NACAT NEWS

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Celebrating 50th ANNIVERSARY 1974-2024
NORTH AMERICAN COUNCIL OF AUTOMOTIVE TEACHERS

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June 2024 issue - May 10, 2024
August 2024 issue - July 10, 2024
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Secretary / Treasurer
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Steve Tucker
SUNY Delhi
2 Main Street
Delhi, NY 13753

Appointments

Business Manager
Heather Sebben
5950 North Oak Trafficway, Suite 201
Gladstone, MO 64118
Email: info@nacat.org
Office Phone: 816.766.1515

Business Advisor
Sheri Hamilton
5950 North Oak Trafficway, Suite 201
Gladstone, MO 64118
Email: info@nacat.org
Office Phone: 816.766.1515

NACAT News Editor
James Curry
JasCor LLC
108 Carolinian Drive
Summerville, SC 29485
Email: nacatnews@nacat.org

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Thank you to those who have either joined or renewed their membership since November 1, 2023.

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...By Automotive Teachers

Share what you have been doing for inclusion in NACAT News!

Email: nacatnews@nacat.org

NACAT PRESIDENT'S UPDATE

DREW BARNES

VALE SCHOOL DISTRICT

Greetings Fellow NACAT Members,

Happy New Year 2024! I am hoping each of you had a very restful and rewarding holiday break. It is always great to take a step back and enjoy some quality time with family and friends. As of now, we are all back to school, knee deep into the beginning of the new semester. With that being said, now is the time to begin thinking about what professional development opportunities you will be looking to attend. Hopefully you are all planning on joining us in Indianapolis this July. Conference registration will be opening very soon! In the meantime, you can begin booking your rooms and looking into flights, if need be. Hotel and travel information can be found on the NACAT website, along with other conference details.

Now, for an update on our NACAT membership. The spring of 2020 and the COVID 19 pandemic was difficult for many organizations, and NACAT was no exception. During that time of online learning and the inability to host an online conference, our membership hit an all-time low. Following the impact of all these struggles, our regular membership dropped down to only 90 members, and our Allied membership was a lonely 1. We did not give up! With the hard work and dedication of an outstanding board of directors and the management from Hamilton and Associates, I am pleased to say, we are growing and moving forward. As we prepare to host our ***50th Anniversary NACAT Conference "Back Home Again" in Indianapolis, IN. July 22-25, 2024***, our regular membership has grown to nearly 180 members, and we currently have 16 Allied members. NACAT is gaining momentum! As an organization, we set a goal to reach 200 members before this summer's conference. With new members joining weekly, I would say that we are on track to meet (and hopefully exceed) that goal. If you know of any colleagues or fellow educators who are not members, please help spread the word. The more educators that get involved, the stronger our organization will become.

Are you an active NACAT member, who is passionate about automotive education, and wondering how you can give back and help our organization? Please consider joining the NACAT board of directors. Elections will take place later this spring, as elections near, updated information will be posted to the website as well as our social media pages.

As always, if you have any questions about the happenings of NACAT or questions about this summer's conference, please feel free to reach out to myself or any of the NACAT officers or board members. Keep up the good work and I am looking forward to seeing you all in person at the conference in July.

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July 22-25, 2024

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Indianapolis, IN

FOR AUTOMOTIVE TEACHERS, BY AUTOMOTIVE TEACHERS

Getting To Know...

...Randal Klitzke, Northern Michigan University

Hello. I am Randal (Randy) Klitzke, Associate Professor of Automotive Technology at Northern Michigan University located near the shores of Lake Superior in Marquette, Michigan. I currently teach (ASE) MAST level A2 automatic transmission, A6 electricity, and A8 engine performance courses; albeit, I have at one time or another taught most topics A1 – A8 including A9 light duty diesel. I am also the instructor of a cohort of secondary students from area wide high schools who are attending on-campus coursework focused on the (ASE) MLR curriculum.

