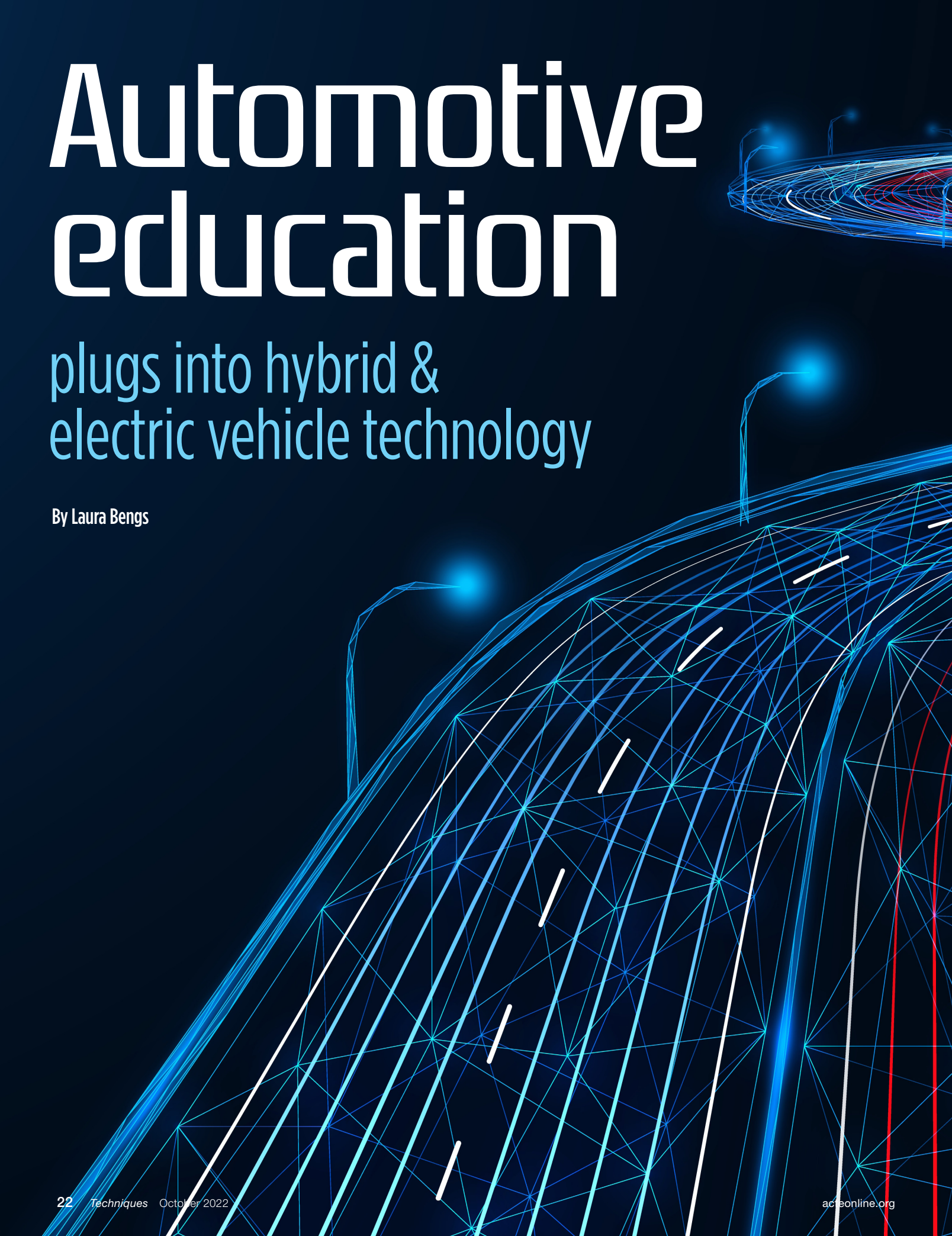
Automotive education

plugs into hybrid & electric vehicle technology

By Laura Bengs



Danny Camden, an automotive instructor in Indiana and vice president of ACTE's Trade and Industrial Education Division, said that even though he teaches in the same high school program he attended, the automotive classroom looks much different than it once did.

Students today are preparing for an industry that has changed and is continuing to change rapidly. From advances in electric vehicle technology to a greater nationwide focus on sustainability, career and technical education (CTE) programs and their automotive industry partners are accelerating efforts to set students up for success.

"I always ask my students to name something that doesn't have wires or some kind of electronics attached to it," said Camden. "And there aren't too many things — short of lug nuts — that you can find on a car anymore."

