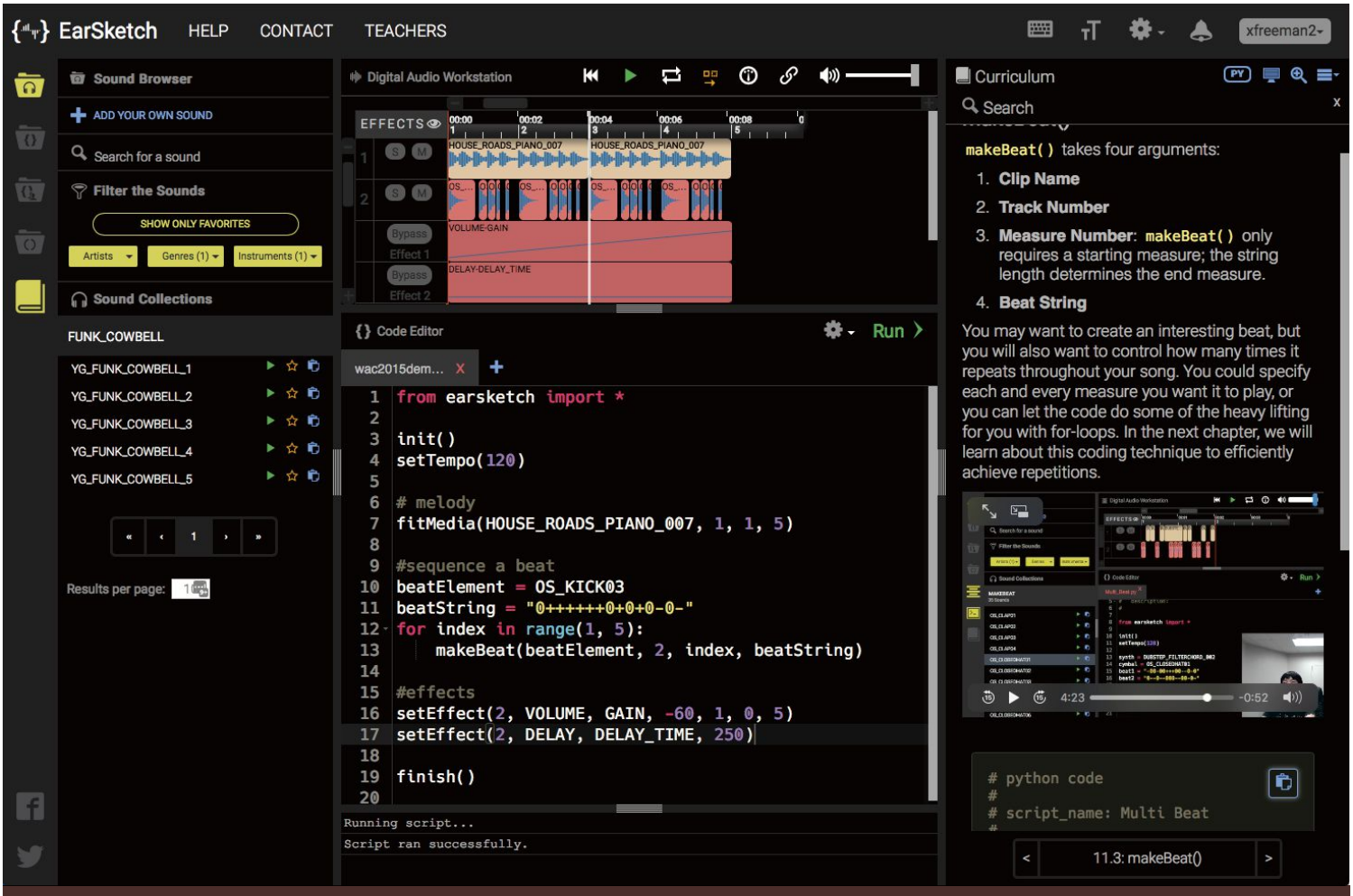

FIGURE 1: The EarSketch learning environment includes a sound browser (left), code editor (center bottom), digital audio workstation (center top) and curriculum browser (right).

> "I got to express my ideas through EarSketch and it was fun and inspiring to see that I could be good at computing."

Figure 1 illustrates a simple EarSketch program application in Python, incorporating a few of the most common API functions. The fitMedia() function on line seven plays a piano audio loop on track one. Lines 10 through 12 design and play a background beat on track two using a for loop computational structure. Line 16 fades in the piano on track one, and line 17 adds a delayed echo effect to the background beat on track one.

When users run their code, the results are displayed in a digital audio workstation (DAW) panel that closely mimics the multi-track displays found in music production software (as seen in the center top of Figure 1). Students can see and hear the results of the code execution, control playback, export their audio for use in other music software or share it directly online. Unlike conventional DAWs, they cannot directly modify audio or effects in the graphical interface: They must accomplish these activities through changes in code.

EarSketch includes approximately 4,000 prerecorded sound samples accessible via a sound browser sidebar. Covering a wide range of popular genres, this sound library was created by sound designer and electronic musician Richard Devine and Young Guru, Jay-Z's Grammy-nominated audio engineer and DJ. Students can also upload their own sounds, record sounds directly within EarSketch and/or import them from Freesound, a large online collection of Creative Commons-licensed sounds. This approach encourages students to identify musical genres and content that are personally meaningful to them and to incorporate this content into their own work.

The sound browser pane allows users to search and filter sounds by artist, genre and instrument. Sounds are grouped into folders that contain loops in the same style and key and are designed to fit well together. By using loops within the same folder, novice users are able to create music that is stylistically, harmonically and rhythmically coherent, even without knowledge of the music theory behind these elements. An additional sidebar displays instructional materials for students, including explanatory text, runnable code examples, video demonstrations, multiple-choice questions and slides.

Curriculum and Teacher Materials

The EarSketch curriculum is aligned with the programming standards of the College Board's advanced placement (AP) computer science principles (CSP) course, as well as a related (non-AP) computer science principles course that is standard for high school students in the state of Georgia. AP CSP was launched in the fall of 2016 with a goal to offer a rigorous introductory curriculum that would broaden participation in computer science. The course introduces students to the creative aspects of programming, abstractions, algorithms, large data sets, the internet, cybersecurity, and the impacts of computing across multiple domains (Astrachan et al., 2011).