Beyond instruction, I serve as the automotive program coordinator, faculty union vice-president, and I am a member of the university's carbon neutrality committee and the Assessment of Learning (AOL) committee. I have worked at length on behalf of the program to realign coursework to articulate credits earned in secondary (MLR) programs statewide, to develop light duty diesel coursework for the college program, and I am regularly creating or revising course task sheets of which I have recently published (internally) my second lab manual. Currently, I am developing curriculum for a new hybrid and EV course. Away from the campus, I have begun to serve as an ASE ETL, helping programs with accreditation and continuous improvement.

Like many teachers, I enjoy working in the classroom and lab with students the most. They (students) are the reason for the program. As an educator, my perspective is that teaching is as much about transitioning students as learners as it is about technical merits. Comparatively, it is reassuring to see students "get it" when focused on an electrical circuit for example, but even more so I find it rewarding when students break through from being a dependent novice and become more of a self-motivated learner striving to be a professional in the making.

Reflecting upon my youth, never did I think I would be teaching, let alone in higher education. Like many, I was focused on other career pathways in junior and senior high school, but the experience of my first car ultimately changed the trajectory. Admittedly, it was difficult for me to pay for regular vehicle maintenance and repair; and more so, the technology was interesting and an intriguing challenge. Truly one (automotive) class in high school – and encouraging teacher – set the stage for the career I now call my own. From high school, to technical college, to industry; I advanced in the career pathway from changing tires at a tire franchise to becoming a dealership master technician. Looking back, I recall how exciting it was to be paid to work on brand new cars at the dealer, and to learn new and emerging technology through dealer training. New technology is still exciting to learn.

With regard to teaching, I began my transition from technician to instructor in the fall of 2001, a time of uncertainty in our country when the 9-11 attacks took place in New York. Much has changed in the world since then; personally, I went on to teach and to attain (MLR) accreditation for the high school program I graduated from, I earned a BS and a MA degree in education, and (importantly) I learned a tremendous amount about people – including myself. In 2014, I stepped away from the high school program and onward to the challenges of teaching in higher education. Teaching at the college level has been a great experience and it has provided many personal and professional growth opportunities for me; including for example, encouragement and support to attend training conferences provided by ASE, ATRA, MATA, and NACAT to name a few; and (maybe) like you, to join NACAT.

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Historically, I never thought about teaching until, ironically, my high school auto teacher suggested it and provided subsequent encouragement. The first years – post 9-11 – were tough in many ways including transitioning from technician to teacher. There was even a moment when the school administration was in favor of cutting the auto program to balance declining finances. This was a time when I learned the value of attending school board meetings, soliciting student involvement and parental support, and the importance of an industry advisory committee. Fortunately, that program is still in place today.

In my career as a teacher, I have come to know not only the value of students as individuals, but also as our future. The reality is that at some point beyond today, a student currently enrolled will eventually take our place in industry, in our classroom, and as a leader in our personal or professional communities. My experiences suggest that they will not only require the knowledge and skills to be successful, but the encouragement to accept risk and manage adversity. Beyond the technical merits of curriculum, I am hopeful that my lessons connect students to experiences that are memorable, and that challenge them to grow both personally and professionally. For me, being a teacher is about more than just subject matter theory, it is about demonstrating the potential that lies ahead for students. Being a teacher is not just a job, it is an opportunity to connect students to the past, the present, and the future.

FUNDING OPPORTUNITY!
2024 SEMA SCHOLARSHIP APPLICATIONS NOW OPEN

-- Awards up to $5,000 are available to students pursuing automotive careers --

The 2024 SEMA Scholarship application period for students pursuing careers in the automotive or performance parts industries is now open and will run through *March 1, 2024*. Interested applicants can review and complete the scholarship application at www.sema.org/scholarships.

The SEMA Memorial Scholarship Fund supports career development and access into the automotive industry by offering financial awards up to $5,000 to help foster the next generation of industry leaders and innovators. In addition to financial assistance, scholarship winners have the opportunity to attend the SEMA Show, providing unparalleled education and networking opportunities.

