



2020

ENGINEERING EDUCATION ANNUAL REPORT





MESSAGE FROM THE DEPARTMENT HEAD

It is a distinct pleasure to be introducing the inaugural Annual Report of the Department of Engineering Education at Virginia Tech. The Department was established in 2004, incorporating the Division of Engineering Fundamentals that had been established in 1967 with a focus on teaching first year engineering students.

The Department remains the home to the General Engineering program which serves as the entry point for the over 2000 first-year engineering students that arrive annually at Virginia Tech. The Department commenced a Ph.D. program in 2008, building on the strengths that its faculty had already established in the newly emerging field of Engineering Education Research (EER). This program continues to grow in enrollment and now has over 50 alumni each making their mark as researchers, teachers and change-agents across the country and further afield.

The word “unprecedented” was most certainly overused during 2020, and for good reason, as we lived through an unprecedented global crisis that changed every aspect of life. The pandemic had us swiftly having to move nearly all of our operations online during March and quickly adapting our teaching to retain the hallmark of student-focused engagement that we have always prioritized. Sadly, we had to cancel our prize-winning study abroad program, which was already well underway in preparing students for their travel experiences. We spent summer progressively realizing that the Fall 2020 semester was not going to be like any before. We ran orientation for new first years full online and proceeded to welcome new students to our course and our advising support – all delivered via zoom. We also on-boarded an excellent new cohort of Ph.D. students in this remote mode – with much creative work by all faculty to work out how to build community and support for our grad students.

Despite all the very real challenges of 2020, with many taking on new domestic care duties and homeschooling, living with anxieties for families both near and far, as well as a turbulent political year in the USA, I am exceptionally proud to be showcasing the annual achievements of our Department in this report.

We have known for a while that we wanted to properly document our work in this way on an annual basis, also to have a core publication to anchor our external engagement. With hindsight it was actually an excellent year to have launched this: during 2019 we had launched a strategic planning process in the Department building on those in the institution and the college, and in early 2020 we were already crystallizing a fresh vision for our future. We took this into the Academic Program Review that Virginia Tech required us to undertake during 2020, and we received exceptionally strong commendation for our work as a Department and our forward-looking plans.

We closed out the year with incredibly positive feedback from students across the courses and programs we deliver, and we celebrated an amazing swathe of awards garnered by our faculty and staff. This Annual Report showcases these achievements and also aims to give a window into the life in this Department during this unusual year. What was proven beyond doubt as we faced unanticipated COVID-related challenges was that the quality and commitment of the people in this Department is its core strength. We are also buoyed by all the ongoing external support that sustains us and we are particularly delighted to share this report with you all – I hope you enjoy the read!

Warm regards,
Jenni Case

VISION STATEMENT

We are a **globally-recognized leader** in preparing emerging engineers, educators, and scholars who work across technical, cultural and social boundaries to **address contemporary challenges and serve the broader community.**

We **influence** practice, **advance** knowledge, and **shape** careers in an environment that **nurtures learning and growth** within the field of engineering education.

STRATEGIC PRIORITIES

Our six strategic plan priorities were developed over 10 months by a team of four cross-department members, including: **Jessica Elmore**, Undergraduate Advising Team Representative; **Matthew James**, Undergraduate Program Representative; **Jeremi London**, Ph.D., Graduate Program Representative; and **Angela Parvin**, Operations Team Representative. In addition, the team developed the entire strategic plan, and the new department vision and mission statements.

- 1 Foster & build collaborations external to the ENGE department.** Doing so will improve the quality of education for our students, extend the reach of our impact, and help us stay current in professional knowledge.
- 2 Embody internal cohesion.** Fostering a culture of mutual trust and respect can help each of us do our jobs more effectively by learning from each other. This will also contribute to a more enjoyable work environment, removing inefficiencies, and support steady progress to shared goals.
- 3 Champion cultural competence in our work and interactions.** Create a psychologically safe experience for people of diverse perspectives and backgrounds. The ENGE department can be a place that celebrates and values differences among individuals.
- 4 Showcase and demonstrate our indispensable value as professionals, educators, and scholars.** To advance goals of the engineering discipline, the COE, and the university, we should cultivate recognition and buy-in from other parties for our meaningful contributions.
- 5 Secure and diversify resources to advance our efforts.** Having consistent resources enables stability and promotes innovation across all of our focus areas.
- 6 Foster a holistic student experience at scale within and beyond ENGE.** By being the first point of contact for all engineering students, we are well-positioned to provide a solid foundation for students' academic and career success.