Thirty-five CSP learning objectives are organized around seven big ideas and six computational thinking practices. Its curricular framework is broader than that of traditional computer science courses, with a focus on collaboration, analysis, communication, creativity and connections to other disciplines. In contrast to other introductory computing courses, CSP is language-agnostic. It does not mandate a specific programming language or problem domain: Students submit performance tasks created with a programming language and/or within an environment of their choice. This all facilitates the integration of EarSketch.

EarSketch curriculum for CSP consists of a 10- to 12-week module covering all learning objectives for programming and many of the objectives for creativity, abstraction and algorithms. The EarSketch CSP module is organized into three units. Each unit features an authentic challenge that requires the student to code musical concepts.

In the first unit challenge, students select a client from their local community and apply research on how tempo and pitch affect mood to develop music for an advertisement. In addition, the student must apply musical effects, like volume fades or pitch shifts, to help create the mood. Students share their music and code with their classmates and teacher and, based on the constructive feedback received, they then iterate on their creation, share with their client to receive additional feedback, and further iterate to reach a final product. Students use a rubric check sheet to confirm they have satisfied all the criteria of the challenge and write a justification of how their programming artifact fulfills the

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> "It gives me choices for college. Computer science is something I would actually like to do with my life."

technical and artistic requirements of the project.

In open-ended projects such as this, there is no single correct solution. Students must collaborate and communicate with their classmates, their teacher and external partners to refine the project goals, assess work in progress, and devise new musical and computational strategies to address feedback. The EarSketch CSP module follows this studio-based learning (SBL) approach across all three units (Hendrix et al., 2010):

- Designing an artifact
- Presenting work to peers and teachers, along with a detailed justification of the decisions made
- Discussing the work of peers and offering constructive questions and feedback
- Revising work based on the feedback of others

Computing teachers may be unfamiliar with this approach and the idea of teaching CSP within the domain of music. We have thus developed scaffolding and supports for teachers that include lesson plans, slides, worksheets, mini-tasks, rubrics and other teaching materials; face-to-face and online professional development; and an interactive community where teachers can ask questions, share materials and review additional training resources.

Implementation and Research Findings

There are currently more than 250,000 unique EarSketch users from all 50 states and more than 100 different countries. We have used EarSketch in summer camps with rising third graders and high school students, and in classrooms from ninth grade to college. Three quantitative studies, conducted in order to explore students' intention to persist (Magerko et al., 2016; McKlin et al., 2018; Siva, 2018), have shown significant pre- to post- increases in intention to persist as well as in students' attitudes toward computing in identity, confidence, belonging, enjoyment, motivation and importance.

During our most recent study with 19 metro-Atlanta high schools, students — majority-represented and underrepresented — demonstrated significantly improved content knowledge and engagement in computing based on assessment and a student engagement survey (McKlin et al., 2018). The study teachers completed a blended summer professional course that consisted of a total of 20 hours: seven hours online and 13 hours face-to-face over three days. The teachers also became part of our community, where they can participate in a Facebook group and share their results and how they have adapted EarSketch instruction.

Conclusion

While our curriculum development and research focus, to date, has centered introductory computing at the high school level, we have begun to create new curricula and to study the impact of EarSketch — on student engagement and intention to persist — in other learning contexts. These include an introductory course for undergraduate non-majors, developed in collaboration with Georgia Gwinnett College, where our initial findings suggest similar student impact (Siva, 2018), as well as work currently underway on music-centric courses for middle-school students and on introductory technology courses for middle school and high school students.

We have also staged online and in-person EarSketch competitions to recognize exemplary creative and technical projects from students. In these competitions students discover the connections between algorithmic composition and domains such as music production, entrepreneurship, writing and visual art.

More than anything else, our goals are exemplified in the words of computer science students and their teachers: that they be inspired to integrate music and coding, and to find joy and balance in both. ■

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> "I tend to have students who are either placed in the course and have no idea what [computer science] is, or they have absolutely no experience in programming. I think EarSketch levels the playing ground."

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EXPLORE MORE

EarSketch is available at earsketch.gatech.edu.

ACTE Student Trophy Design Contest Winners Set Standard for Excellence

By Lia Milgram

ACTE is committed to providing career and technical education (CTE) students with opportunities to develop the skills they'll need for success in a global economy. One such opportunity, the Student Trophy Design Contest, encourages secondary, postsecondary and adult CTE students in 3D design or CAD courses to develop and submit a trophy design that reflects the prestige of ACTE's Excellence Awards Program. Designs are then judged by ACTE staff and Stratasys Ltd. — a manufacturer of 3D printers and production systems — on visual appeal, function and structural integrity.

"Stratasys is pleased to partner with ACTE to create this contest for the students. It is clear that the educators are doing an outstanding job immersing the students in additive manufacturing and computer-aided drafting," said Jesse Roitenberg, national education manager for Stratasys. "The trophy entries we have judged over the past three years are phenomenally designed and could not be created by any other manufacturing process."

We are proud to announce that the winners of the 2018 ACTE Student Trophy Design Contest are Rashi Kejriwal and Shreya Santhanagopalan, of Ellicott City, Maryland, supported by their teacher, David Lucania.

Winners of the 2018 ACTE Student Trophy Design Contest, Rashi Kejriwal and Shreya Santhanagopalan, will receive a $1,000 scholarship prize, a one-year lease of a 3D printer (courtesy of Stratasys) and materials to be installed at their Maryland high school, and a trip to ACTE's CareerTech VISION 2018 in San Antonio, Texas, where they will be recognized at the Awards Banquet before the Association's esteemed award winners, industry leaders and attendees. And here, an exclusive interview.

"I have had the privilege of teaching Rashi Kejriwal and Shreya Santhanagopalan since they enrolled in the Project Lead the Way engineering program during their freshman year at Mount Hebron High School; now juniors, they are among our top-performing students," said David Lucania, a technology education instructor in Ellicott City, Maryland.