Masen Schneider, a freshman studying mechanical engineering at the **University of North Dakota**, received a **SEMA Scholarship in 2023**, furthering his opportunity to achieve his dream career in the automotive aftermarket. “It means a lot to receive a scholarship from an organization like SEMA because as big and impactful as they are, they see your story and experience and want to help propel you towards your dream,” he said. Schneider hopes to one day be an automotive parts designer.

High school seniors and college students in the United States and Canada who demonstrate a passion for automotive hobbies and careers are eligible to apply. Scholarships are available in a variety of disciplines leading to a career in the automotive aftermarket, including accounting, sales, marketing, engineering, and more.

“SEMA is committed to supporting students with an ambition to accelerate their career in the dynamic and exciting world of the automotive aftermarket,” said SEMA Manager of Recognition Programs Chris Standifer. “The financial support can help alleviate the burden of student loans and make pursuing their education more accessible.”

A loan forgiveness component is also available to employees of SEMA-member companies who have completed and are currently paying off a loan for a program of study at an accredited university, college or vocational/technical school within the United States and Canada. Loan forgiveness awards are issued up to $2,000.

Eligible students and SEMA-member company employees can apply until March 1, 2024.

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Lisse Duvic

deadline: May 15, 2024

Lisse Duvic *Scholarship*

In memory of Lisse Duvic, the Duvic family is providing a scholarship to one first-time spouse at the 2024 NACAT Conference.

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MITCHELL 1 AUTOMOTIVE TECHNOLOGY SCHOLARSHIP

Applications are now being accepted for the annual Mitchell 1 Automotive Technology Scholarship. High school seniors and college students in the U.S. and Canada who are interested in pursuing a career in the automotive aftermarket can submit applications through ***March 31*** by visiting www.AutomotiveScholarships.com.

"Mitchell 1 has been a long-time supporter of academic achievement in automotive education," said Nick DiVerde, senior marketing director, Mitchell 1. "We're proud to continue our support by offering this scholarship to a worthy student, so they can acquire essential skills achieve their career goals in this rewarding industry."

The recipient will receive a $2,500 scholarship, a check for $500 and roundtrip airfare and accommodations for the winner and a guest to attend the North American Council of Automotive Teachers (NACAT) conference to be held July 22-25, 2024, in Indianapolis, Indiana.

To be eligible, scholarship applicants must be a current student majoring in automotive technology / auto shop repair course work and meet the following criteria:

- Nomination from his/her NACAT instructor
- Minimum overall 3.0 grade point average
- Planning to attend an accredited college or university, or already enrolled in an accredited college or university
- A U.S. or Canadian citizen

The streamlined website allows applicants to view the details of all scholarships available and continue to update their application until the ***March 31*** deadline.

HYBRID & ELECTRIC VEHICLE CORNER

CURT WARD

PROFESSOR AT JOLIET JUNIOR COLLEGE

Exploring the 5th Generation Toyota Hybrid Synergy Drive

As I write this article, snow is falling in Chicagoland, and the spring semester is off to a fast-paced start. Recently, I had the opportunity to tear down the hybrid transmission out of a 2023 Toyota Corolla Hybrid. The model I disassembled was a PA10, which is used behind the 1.8- and 2.0-liter 2ZR hybrid engines. In this article I will highlight some of the differences between this transmission and a second-generation transmission I shared with you at the summer conference in Northern Kentucky.

Figure 1: Cables between transmission motor windings and inverter.

My objective in disassembling the transmission was to create a power flow demonstrator, which will become part of a hands-on lab activity in our hybrid and electric vehicle program. Students will be able to demonstrate power flow, calculate gear ratios, measure winding resistance, and test for a loss of isolation.

The first item I noticed was the size of the cables that are between the transmission motor windings and the inverter (***See Figure 1***). Compared to earlier designs, these cables are much smaller. This change occurred because the system voltage is lower, the motor-generator power ratings are lower, and the inverter is located directly on top of the transmission.