MISSION STATEMENT

We offer a **world-class education** through exceptional advising, pedagogy, scholarship, and operational practices that **empower informed career decisions** and **serve as a meaningful touchpoint** for undergraduate and graduate engineering students at Virginia Tech.

We are **a community of forward-thinking professionals** who develop and disseminate knowledge, fostering cohesion between innovative research and practice.



JUNE 1, 2020: A MESSAGE TO THE ENGINEERING EDUCATION COMMUNITY

The death of George Floyd at the hands of police officers a week ago in Minneapolis has reminded us once again of the realities of racism in this country. As a Department of Engineering Education at Virginia Tech, we could say “these are political matters;” “these are personal matters;” or “we will leave this for others to make statements.” At this juncture I do not feel we have that option. An explicit stance is needed.

Engineering Education is not a “neutral” discipline: we take as our departure point the people who learn, teach, and go into engineering careers, and we think critically about the impact of engineering work on society. We cannot be unaffected by what is presently happening in the country: a key focus in our work is on how inclusion and exclusion operate in our society. Today we see a potent expression of pain and frustration at the differential treatment of citizens in this country based on their race.

In our Departmental community are Black faculty and students whose lives have been marked by experiences of racism, and for whom traumas resurface with the video footage currently on our screens. Those of us who are not subjected to racism have all too easily been able to continue our lives without having events like this trigger this kind of fear, pain, and anger. It is easy to make simplistic judgments of these events but as those who research and think about education and society, we should expect better of ourselves.

I also know that not everyone experiences our Department as the safe haven that I would like it to be. We had started a process earlier this year to start to engage more deeply with these challenges, and the present moment adds a terrible urgency to this work. As a Department, we need to build a renewed effort to understand what is happening both in our society and in our ENGE community, and to do everything we can to change things for the better. We must build the capacity to have difficult conversations, where we can listen better to each other and provide a space for all to grow. I invite you to connect with me on ways we can do this and will also continue to work closely with the faculty/staff and student representatives on our newly elected Equity and Inclusion Committee as they begin their important work identifying ways for us to systematically address these issues as a community.

Jenni Case, Department Head

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GRANTS

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HONORS
& AWARDS

BY THE NUMBERS

SECTIONS OF
MANDATORY GENERAL
ENGINEERING COURSES

2 FOUNDATIONS
OF ENGINEERING
PRACTICE

FOUNDATIONS
OF ENGINEERING **42**

40 FOUNDATIONS
OF ENGINEERING

48 DOCTORAL STUDENTS

ACADEMIC ADVISORS

7

14 TENURE/TENURE-TRACK FACULTY

STAFF & A/P FACULTY

7

10 INSTRUCTORS & PROFESSORS
OF PRACTICE

33 < JOURNAL
PUBLICATIONS

BOOKS &
CHAPTERS > **9**

Review our 2020 publications on **pages 28-31**.



Learn more about our
2020 doctoral graduates
on **pages 32-33**.

SIX
DOCTORATES
AWARDED

OVER
2500

GENERAL
ENGINEERING
STUDENTS



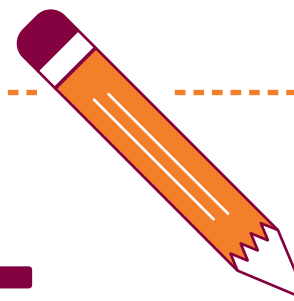
Spring
2020
Fall
2020
1 = 100

15 <

RESEARCH GROUPS & LABS

17,520

^ DROP-IN & SCHEDULED
ADVISING APPOINTMENTS



RESEARCH
EXPENDITURES >

\$2,279,710

Review the breakdown of our 13 new grants on **pages 26-27**.