While electric vehicles may still be uncharted territory for some consumers, they're a content area that auto instructors need to embed in their curriculum, Camden said.

Darcy Wedel is a customer success manager for Electude, and he'll lead two program sessions at ACTE's CareerTech VISION 2022 in Las Vegas, Nevada; he told *Techniques* that the abstract nature of automotive electronics can make it challenging to incorporate into a hands-on learning environment. "When you teach a mechanical part of an automobile — like an engine — you can roll an engine into the classroom," he said. "You can put a wrench on the end of a crankshaft, and you can see the piston engines move up and down. You can teach students how that part works simply by taking it apart."

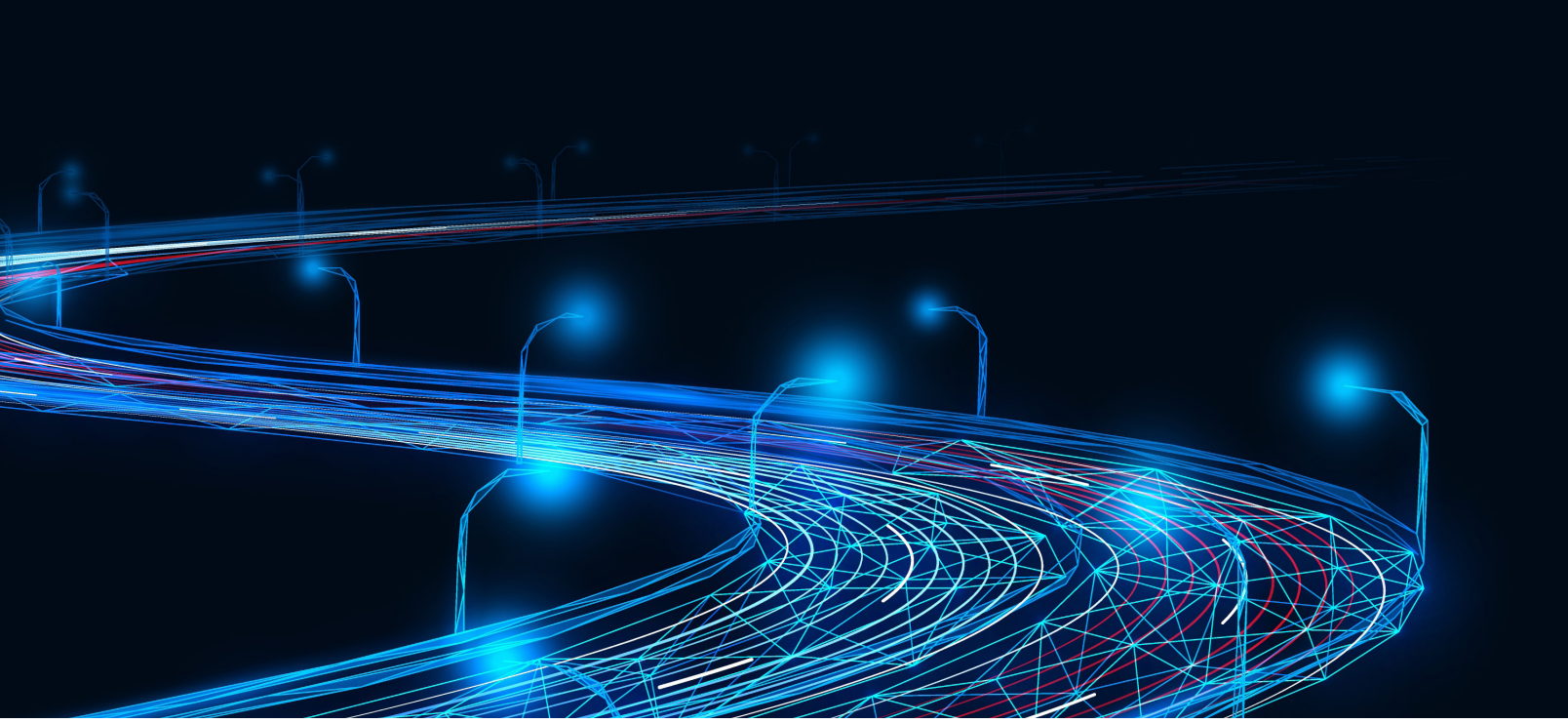
In contrast to the traditional internal combustion engine fueled by gasoline, the electric vehicle drivetrain used in hybrid electric vehicles, plug-in hybrid electric vehicles, and battery electric vehicles is propelled by electromagnetism. Electromagnetism also makes other new technologies possible, like regenerative braking, which captures wasted kinetic energy from slowing the vehicle, converting it to energy to recharge its battery (U.S. Department of Energy, n.d.). And these changes in drivetrain technology aren't the only changes happening in the automotive industry. CTE educators and students also must contend with developments in driver assistance technology, and automated driving.