During the disassembly, an item that caught my attention was the similarities of this 5th generation transmission to the 4th generation P610 series transmission. The P610 (as well as the P710 and P810) were the first of the Toyota hybrid transmissions to use a parallel power flow design. The previous generations of the transmission used a series power flow design. The PA10 uses a parallel power flow design (***See Figure 2***). As in all previous generations, motor generator 1 (MG1) is still used to start the internal combustion engine and to charge the high-voltage battery. Motor-generator 2 (MG2) is used to propel the vehicle. In the parallel power flow design the internal combustion engine, in combination with MG1 through the power-split device, can provide additional torque to MG2 to help move the vehicle. Both motor-generators are smaller than earlier series power flow designs. MG1 is rated at 23Kw and MG2 is rated at 53Kw. The additional needed torque is created by changes in gear ratios in the final drive assembly.

Figure 2: PA10

The MG1 and MG2 resolvers are different from previous models. Resolvers are used on systems with permanent magnet motors to determine motor position, speed, and direction of rotation. The resolvers for MG1 and MG2 appear to be electrically the same, however, they have different part numbers, and they are not interchangeable due to the way they are indexed. The trigger mechanism for the resolver for MG1 appears to be a higher definition version than MG2 (***See Figure 3 on the facing page***). It has more detents, and therefore would create a more frequent signal change.

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Figure 3: Resolver Trigger Mechanism

Another significant change in the parallel power flow design is the way the transmission is lubricated and cooled. The oil pump is now an internal component. In the series power flow design, the oil pump was external. The design of the oil pump is different from the 4th generation transmission, which was also an internal pump. Additionally, the displacement of the pump has been increased (***See Figure 4***). The increased volume of lubricant will result in better heat absorption.

Figure 4: Oil Pump

The oil pump is turned by the internal combustion engine via the planetary gear set. This means the oil pump only operates when the internal combustion engine is turning. The "Prime" version of the transmission has an external electric oil pump that operates anytime the vehicle is in electric mode. The oil cooler, that was internal on the series design transmission, is mounted externally on the parallel design (***See Figure 5***). It seals to the transmission case with two O-rings. Coolant is circulated through the transmission, the inverter, and the radiator by an electric coolant pump.

The items described in this article are just a few of the differences and highlights of this transmission when compared to previous models. For a complete overview of the 5th generation Toyota hybrid synergy drive, look for my presentation during the upcoming conference season.

Figure 5: Oil Cooler

I will finish this article with the same offer I make after each of my presentations. If you are interested in getting started in the process of adding hybrid and electric vehicles to your curricuulum or want more information, please feel free to reach out. I am more than willing to sit down in-person or online and share my experiences. Are you looking for a classroom textbook? Reach out to Pearson and ask for a review copy of the all-new **Electric and Hybrid Electric Vehicle** text that Jim Halderman and I co-authored. It is a comprehensive text covering all the latest information on the subject.

MONEY FOR A COLLISION EDUCATION! CREF OPENS 2024 SCHOLARSHIP APPLICATIONS

Tuition is expensive, especially for aspiring collision repair professionals who also need to stock their toolboxes, but the Collision Repair Education Foundation (CREF) wants to help! Funding is available for secondary and post-secondary collision students to support their educational endeavors and help supply the employee pipeline for collision repair facilities around the country.

Applications will open January 11 with a deadline of March 8, 2024. Apply for a Student Scholarship online.

"Helping students pursue a collision education without accruing debt has made a huge impact for hundreds of students over the years, and CREF is thankful for the industry supporters who have made this possible by continuing to step up and donate to fund these annual scholarships and tool grants," says Melissa Marscin, Director of Operations and Impact for the Foundation.