"Kejriwal and Santhanagopalan possess an amazing work ethic and are genuinely excited, each and every day, to learn and grow. They see the need for more young women in CTE programs and are proud to be ambassadors for future female engineering students."

The Mount Hebron High School juniors, Kejriwal and Santhanagopalan, sat down with *Techniques* recently to discuss the school's CTE program, their interests in STEM now and in the future, and how they were inspired to enter — and ultimately win — the 2018 ACTE Student Trophy Design Contest.

Lia Milgram: Tell me a little about yourself and your background, your school, your experience with CTE, and your plans for the future.

Rashi Kejriwal: I'm a junior in Howard County, Maryland, at Mount Hebron High School and I'm enrolled in the Project Lead the Way (PLTW) engineering classes at our school. Personally, apart from PLTW, I have always had a background in STEM. For example, I completed an assignment in elementary school in which students were tasked to design and build a city; mine was based around a computer's motherboard and environmental efficiency. The city featured buildings modeled after the CPU in the center of the board and solar panels throughout.

I have participated in three Rube Goldberg challenges as well as the FIRST LEGO League, in competition to develop real-world solutions for challenging problems. Currently, I am learning many different types of computer software and programming. Through these and other activities I have developed a strong interest toward multiple fields in engineering. In the future I want to pursue a career in which I can learn and contribute to society. I am still exploring what I want to do specifically, but I know I want to continue with higher education and future work in engineering and artificial intelligence.

Shreya Santhanagopalan: I am also a junior at Howard County, Maryland's Mount Hebron High School. I'm also enrolled in the Project Lead the Way classes and I plan to finish the program. (Editor's Note: Project Lead the Way engineering programs feature nine classes in grades nine through 12, designed to "engage students in compelling, real-world challenges that help them become better collaborators and thinkers" ("PLTW Engineering," n.d.). Courses include introduction to engineering design, principles of engineering, digital electronics and environmental sustainability, among others.)

From a young age, I was brought up to love engineering tasks and figuring

out solutions to difficult problems. I began to learn to code when I was in fifth grade and grew a love for it over the years. In middle school I learned to create multiple apps with guidance. I also programmed a machine, with multiple options, to complete its given task.

In my high school career I have continued my engineering interests by taking computer science along with PLTW courses in order to expand my knowledge and learn more about the field. I would like to pursue a career in which I am able to share my abilities with others and learn. I am still exploring options for my future but I take great interest in computer science and engineering, and I plan to attend college until I receive a Master's degree in my chosen field.

LM: How and why did you decide to enter the ACTE Student Trophy Design Contest? What inspired your winning design?

SS: Rashi and I were intrigued when our teacher, Mr. Lucania, brought up the ACTE Student Trophy Design Contest in our shared Project Lead the Way class.

RK: Since we were both quite proficient and interested in AutoDesk Inventor, which is the program we used to create our trophy, and we had a great work dynamic previously, Shreya and I decided to take up the competition together.

SS: After weeks of planning in school classes and meeting outside of school, we had developed seven different design sketches, but we needed to find some way to create only one cohesive design. First we eliminated designs that were not up to par with the others, and this left us with two.

RK: We combined the top portion of one remaining design with the bottom portion of the other to create our final design. For the top portion we started with the ACTE logo, which we wanted to be the main focus. The top also represents a globe-like structure with a steering wheel shape to signify that we are in control of our future. And the base, which contains a spiral, was inspired by innovative thinking.

LM: What guidance did your teacher provide?

RK: Our teacher, Mr. Lucania, was the one who first taught and introduced us to AutoDesk Inventor.

SS: When it came time to build the trophy, Mr. Lucania's mentoring, along with the use of AutoDesk Inventor and its unique features, helped us turn our dreams into reality.

LM: What are your hopes for, and how do you plan to use the 3D printer leased by Stratasys?

RK: We want the 3D printer leased to us by Stratasys to be used to benefit our school. Specifically, we hope students enrolled in the Project Lead the Way classes will benefit and be able to experience the 3D design process.

SS: Currently, at Mount Hebron High School, we only have one 3D printer. The lease and use of an additional 3D printer will allow a great majority of the engineering students to experiment with this technology.

LM: Thank you for taking the time to speak with me. And congratulations again. ■

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EXPLORE MORE

The ACTE Student Trophy Design Contest is back for 2019! Encourage your CAD and 3D-design students to enter the competition, which is open to those enrolled in secondary, postsecondary and adult CTE programs. To learn more, visit www.acteonline.org/professional-development/acte-awards/.

Teaching Outside the Box

By Chaney Mosley, Nicole Cobb & Kristopher Elliott

WHEN PEOPLE ARE ASKED TO LIST SOME OF THE TOP MARKET SECTORS IN THE UNITED STATES, rarely do they reference the outdoor industry as a leading economic driver. In a country as large as the U.S., with so many natural outdoor spaces, it's understandable why we might overlook the related career opportunities. When we look at the numbers, there's no denying the outdoor economy continues to grow in importance; according to the U.S. Department of Commerce, Bureau of Economic Analysis (2018), the industry accounts for a larger percent of the economy than oil and mining, growing at a rate of 3.8 percent in 2016 and exceeding the growth rate of the overall economy. As we continue to think about ways in which to better prepare students for future careers while contextualizing their learning, perhaps we should focus more on the myriad opportunities for students to pursue the outdoors as a career option.

Get Out[doors]

You may be asking how an outdoor learning and careers article found its way into a *Techniques* issue focusing on technology. The answer is twofold. We agree that our students' futures are tied to opportunities in technology booming like never before. This applies to every career; technology is pervasive. In fact, technology is reshaping how we interact with natural spaces. Have you noticed the number of mobile applications related to outdoor activities?

While outdoor spaces provide opportunities to explore more technology opportunities, they also provide a space for

"While one might think of traditional career pathways, the outdoor economy includes many industry sectors: outdoor recreation, manufacturing (Think gear and apparel.), finance, retail, transportation, food service, tourism and travel. These diverse, high-paying careers exist throughout the U.S., both in large urban areas and small, rural towns."

us to learn in its absence. There is value in having students learn to unplug and use their own natural senses. As such, we propose a balanced approach to technology — one that incorporates the responsible use of tech and encourages stepping away for a different approach to learning.