While industry employers seek many of the same qualifications they always have — a good work ethic, proficiency with tools, and general knowledge of automobile systems — automotive students in CTE need a general understanding of electric vehicle technology. Yet we acknowledge that it can be challenging for teachers when the industry has changed so remarkably, and the new systems are unfamiliar. To better prepare students for an evolving workforce, automotive instructors can transform the student experience by employing some of these creative innovations in the classroom.

1. SHIFT YOUR MINDSET.

Think of yourself as a facilitator, not an expert.
Wedel said that to adapt to this changing industry, instructors need to alter how they think about teaching. "I think if a teacher goes up there and lectures and talks about highly technical things as the expert, it often intimidates the students into thinking, 'Wow, this person knows everything there is to know about this, but I'll never get there.'" His point was that it's okay for instructors not to know everything about electric vehicle technology.

Rather than spending time on becoming



an expert, Wedel recommended investing in finding opportunities and environments for students to learn. "Don't worry that you haven't worked on an electric vehicle," he said. "You're probably going to be learning right alongside your students, but that's okay. It shows the student the importance of lifelong learning."

Be realistic about what you can take on.

Camden shared that he finds it's in the students' best interest to address the basic foundations and safety of electric vehicle technology. He said the specifics of vehicles from Tesla, General Motors (GM) and other manufacturers can be quite different, and focusing too narrowly on a specific car can limit student knowledge growth. After all, it's likely students will receive on-the-job training for the vehicles they'll be servicing.

Instead, provide lots of exposure to fundamentals like safety, battery technology, cooling systems, and brakes by incorporating technology throughout the curriculum. For example, when talking about transmissions and drivetrains, Camden's students learn how planetary gearsets work on a hybrid. "You can't overprepare with electricity," he said. He recommended that instructors seize any opportunity to address electric vehicle technology.

2. SET STUDENTS UP FOR SUCCESS

Teach them how to find information.

The days when a car will come with a users' manual are dwindling, Camden said. Instead, CTE students have to seek the right answers and be able to distinguish them as such. A critical skill Camden focuses on with students is teaching them how to use online service information. "Sometimes you have to do a lot of research to get to the right answer," he continued. And an important part of research, he said, is learning how to evaluate information found on the internet.

Students need to know where to look, how to think critically and how to solve problems. These and other vital employability skills can be helpful in learning how to stay current on changes in the industry. And this is true for students and educators alike. Developing lifelong learners who know how to seek opportunities or find information to learn about new technologies is an important task for CTE instructors in 2022 and beyond.

Prioritize hands-on training.

Time constraints can make it challenging to balance technical content knowledge with hands-on training. But Wedel suggested it's imperative to give students as much time as possible with hands-on training. "Now you have vehicles that are so much more sophisticated than they were 20 years ago, and we don't have more time to teach students," he said. "The teacher needs to focus on the fundamentals." Focus on skills like how to position your body for mechanical advantage, when to use rust penetrant, and when to use a gasket sealant.

Innovative strategies for content delivery, such as asynchronous online learning, can help educators increase time for hands-on training. Pandemic-related shutdowns thrust many teachers into online learning environments, and these new skills leveraged wisely can enhance in-person learning. "They need more time than ever out there in the lab," said Wedel. "There's no substitute for students getting their hands dirty."

Incorporate work-based learning into the curriculum.

Camden's program at Ben Davis High School in Indianapolis, Indiana, takes customer work in the shop, and through that experience, his students learn many necessary interpersonal skills. They engage in many steps of the customer service process, including talking with customers, writing up repair orders, and calling the customers when repairs are completed.

"If they're going to be technicians, fixing cars right the first time often involves

listening to the customers tell their story," Camden said. Work-based learning opportunities such as these help stress the importance of critical thinking, active listening and honesty.

3. EMBRACE TECHNOLOGY.

Explore simulations and other creative ways to illustrate concepts.
To teach new technologies effectively, according to Darcy Wedel, the teaching method needs to change. "I don't believe you can teach hybrid electric vehicles without some sort of animation to bring these electronic components to life," he said. "You're probably not going to pick it up by just looking at a static picture in a book."