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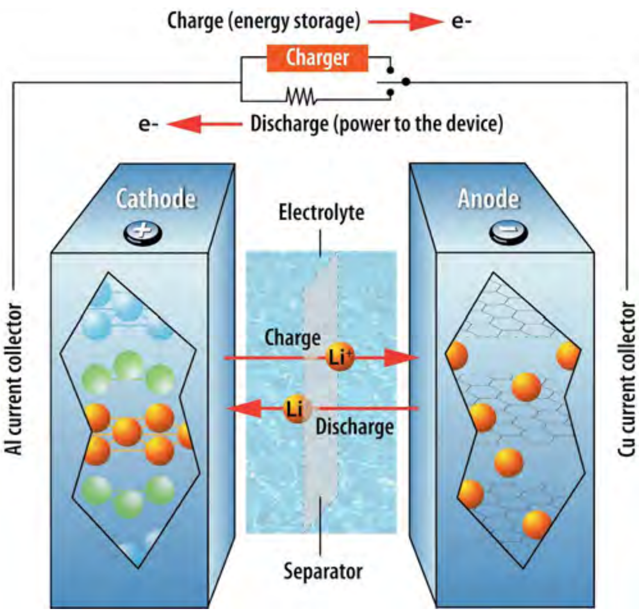
Electric vehicles combust with a fire that is difficult to extinguish. Examples have been scattered across global news since the transition towards EVs from ICE vehicles has gained momentum. Are the sensational fire reports representative of a commonly occuring event?

An analysis of US government data illustrates that EV fires occur much less frequently as compared to those in ICE vehicle, with 25.1 fires for every 100,000 vehicles sold (0.025%) compared to 1,529 fires for ICE vehicles (1.529%). (Hybrid Electric Vehicles appear to represent a different, yet more risky category, possibly due to design parameters placing the battery near the engine.) *Please do not interpret the low percentages to indicate fires pose minimal danger to people or property. A 2020 analysis by the National Fire Protection Agency revealed vehicle fires caused 560 deaths, 1,500 injuries and $1.9 billion in property damage in 2018.*

A 2021 National Traffic Safety Board (NTSB) safety report, entitled "*Safety Risks to Emergency Responders from Lithium-Ion Battery Fires in Electric Vehicles*," resulted in recommendations being made to twenty-two manufacturers on improving their emergency response guides and incorporating vehicle-specific information for fighting high-voltage lithium-ion battery fires in electric vehicles. (Watch this NTSB video to learn more about Safety Report 20/01.)



Graphic representative of a single Lithium-ion battery cell of which there can be thousands in a battery pack. When a lithium-ion battery delivers energy to a device, lithium ions (atoms that carry an electrical charge) move from the anode to the cathode. The ions move in reverse when recharging.
Argonne National Laboratory/Flickr, CC BY-NC-SA

What's different with an EV fire?
What makes an EV fire so news-ready is that they are "sensational" since they burn differently than gas fires. A typical EV fire burns at roughly 5,000 degrees Fahrenheit (2,760 Celsius), while a gasoline-powered vehicle on fire burns at 1,500 F (815 C). EV fires provide their own fuel source, can reignite days after appearing to be out, and they emit toxic fumes such as lithium oxide, lithium hydroxide, hydrogen fluoride, and hydrogen chloride. They can also be triggered by corrosion due to salt water intrusion (flooding).

The duration and intensity of the fire, due to the use of lithium ion battery packs, can make them very difficult for firefighters to extenguish without proper training or tools. A late 2023 Tesla accident in Alabama paints the concern: while a typical car fire can take between 300 to 1,000 gallons to put out, the local volunteer fire department reported the fire required over 36,000 gallons of water over the course of more than an hour before it was extinguished.

What tools are being used to mitigate the EV fire concern?
One tool being used by fire departments which can provide a safer and faster method to fight EV battery fires is Rosenbauer America's BEST, Battery Extinguishing System Technology. The tool utilized a pike pole to enable deployment under the battery pack where it then quickly punctures the pack and floods it with water. The design seeks to keep the user 26 feet away from the vehicle.