Learn more about our
research facilities at
bit.ly/ENGResearchFacilities



DISCOVERING THE RURAL ENGINEER

THE VT PEERS PROJECT

When the bell rang at 10:10 a.m., the kids left the classroom and Kristin Carter was alone for a few minutes to reset. She collected 16 soil test chambers from the desks in a plastic bin and carried them into a nearby supply hall. In the narrow hall, Carter pivoted past a bulletin board she'd pinned with baby pictures, a student's drawing of Carter's donkey Pearl on a sunlit hill, and two clips from the Smyth County News and Messenger: a photo of her son Dalton pushing off the mound before pitching a perfect game for Northwood High School in 2015 and a 2018 story about her parents selling their dairy herd.

"The Lamies' farm, Walker Mountain Dairy Farm, is the last dairy farm in Rich Valley," it read. At a big sink, Carter rinsed the test chambers out for her second-period life science students to use next. Then she walked out to greet them.



"Unscrew the lid from the jar," Carter told the seventh-graders after they received gold-lidded glass jars filled with soil samples – black mixtures of clay, sand, and silt topped with water and a teaspoon of borax. "I'm gonna warn you, they've got a good stink."

A few kids stuck their noses too close to the brims of the jars and snapped back at the smell. Carter reminded them to follow scientific precautions and waft, so they parted their fingers and gently waved the stink upward. "Mrs. Carter, this smells like farts!" one kid cried out.

They skimmed water from the samples with pipettes, filled the test chambers, and added color-changing chemical agents. "Close the chambers and shake," Carter said. "Shake, shake, shake!"

The group's soil testing ate up the full class period, so the second half of the activity came the next day. Working from their soil data, Carter's students looked at the genetics of corn and chose alleles to replace for traits that suited the soil. These steps gave the kids an SOL-inspired sense of genetic engineering and its use in agriculture, and to complete them, the students navigated engineering design criteria and constraints. Behind the activity is that broader goal: Carter wants kids to step into the shoes of engineers and see that it's possible to wear them.

"You want to figure out a way to make engineering a positive experience for them," said Carter. "They can come in, have fun with it, and see that they can do these things. It sticks with them."

Since 2018, Carter, a seventh-grade life science teacher at Northwood Middle School in Saltville, Virginia, has worked with Partnering with Educators and Engineers in Rural Schools, or VT PEERS. The applied research program brings middle-school teachers, local industry partners, and researchers from the College of Engineering



"YOU WANT TO FIGURE OUT A WAY TO **MAKE ENGINEERING A POSITIVE EXPERIENCE** FOR THEM. THEY CAN COME IN, HAVE FUN WITH IT, AND SEE THAT THEY CAN DO THESE THINGS. IT STICKS WITH THEM."

Department of Engineering Education together in the classrooms of rural Appalachia to design, run, and study hands-on engineering activities. The program is in its third and final year of funding from a \$1.3 million National Science Foundation grant through the foundation's Innovative Technology Experiences for Students and Teachers initiative.

Engaging more than 1,800 students in seven schools in the Southwest Virginia counties of Smyth, Bedford, and Giles since 2017, VT PEERS aims to open kids' conceptions of engineering before they move on to high school and narrow down their options for higher education and careers. The program works to show students that engineering is everywhere – in roads they travel and water that flows through town – and the people behind it can be creative and curious, make mistakes and compromises to solve problems, and live in their communities.

WHEN I WAS A KID AND WAS ASKED, 'WHAT DO YOU WANT TO BE WHEN YOU GROW UP?' I THOUGHT ABOUT THE STUFF I SAW ON A DAILY BASIS. OKAY, I WANT TO BE A DOCTOR. A FIREFIGHTER. THE STUFF THAT ENGINEERS DO BEHIND THE SCENES – PEOPLE AREN'T NECESSARILY AWARE OF IT. ESPECIALLY AT THAT AGE.

"Those are conceptions that open doors and keep doors open," said Jacob Grohs, an assistant professor in the Department of Engineering Education and the project's principal investigator.

Grohs said the onus to create positive engineering experiences for students has remained on teachers thus far, despite the unique expertise and resources that university and industry partners could offer. These groups – teachers and their school systems, universities, and companies – are all positioned at important points on a child's path to college and careers. Collaboration between them could create supportive infrastructure for teachers.