Simulations appeal to and engage the generation of digital natives in secondary CTE classrooms today. E-learning programs such as those developed by Electude, CDX Learning Systems and SP2 make it possible for students to engage in self-discovery and career exploration activities. For example, Electric Drive, an Electude learning module, uses gamification principles to teach hybrid and electric vehicle systems. Training aids are paired with interactive, animated lessons to help students explore technology.

Don't rule out personal technology.
Cell phones can be a challenge to manage in any classroom, but Camden and Wedel agreed that students can learn to use their personal devices as tools for work. And the hope is, then they will know when to put them away as well. Accessing relevant automotive applications on a cell phone can engage students in learning by using technology that they're familiar with. Interactive, technology-based learning applications are also accessible on cell phones, making it possible to blend hands-on training with online learning or assessment activities.

Grow your own digital toolbox & network.
Wedel recommended incorporating a lot of different tools in the classroom, especially when designing a blended or online course. Simulations, game-based learning platforms like Kahoot!, blogs, webinars, virtual tours and online discussions — when integrated strategically — can enhance students' learning experiences. And not only do such tools increase engagement, but they also address the diverse learning styles of students. "There's a lot of great resources out there," he said. "Teachers need to be open to using them all."

Further, technology can be used to connect educators with resources and opportunities that benefit themselves and their students. Camden said that his local automotive education organization — the Indiana Association of Transportation Technology Instructors (IATTI) — uses a Facebook page to foster networking and collaboration. In their online community, members share work opportunities for students, equipment available for sale (or donation) and upcoming professional development experiences.

4. STRENGTHEN TIES WITH INDUSTRY.

Develop meaningful partnerships. Camden stressed the mutually beneficial nature of working with local industry leaders. Through a partnership sustained by Ben Davis High School and Cummins Sales and Service, automotive students have an opportunity to gain valuable work-based learning with the support of a mentor. After program completion, students may:

- Get a job at Cummins
- Work at Cummins while attending a local college (with tuition paid for by Cummins)
- Attend the Technical Apprenticeship Program through Cummins

Another local program — made possible through IATTI — pairs 15 schools in central Indiana with a national sponsor. The national sponsor donates automotive goods and supplies to a warehouse at a local dealership, and once a month, school programs can shop for supplies at no cost to the school. Because automotive can be such an expensive program, Camden said, partnerships like this are critical to their success. He says he'll often talk to dealers about how these partnerships prepare students better and result in better talent available for hire.

Camden said he often gets phone calls from dealerships looking for talent, and rather than just sending students over, he'll optimize that relationship. He said he often talks to dealers about partnership activities and how they result in better talent available for hire. Then he invites professionals into his classroom to deliver a guest lecture or work alongside students.

"They get to know the students, and the students get to know them and that just helps everyone in the big picture," he said. Finding partners takes some creativity and "turning over rocks." Camden recommended getting started by networking with contacts within the field or talking to local parts supplier chains.

Get involved with other schools and educational organizations. Developing relationships with fellow educators can be another great way to support high-quality CTE programs. Especially when big-ticket items need to be replaced, sharing resources and leads on equipment may help tremendously. Danny Camden said he'll post a notice for equipment he's replacing on IATTI's Facebook page, and other schools in need can make the connection. "Everybody kind of benefits when somebody gets something new," he said.

CONCLUSION

Ultimately, Wedel said it's important to let an attitude of lifelong learning drive classroom adaptations to changes in the industry. While teaching electric vehicle technology may seem like a daunting undertaking to instructors unfamiliar with it, an open mind, a willingness to learn, and a focus on sound problem-solving practices can carry a program through any evolution.

Laura Bengs is a freelance writer in the Midwest covering education, the arts, food, culture and finance. She is also a former educator. Her teaching experience includes courses in publications, writing, theater, and literature at the high school and college levels.

REFERENCE

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Valued contributors

Danny Camden has been an automotive instructor at Ben Davis High School in Indianapolis, Indiana, for the past 12 years. Prior to that, he taught for three years at the Lincoln College of Technology following 12 years at a Chevrolet dealership. He is currently serving as vice president of ACTE's Trade and Industrial Education Division.

Darcy Wedel is a customer success manager for Electude, an e-learning platform for vehicles. He mentors teachers on how to successfully use technology in automotive instruction. His experience in the automotive industry spans 30 years, with experience as a GM technician and an instructor at Barton Community College. Wedel will present at VISION 2022.