Big is an understatement when referencing the importance of the national outdoor economy. According to the Outdoor Industry Association (2018), the outdoor recreation economy generates $887 billion in consumer spending annually, 7.6 million jobs and $125 billion in federal, state and local tax revenue. That adds up to more jobs than computer technology, construction and trades, finance and insurance, and transportation. Even more impressive, reports the Outdoor Industry Association, more Americans participate in outdoor recreation than attend all NFL, NBA, MLB and NHL games combined! The U.S. is the international leader in outdoor recreation and the industry is an important career area consideration for our students.

While one might think of traditional career pathways (e.g., park rangers and foresters), the outdoor economy includes many industry sectors: outdoor recreation, manufacturing (Think gear and apparel.), finance, retail, transportation, food service, tourism and travel — supporting careers that include product design and development, specialized retail, technical apparel, footwear, new technologies, sustainability, manufacturing and global commerce. These diverse, high-paying careers exist throughout the U.S., both in large urban areas and small, rural towns. Similarly, many higher education and postsecondary opportunities are emerging to help students prepare for outdoor economy careers. Related degrees and certificate programs are becoming more popular at institutions like Unity College, Naropa University, Middle Tennessee State University and Oregon State University Cascades, to name a few.

Exposed to the Elements

While some are exposed to the outdoors through family activities or personal hobbies, a future career in the outdoor industry might not occur to many students. As career and technical education (CTE) teachers strive to prepare students for postsecondary pursuits, and because opportunities in the outdoor industry span all 16 career clusters in the National Career Clusters Framework, outdoor learning pedagogy can be a tool for introducing students to the industry, but.

What is outdoor learning?

Different from outdoor education, which focuses on the outdoors as the primary subject, outdoor learning is a pedagogical method teachers can use to provide CTE subject-specific content instruction. Leaving the classroom reinforces learning by providing students with opportunities to apply knowledge and skills in a practical way, outdoors.

Outdoor learning draws upon experiential learning, a cornerstone of CTE. Modern philosophies of outdoor learning accentuate responsiveness to local conditions and cultural traditions. Emphasizing the importance of responding to and empathizing with places rich in local meaning and significance, outdoor learning pedagogy meets the educational needs of today's youth as they grapple with rapid social and ecological changes. Further, outdoor learning is accessible to everyone regardless of geographic location or socioeconomic status. Let's face it. Teachers and students alike can feel claustrophobic inside the same walls all day. The pedagogy of outdoor learning requires leaving the four walls of a classroom from time to time and teaching outside the box.

To better understand outdoor learning, take a look at the conceptual framework (Figure 1) with four concentric circles describing high-quality outdoor learning pedagogy. The outer circle explains how, when applying this method, instruction moves seamlessly from indoors to outdoors and can occur repeatedly throughout a lesson. The middle circles indicate characteristics of a lesson that must be present for outdoor learning instruction. There are three primary domains: curricular focus, outdoor location and real-world application, followed by descriptors. When all nine descriptors are present in a subject-specific lesson, a teacher has used outdoor learning pedagogy!

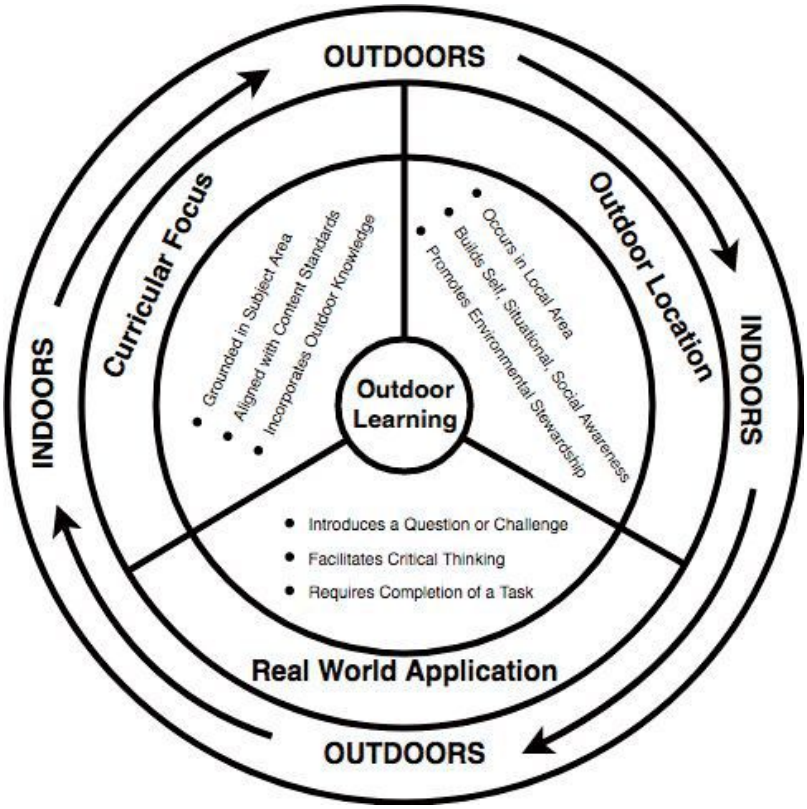

FIGURE 1: Outdoor Learning Conceptual Framework (Mosley, Cobb, & Elliott, 2018)

Key tenets of other instructional methods — project-based learning, social and emotional learning, contextual teaching and learning, place-based learning, and deeper learning — are embedded in this pedagogy. Outdoor learning can be further enhanced by incorporating literacy with a book study or article about the outdoors, using an outdoor expert as a guest lecturer, and teaching global competence to help students prepare to live and work in an interconnected world.

Where is the time?

In this era of accountability, one might wonder if we have the luxury of time to incorporate outdoor learning into our already packed schedules. Intuitively, we know how we all benefit from an afternoon spent on a trail with the sun beaming through the trees. The good news is, we now have an extensive (and ever-growing) body of research to support time spent playing and learning outdoors. In today's world, our students spend more time playing video games, watching television or on social media than they do anything else. The Kaiser Family Foundation found that, among eight- to 18-year-olds, the average child spends over seven hours a day on media platforms, a phenomenon coined as "nature deficit disorder" by researcher Richard Louv. Louv connects the rise of obesity, along with increased psychological and academic problems, to a decline in outdoor time. He explains that this disorder, though not clinical, relates to trends in children's mental and physical health, arguing that children have less exposure to nature and fewer opportunities to explore natural landscapes (Louv, 2008). Teachers are in a prime position to help combat this epidemic.