Other tools, some much more simplistic such as a "Gerry Pipe", invented by retired Fire Captain Gerry O'Hearn, seek to bridge the cost barrier to protection (BEST can cost $34,000) by creating manner (pipe on wheels with a nozzle for the outlet) by which water can be delivered under the battery while keeping the firefighter at a safe distance. Large single-use fire blankets, currently being made by many manufacturers and which stay on affected vehicles after the fire is initially put out to prevent reflash, are also being utilized to starve the fires of oxygen.

Vehicle fire suppression technology and methodology are evolving with vehicle technology. Do you have special EV fire suppression materials or protocols for your lab / shop? Has your toolkit expanded? Do you simply evacuate?

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Back To The Future 2044

If time travel were possible, and we could hop into a "DeLorean Time Machine" and leap to the year 2044, what sort of cars would technicians be working on?

Would they be mostly ICE (internal combustion engine), hybrid, or fully electric? Would cars be driven by their owners, or would they be summoned to arrive at the appointed time? Would we see technicians roll under cars on wheeled creepers, or levitate a few centimeters (I assume we'll use metric by then) from the ground, on some sort of anti-gravity skateboard? All these things are fun to consider; but one thing's for sure, tomorrow's technicians will most certainly be working on more cars without gas tanks and tailpipes, and perhaps even steering wheels.

In 2044, EVs might outnumber ICE cars by four to one, but unlike the comparatively quick transition from carburetors to fuel injection in the 1980s, the transition from ICE to electric will likely take decades. This means today's 18-year-old automotive student (who will only be 38 in 2044), will be working on both ICE and electric cars for the duration of their automotive service career.

Although 2044 seems far off, did you know nearly 1 million EVs were sold in the U.S. in 2023! So maybe 2044 is closer than we think. Which leads to the question, what are we doing today, to ensure students are prepared for working electric vehicles? Are most schools teaching hybrid and electric vehicles today? Although the numbers are growing, it's still a minority of schools, and mostly at the post-secondary level.

Modern hybrids have been around for over 20 years, so it seems schools are lagging, but have we been here before? To find out, let's hop in the DeLorean, and go back to the year 1990, when I was in Vo-Tech school (that's what they called technical colleges back then). I was only 18, and eager to learn about electrical, computers, and electronic fuel injection (I probably wasn't normal). To make a long story short, after three days of carburetors and ignition points, I asked, "When will we learn about fuel injection?"

"Oh Darcy", my instructor said, "Most cars you'll be working on are carbureted, so that's what you need to learn right now. Someday when you're working at a dealership, they'll send you to training, and you'll learn all you need to know about fuel injection". Although not the answer I hoped for, it made sense at the time…Oh well, back to my notes on setting air/fuel mix and idle speeds.

Move forward from 1990 to the early 2000s. After 10 years working at a GM dealership, I found myself teaching automotive technology at a local community college. It was during this time, that the modern hybrid came to fruition, and I was greatly intrigued by the technology. I read all I could and even went to a few classes. Then in 2009, I decided it was time to develop a course on electric hybrid technology.

It was during this time of planning when things came full circle. I found myself questioning whether or not I was qualified to teach hybrid and electric vehicle technology. I knew a lot of facts about hybrids, but what if students asked questions I couldn't answer? After all, I've never diagnosed or worked on a hybrid, having only a few experiences to draw from.

I then recalled the conversation I had with my auto instructor 19 years earlier. Perhaps the real reason we

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weren't taught fuel injection wasn't because most cars on the road were carbureted, but rather, maybe my instructor had never worked on a fuel-injected engine before, and the thought of teaching students something he knew little about, was intimidating. Well, if that was the reason, I could sure identify with those same feelings now, in regard to teaching hybrid and electric vehicle technology.

After wrestling with my insecurities, I resolved not to worry about what I didn't know or fully understand about hybrids. If students asked questions I couldn't answer, I decided to admit the truth, and explain, "I don't know, but we'll figure it out". Little did I know, this would be the catalyst that changed the way I taught.