Learning outdoors provides an immediate and real experience for students that sparks questions, offers avenues of exploration and investigation, and is available at little to no expense. The outdoors also serves as a natural setting

that encourages an interdisciplinary approach to learning — engaging students in real-world experiences and problems can lead them to think creatively and critically about the world. The processes of inquiry and analysis that students use in outdoor instruction transcend the boundaries of subject areas. Providing students with direct experiences helps them make connections and master curriculum standards, while also being encouraged to think about their roles in the community and environment.

Not only does outdoor education generate energy and enthusiasm in the classroom, it can also help slow the pace of learning and promote reflection. A natural environment can enhance the senses and allow students to be more observant of sights, sounds, smells and textures. Engaging multiple senses can deepen learning, and learning outside makes the process more about experience than rote memorization, helping students produce concrete connections for abstract concepts, thereby enhancing understanding of concepts. Students who struggle in traditional classroom settings can gain the most through outdoor education. Instead of experiencing struggles with motivation, confidence, attention or social skills while stuck indoors, students gain these particular skills and can thrive and take on the leadership roles and have a sense of achievement. Access to nature has also been shown to decrease the symptoms of ADHD/ADD (Taylor & Kuo, 2011).

It's good for you.

Another argument for the inclusion of outdoor education is that it helps to develop students' social emotional competencies, in turn supporting their engagement in the curriculum. Social and emotional learning (SEL) is the process through which students learn to recognize and manage emotions, care about others, make responsible decisions, behave ethically and responsibly, develop positive relationships and avoid negative behaviors. The benefits of SEL extend from socially acceptable behaviors into the academic realm. Key findings that link SEL to academics include improving academic performance and educational outcomes, promoting deeper understanding of subject matter, helping students learn well with others, increasing student engagement in school, and decreasing behaviors that interfere with learning (CASEL, 2018). When students engage in classroom content outside, they learn cooperation, conflict management and communication skills that transfer to other aspects of their lives. Further, outdoor learning positively impacts students who experience high levels of stress or trauma outside of school, as being exposed to natural environments can help increase resilience against adversity (Brody, 2011).

Students are not the only ones who benefit from outdoor learning; taking the classroom outdoors benefits teachers as well. With high teacher attrition rates, increasing class sizes and mounting testing expectations, it's a good time to ask: How can outdoor education support teacher well-being? Teaching outdoors makes educators more confident and enthusiastic about their work and more innovative in their teaching strategies. Going outside takes away the boundaries of classroom walls, giving teachers the time and space to see things in new, creative ways. Teaching outdoors invigorates us when we see students get excited about concepts that once bored them. We can respond to their inquiries and curiosity with a newfound enthusiasm for our craft.

When examining career clusters and their related pathways, it is easy to see the ways in which students could pursue a career in the outdoor economy. While we would need many more pages for every example, there are few, if any, pathways that can't be tailored to a career in the outdoors. Arts, audiovisual technology and communications? Resort towns, big retailers and independent destinations are host their own local media, including traditional broadcasting and emerging social media. In fact, many new marketing opportunities exist, through nontraditional methods like Instagram and Google analytics, in connection to the outdoor industry. Health sciences? The outdoors is good for our health. As such, health and insurance companies are devising new ways to help get us outside and more active. Agriculture, food and natural resources? This sector works to help find the careful balance of recreational use of our forests and natural lands, food production and resource management. The list goes on and on. The key is this: Each career pathway can be applied to the outdoors. We only need to ask, "How?"

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Career Pathways 2.0: Academies of Louisville Link Coursework to College and Career Readiness

By Christy Rogers

IN 2013, WITH AN ECONOMY ON THE UPSWING AND COMPANIES LOOKING TO OPEN OR EXPAND, Louisville, Kentucky — home to industry leaders like Ford Motor Company, UPS Worldport, GE Appliances, Humana and Norton Hospital — faced a challenge echoed in many cities across the country: too few qualified workers to meet the demand.

The problem didn't impact just business, of course; young workers entering the job market found themselves unprepared for the high-tech, high-skilled and high-paying roles of the 21st century. There were good jobs to be had but no one to have them.

The community took action. Jefferson County Public Schools (JCPS) began meeting with leaders in business, civic and community organizations to develop the JCPS Ford Next Generation Learning (NGL) Master Plan, an innovative strategy designed to transform teaching and learning, redesign high schools, and sustain the changes through premier partnerships. The goal was simple: Increase the number of students who graduate college- and career-ready.

The master plan was written at a time when professional career theme academies were emerging as among the most successful strategies for developing a personalized, supportive learning environment. The objective was to improve student achievement and graduation rates, and help graduates transition to postsecondary education and the workplace. Over the next three years, the district embarked

> "What happens in our classrooms today impacts what happens in our world tomorrow," said Dr. Pollio, who was appointed the district's permanent superintendent in March 2018. "The academy model connects schools to committed business partners, and links what students learn in the classroom to real-world experiences so that all academy graduates are prepared for college, career and life, and ready to compete in a global economy."

on Phase 1 of the Ford NGL model, which promised collaboration, stakeholder engagement and commitment.

Challenges

For all its early promise, the career academy model did not scale as written in the master plan. Key school leadership changed; business and community leaders went back to work, and competing programs were championed. Although the master plan had been crafted and supported by communitywide partners, there was no singular leader — an individual who would be focused on implementation and progress. Many high schools throughout JCPS implemented pieces of the Ford NGL system with freshman academies, career pathways and business partnerships but overall, the district initiative lacked coherence promised by the master plan.

The workforce shortage grew more dire and, in 2016, business leaders challenged local educators to reboot the master plan and create a version 2.0 — focused on implementing the career academy model like the one at Doss High School, helmed by Dr. Marty Pollio. A former social studies teacher and assistant principal, Pollio has been a JCPS educator for more than 20 years. He served as building principal of Jeffersontown High School and then Doss, and remains committed to small learning communities and challenging teachers to engage students through the lens of career academies. In 2017, he was appointed acting superintendent of Jefferson County Public Schools, serving more than 100,000 students.

JCPS formed a new business guiding team and tasked key representatives with identifying business partners; meeting regularly to discuss the development of necessary skillsets; and gaining trust and support from the community, as well as implementing the updated model. Other changes included district clarification of school-level non-negotiables, development of a support package, and communication of a clearly defined mission to every JCPS high school. In a move to generate enthusiasm and buy-in, instead of implementing from the top down, schools were required to apply to be part of the newly branded Academies of Louisville.

"The first time around, we built the plan and then we stepped back and asked the school system to do all the work," said Michael Gritton, executive director of KentuckianaWorks and a key supporter of the initiative. "This time we are staying engaged and providing support and guidance."

Launched at the start of the 2017–18 school year, the Academies of Louisville aim to evolve public education to equip students with the skills and know-how to meet the needs of a 21st-century workforce. The academy model benefits all students through a personalized learning experience within small learning communities; participation in hands-on, project-based learning; development of employability skills; and community involvement.

The Academies of Louisville High Schools promise to prepare, inspire and empower students by offering a new kind of educational experience — one that shifts from traditional teaching and learning to more engaging, relevant instruction. Local leaders have extolled the academies initiative as the educational link to economic development in Louisville, and beyond.

"What happens in our classrooms today impacts what happens in our world tomorrow," said Dr. Pollio, who was appointed the district's permanent superintendent in March 2018. "The academy model connects schools to committed business partners, and links what students learn in the classroom to real-world experiences so that all academy graduates are prepared for college, career and life, and ready to compete in a global economy."

From its business partners JCPS learned the 'carrot and stick' approach to motivation. The entire school community and site-based decision-making councils were required to sign the application to implement, with fidelity, all structures of the academy model. In return, schools would get added career pathways, teachers, equipment, training, administrators, counselors and the all-important academy coach.

Academy students benefit from the following:

- Direct career and industry exposure
- More personalized education
- Rigorous, hands-on learning
- Development of 21st-century essential skills such as creativity, leadership, problem solving, critical thinking and determination
- Community involvement
- Networking opportunities with local industry professionals
- Academic and technical knowledge and skills mastery
- College credits, industry certification and internship experience
- Seamless transition to post-secondary education

When Academies of Louisville 2.0 re-launched in the fall of 2017, 11 JCPS high schools had signed up, each offering a freshman academy and specific career academies.

The freshman academy helps rising ninth-grade students transition to high school. These smaller, more personal high school learning environments provide students the opportunity to take a career seminar course in which they focus on personal and career exploration. All freshmen participate in an industry-related field trip and a promise-to-graduation ceremony. Students engage in selecting their career academy during the scheduling process and schools celebrate with events like the Career Academy Reveal, held at Seneca High School.

Small Learning Communities and the Academy Model

In 2018–19 the original 11 schools will organize into small learning communities and JCPS will onboard an additional three schools, bringing a total of 14 high schools into the wall-to-wall career academy model. At that time more than 17,000 high school students will be afforded all the benefits of a career academy, and JCPS is poised to make a huge jump in transition readiness and successful outcomes for high school graduates.

The career academies are designed for 150–300 students who share common classes, and in which a core group of teachers collaborate to develop authentic, problem-based learning units. The goal is for every academy student to feel a sense of security, ownership and belonging, leading to increased attendance, participation and student achievement. Students enrolled in an academy take increasingly focused coursework, starting in the 10th grade with one introductory career course and then a sequence of career-related courses, culminating in industry-recognized certification and licenses.

Academies are designed to revolutionize how students learn, how they feel about learning, and how they will approach the world. Each career-themed academy has a dedicated principal, counselor and core group of teachers working side-by-side with business partners to determine what students should know. More than 80 business partners have signed on to the career academies, working closely with teachers to ensure students have the academic, technical and hands-on training necessary to match the job opportunities in the region. With the addition of a dedicated academy coach, students are provided industry and college field trips, career and personal exploration courses, and equitable opportunities through the academy experience.

Where We Are Now

The Academies of Louisville 2.0 is showing promise and has recently received a boost of support at the district level. A champion for project-based learning and the academies model, Dr. Pollio named Dr. Carmen Coleman, a national expert on deeper learning, to serve as his chief academic officer. The two have focused on culture and climate, organizational coherence, and improving student outcomes.

To that end, JCPS is launching a K–12 system, the Backpack of Success Skills, that will ensure students have a strong foundation in the academic and employability skills needed to engage in a rigorous college career preparatory program within the Academies of Louisville. (Think college and career awareness in elementary school, middle school exploration, and high school preparation.)

The Backpack of Success Skills program identifies five key areas, building:

- Prepared and resilient learners
- Globally and culturally competent citizens
- Emerging innovators
- Effective communicators
- Productive collaborators

Imagine all 100,000 JCPS students filling a digital backpack with artifacts, speeches, writings and projects, along with reading and math achievement, every year from first grade through graduation. Along the way, students will use the evidence in the digital backpack to make presentations that showcase their personalized journey. Students stand at the center, taking an active role in their learning experiences and bearing responsibility for deciding what artifacts best represent their development.

With the Academies of Louisville in full swing and the Backpack of Success Skills initiative moving into all schools, Jefferson County Public Schools is on the move with a clear vision for student success, and the future looks bright. ■

Christy Rogers is assistant superintendent for transition readiness at Jefferson County Public Schools. Rogers has served nearly three decades in public education, as a business educator, principal and college and career director for Bullitt County Public Schools prior to JCPS. Email her at christy.rogers@jefferson.kyschools.us.