Yes, it was a bit uncomfortable to admit "I don't know" at first, but it got easier each time. I recall a few puzzled looks from students, and someone might have said: "What, you don't know? Aren't you the teacher?" Although I can't recall my exact words, my response was something like, "Well, I've never actually worked on a hybrid; but maybe if we put our heads together, we can discover the answer to your question, starting with what we know".

Through this, I made the transition from the "all-knowing" content expert to more of a learning facilitator, and at times I found myself learning something new, right alongside my students. The conversations and activities we did in class worked to improve student engagement and caused them to learn for themselves vs. absorbing information from lectures.

I discovered I was equipped to lead students on this journey. The fundamental things I understood about electricity, motors, and conventional automobiles, was directly transferrable to hybrid and electric automobiles. Therefore, I was able to provide context and examples that helped students learn. I also discovered it was more important for students to understand the underlying theory that changes little over time, vs. specific facts about the latest hybrid and electric vehicles. After all, Ohm's law works the same on Henry Ford's Model T as it does on Elon's Model Y.

In closing, I believe there are many instructors today who feel as I did in 2009, and as my auto instructor did in 1990. Concerned that they're not qualified to teach, because they lack practical hands-on experience in whatever the subject. Be encouraged! It's OK if you're not an electric vehicle expert. Perhaps it's even better that you aren't, because it will cause you to teach differently than if you were to rely on your strengths and previous work experiences.

Regarding your automotive program and electrification, whether you're already offering, or planning to soon offer a dedicated course on electric vehicles, you're doing well. If you don't have plans to ever offer a dedicated electric vehicle course, well maybe that's OK too. In fact, maybe it's for the better you don't. After all, today's students will be working on ICE and electric cars side-by-side, for likely the majority of their careers. So why not teach with this mindset, starting today?

Whether you're teaching engines, brakes, or electrical; start mixing a bit of hybrid and electrification in all subjects. Keep feeding more, and more, and soon students will be gaining knowledge about electric vehicles in all their existing automotive courses. After all, electric cars have largely the same systems conventional cars have, just different powertrains.

In addition, students will realize (as modeled by their instructor), that there will always be knowledge and experience gaps. If students understand the underlying theory and have the ability to assimilate what they know with what they're learning, they will be set for a lifetime of success, in a world continually evolving.

HAVE YOU HEARD THE ONE ABOUT THE SHELLFISH BATTERY?

Accelerating demand for renewable energy and electric vehicles is sparking a high demand for the batteries that store generated energy and power engines. But the batteries behind these sustainability solutions aren't always sustainable themselves. In a paper published in the journal Matter, scientists create a zinc battery with a biodegradable electrolyte from an unexpected source—crab shells.

"Vast quantities of batteries are being produced and consumed, raising the possibility of environmental problems," says lead author Liangbing Hu, director of the University of Maryland's Center for Materials Innovation. "For example, polypropylene and polycarbonate separators, which are widely used in Lithium-ion batteries, take hundreds or thousands of years to degrade and add to environmental burden."

Batteries use an electrolyte to shuttle ions back and forth between positively and negatively charged terminals. An electrolyte can be a liquid, paste, or gel, and many batteries use flammable or corrosive chemicals for this function. This new battery, which could store power from large-scale wind and solar sources, uses a gel electrolyte made from a biological material called chitosan.

"Chitosan is a derivative product of chitin. Chitin has a lot of sources, including the cell walls of fungi, the exoskeletons of crustaceans, and squid pens," says Hu. "The most abundant source of chitosan is the exoskeletons of crustaceans, including crabs, shrimps and lobsters, which can be easily obtained from seafood waste. You can find it on your table."

A biodegradable electrolyte means that about two thirds of the battery could be broken down by microbes—this chitosan electrolyte broke down completely within five months. This leaves behind the metal component, in this case zinc, rather than lead or lithium, which could be recycled. "Zinc is more abundant in earth's crust than lithium," says Hu. This zinc and chitosan battery has an energy efficiency of 99.7% after 1000 battery cycles.

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