An Eco-friendlier VISION with Mobile App

This year, ACTE's CareerTech VISION will take place **Nov. 28–Dec. 1** in San Antonio, Texas, a city alive with festivity as it celebrates its 300th anniversary. To maximize your time and networking opportunities at VISION, ACTE offers the VISION mobile app, which will provide:

- Up-to-date session schedules, room assignments and real-time alerts on last-minute changes
- The ability to personalize your VISION agenda
- Networking opportunities through messaging with speakers and other VISION attendees
- Access to event and city maps to enhance your San Antonio experience
- An eco-friendly event, helping us collectively reduce our carbon footprint while ensuring you have all the latest event information you need in one, easy place

Watch for additional event app download details coming soon. And if you have not yet registered for VISION, be sure to do so by **Oct. 26** to secure the advance discounted rate. Visit **www.careertechvision.com**.

ACTE Board of Directors Election

The 2019 ACTE board of directors election will be held this year **Nov. 30–Dec. 31**! Please mark your calendars to reflect the updated election schedule below:

- In order to vote, you must be an ACTE member by Oct. 30.
- Voting will open during CareerTech VISION on Friday, Nov. 30 and end at 11:59 p.m. on Dec. 31. You can vote online with the email you receive from Survey & Ballot Systems (actevote@directvote.net).
- Winners will be announced the week of Jan. 1, 2019.

For more information about the election, including information on the positions and candidates, please visit **www.acteonline.org/about/get-involved/board-election/**.

CTE Develops the Finance Workforce

Learn more about how career and technical education (CTE) prepares the future workforce in financial services. This ACTE Sector Sheet has been updated with the latest information on job outlook and earnings potential in this sector, as well as profiles of exemplary CTE programs preparing secondary and postsecondary students for careers in finance. You can access this and 12 other publications in the series at **www.acteonline.org/why-cte/economic-impacts/sector-sheets**.

Save the Date for NPS 2019

Join educators from across the country to voice your vision, success stories and local funding needs for career and technical education to Members of Congress and policymakers on Capitol Hill. Taking place **March 25–27** at the Crystal Gateway Marriott in Arlington, Virginia, with dedicated time on Capitol Hill, National Policy Seminar 2019 will offer essential resources and informative sessions to help CTE professionals move toward implementation of the new law, *Strengthening Career and Technical Education for the 21st Century Act* (Perkins V). For more information, visit **www.acteonline.org/nps**.

No ACTE Bylaws Amendments

No bylaws amendments were received or approved by the 2018 deadline. As a result, none will be considered at the Assembly of Delegates.

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BIOMEDICAL EQUIPMENT REPAIR TECHNICIAN

By Susan Reese

BIOMEDICAL EQUIPMENT REPAIR TECHNICIANS HELP ENSURE THAT THE TECHNOLOGY AND SYSTEMS used for patient care are safe and properly maintained. Their duties include installation, testing and preventive maintenance of medical equipment. They may be called upon to diagnose problems and repair electronic, electromechanical and/or hydraulic equipment. Some medical equipment repair technicians specialize in specific equipment (e.g., CAT scanners, X-ray machines or ultrasound equipment) while others maintain and repair a wide range of medical equipment.

The Workplace

Biomedical equipment repair technicians work in local, state and private hospitals and clinics; for equipment manufacturers and wholesalers of commercial equipment and supplies; and for companies that rent or lease biomedical equipment.

Education

Most employers look for biomedical equipment repair technicians who have at least some postsecondary education, which is often an associate degree, although some areas of specialization may require a bachelor's degree. The fields of study are most commonly biomedical equipment technology, electronics or engineering. Additional training and certification may be needed to ensure skills and knowledge are aligned with the most current technology, as well as for career advancement. Through its AAMI Credentials Institute, the Association for the Advancement of Medical Instrumentation offers certifications that include certified biomedical equipment technician, certified laboratory equipment specialist and certified radiology equipment specialist.

Earnings

According to the *Occupational Outlook Handbook*, a publication of the U.S. Department of Labor's Bureau of Labor Statistics, the median annual wage for medical equipment repair technicians in May 2017 was $48,820, with the highest 10 percent earning more than $80,460.

Job Outlook

The *Occupational Outlook Handbook* projects that employment of medical equipment repair technicians will grow four percent from 2016 to 2026, with much of that growth due to our aging population and a need to replace retiring workers. In addition, because of budgetary issues, some health care facilities will purchase refurbished equipment, which may result in an increased need for technicians to ensure that such equipment operates safely and effectively.

EXPLORE MORE

For more information about the career of medical equipment repair technician and the education and training it requires, here are some resources to explore.

Association for the Advancement of Medical Instrumentation
www.aami.org

Electronics Technicians Association International
www.eta-i.org

Medical Equipment and Technology Association
www.mymeta.org

IEEE Engineering in Medicine and Biology Society
www.embs.org

Biomedical Engineering Society
www.bmes.org

SCHOOL SPOTLIGHT

SAN JACINTO COLLEGE

SAN JACINTO COLLEGE HAS BEEN SERVING THE CITIZENS OF EAST HARRIS COUNTY, TEXAS, SINCE 1961. Approximately 45,000 credit and non-credit students each year benefit from a support system that maps out a pathway for success. The college offers eight areas of study that prepare a diverse body of students to transfer to four-year colleges or universities or enter the workforce with the skills to support growing industries along the Texas Gulf Coast. San Jacinto College graduates contribute nearly $690 million each year to the Texas workforce. San Jacinto College is also one of 30 institutions participating in the American Association of Community Colleges Pathways Project to create an infrastructure that promotes the successful completion of student educational goals.

San Jacinto College notes that it is "confident of the quality of its instruction" and boasts a graduate guarantee program designed to help students "transfer their credit courses to Texas public colleges and universities," and/or "acquire job skills for entry-level employment in their fields."

San Jacinto College is part of a collaborative partnership that developed the Houston Guided Pathways to Success, an integrated system of cohesive, interdependent strategies designed to increase and accelerate student completion while improving educational quality for Houston-area students. Students at San Jacinto College also benefit from a number of community and industry partners that work with the college's continuing and professional development division, gaining skills and certifications for rewarding careers in high-demand fields.

Among the programs offered at San Jacinto College is biomedical medical equipment repair technician, in which students can earn an occupational certificate in one term, a certificate of technology in three terms, a Level 2 certificate in four terms or an associate of applied science degree in five terms.

All biomedical medical equipment repair technician students take applied biomedical equipment technology, safety in health care facilities, electricity principles, fundamentals of networking technologies, and integrated software applications or business computer applications. There is also a capstone experience, required for all, and a summer internship requirement from which only occupational certificate students are exempt. The certificate of technology program adds courses in medical equipment networks, medical circuits troubleshooting, diagnostic ultrasound imaging system and medical electronic applications. Level 2 and associate degree students take courses that include fundamentals of x-ray and medical imaging systems and physiological instruments.

The degree program requirements include courses in English, speech, math and humanities or fine arts. With an associate degree and at least two years of work experience, professionals can earn certifications through the Association for the Advancement of Medical Instrumentation.

U.S. News and World Report ranked medical equipment repairer No. 80 on its list of The 100 Best Jobs and No. 1 in the "best maintenance and repair jobs" category. With the high quality offered by San Jacinto College, graduates of its biomedical medical equipment repair technician program will be well prepared to help guard the health of Texans by ensuring that equipment needed to diagnose and treat patients operates safely and effectively.

For more information about San Jacinto College and its biomedical medical equipment repair technician program, visit ***www.sanjac.edu.*** ■

Susan Reese is a *Techniques* contributing writer. Email her at susan@printmanagementinc.com.

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Design and Remodeling Careers Are Calling

By Dianne M. Pogoda

IN A WORLD WHERE TECHNOLOGY IS TRANSFORMING THE WAY WE LIVE AND WORK — WITH SO many jobs yet to be invented — the prospect of picking a career can be overwhelming. But there are a few categories that remain constant necessities of the human condition: food, clothing and shelter.

At the National Kitchen & Bath Association (NKBA), we're mainly concerned with shelter and to a lesser degree, food — at least its preparation! We have good news for young people trying to find some direction for life after high school: There are plenty of high-paying jobs available in the skilled home-building arena, specifically in kitchen and bath design and remodeling; they can lead to fulfilling and creative careers.

NKBA strives to build awareness of jobs in our industry that capitalize on students' passion for drawing and art, for working with their hands, mechanical thinking and finding solutions to problems in everyday living situations. There's a dearth of skilled talent coming into the workforce to fill the needs of the residential design, building and remodeling business. Construction employment took a big hit after the Great Recession of 2007 to 2009, as 1.5 million individuals retired or otherwise left the industry (Strassmann, 2017). While it has recovered somewhat, there are still about two million jobs in this area expected to be available by 2020 (Gordon, 2013). According to the Bureau of Labor Statistics, for every five people leaving the industry, only one is entering (Gordon, 2013).

Exacerbating the problem, as the number of these workers dwindles, the need is growing. The residential kitchen and bath industry generates $150 billion in sales of products alone, excluding design and labor — and this is growing at a rate of about 10 percent each year (NKBA, 2018). The U.S. residential construction market is valued at about $600 billion, and kitchens and baths account for about a quarter of this crucial segment of the American economy (Statista, 2018).

NKBA is working to encourage students in high school and even middle school, along with their parents and educators, to consider career pathways in kitchen and bath design, skilled trades, and construction management. With a shorter postsecondary training process — and much less student loan debt to incur — employees in these fields will be on the road to their career and the rest of their lives faster than their four-year-college counterparts.

How are we doing it?

NKBA has an extensive Affiliated Schools program that offers free membership to any learning institution and its educators with an interest in kitchen and bath (K&B) education. We help high schools, two- and four-year colleges, tech institutes, vocational programs and trade schools develop programs to train the next generation of K&B professionals. This membership allows educators to connect in an online community

dedicated to instructors in our industry; attend educator-focused, in-person forums and virtual meetings; and be eligible for a discounted pass to attend our trade expo, the Kitchen & Bath Industry Show (KBIS).

A skilled labor and design initiative makes high school students more aware of the lucrative and creative opportunities — and plentiful jobs — available in this dynamic business. NKBA's student videos have launched on a dedicated YouTube channel, with content ranging from specific subjects like lighting or countertops, specifying materials or design-centric themes, to enhancing business and marketing skills and strategies for building a portfolio and job-hunting. These videos can be a resource for aspiring professionals.

K&B students may take advantage of free membership, too. This allows them to be part of a local chapter where they can network with established professionals and find internships and mentors to help guide them along their journey; they get free entry to KBIS, and may also participate in NKBA's Student Design Competition, which earns industry-wide recognition. And, as members, they may create a personal profile page at nkba.org, on which they can build a portfolio of work to showcase their talents.

Membership puts students on the fast track to becoming certified as a designer in a highly regarded program, starting with the associate kitchen & bath designer (AKBD) certification. The AKBD and subsequent certified kitchen & bath designer (CKBD) show the world that a designer has dedicated hours to study and professional practice, and passed rigorous testing to maintain the highest standards in the industry.

This is a mission that's bigger than any one voice or organization. That's why NKBA has partnered with other groups, including skilledlaborfund.org, This Old House Ventures' Generation Next campaign and the ACE Mentor Program of America. Our collective goal is to make young people aware of options in this creative and lucrative sector. ■

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EXPLORE MORE

COMING SOON on NKBA.org: a jobs tool for finding and offering mentorships, internships and training programs that can lead to career opportunities and potential entrepreneurship.

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Internet of Things Crossword Puzzle

ACROSS

1. Apple Watch, pedometer or Google Glass, for example
2. The practice of using a network of remote servers to store, manage and process data
3. Information technology sector that deals with the long-distance transmission of computerized information
4. A wireless local area network
5. A system used by entrepreneurs to raise capital for a business venture
6. Programming that's written to the read-only memory (ROM) of a computing device
7. The T in IoT
8. A software licensing and delivery model in which applications are hosted by a third party and made available over the internet (acronym)

DOWN

1. Programming methodology (also defined as "able to move quickly and easily")
2. A large set of information that can be analyzed for trends
3. Components that make up the internet of things
4. This issue's theme
5. Radio waves
6. A device or software program that connects the cloud and controllers, sensors and intelligent devices
7. A device or component that perceives and responds to physical input from the environment
8. The support of medical processes and applications through information and computer technologies
9. Device that receives and re-transmits a digital signal to extend network reach
10. Short-range wireless technology standard

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