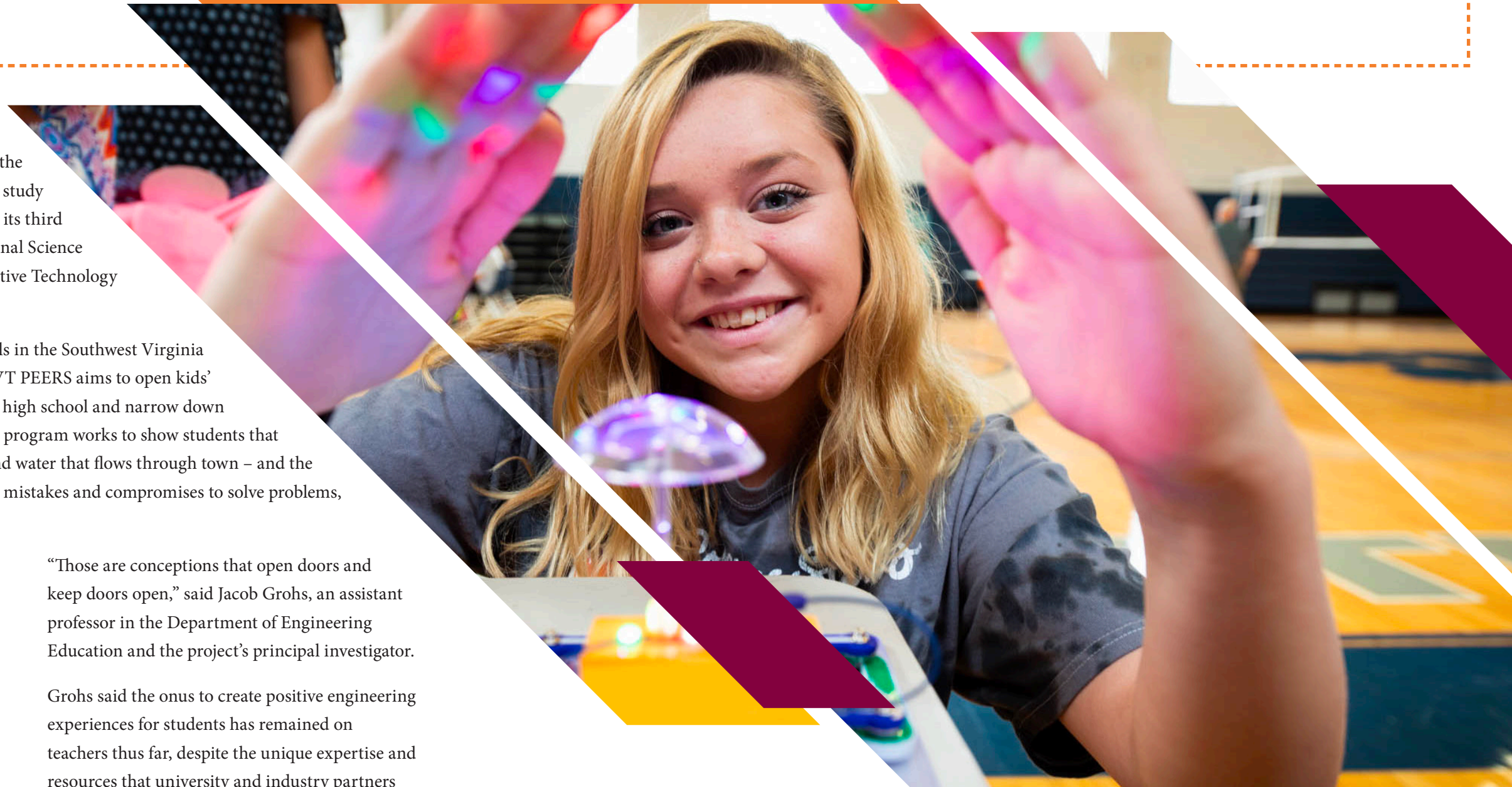
"Groups that could be talking to each other and supporting each other, aren't," said Grohs. "How do we find ways to get people to work together? How do we study how that process happens? Because we know that putting all of this additional work on the backs of teachers is

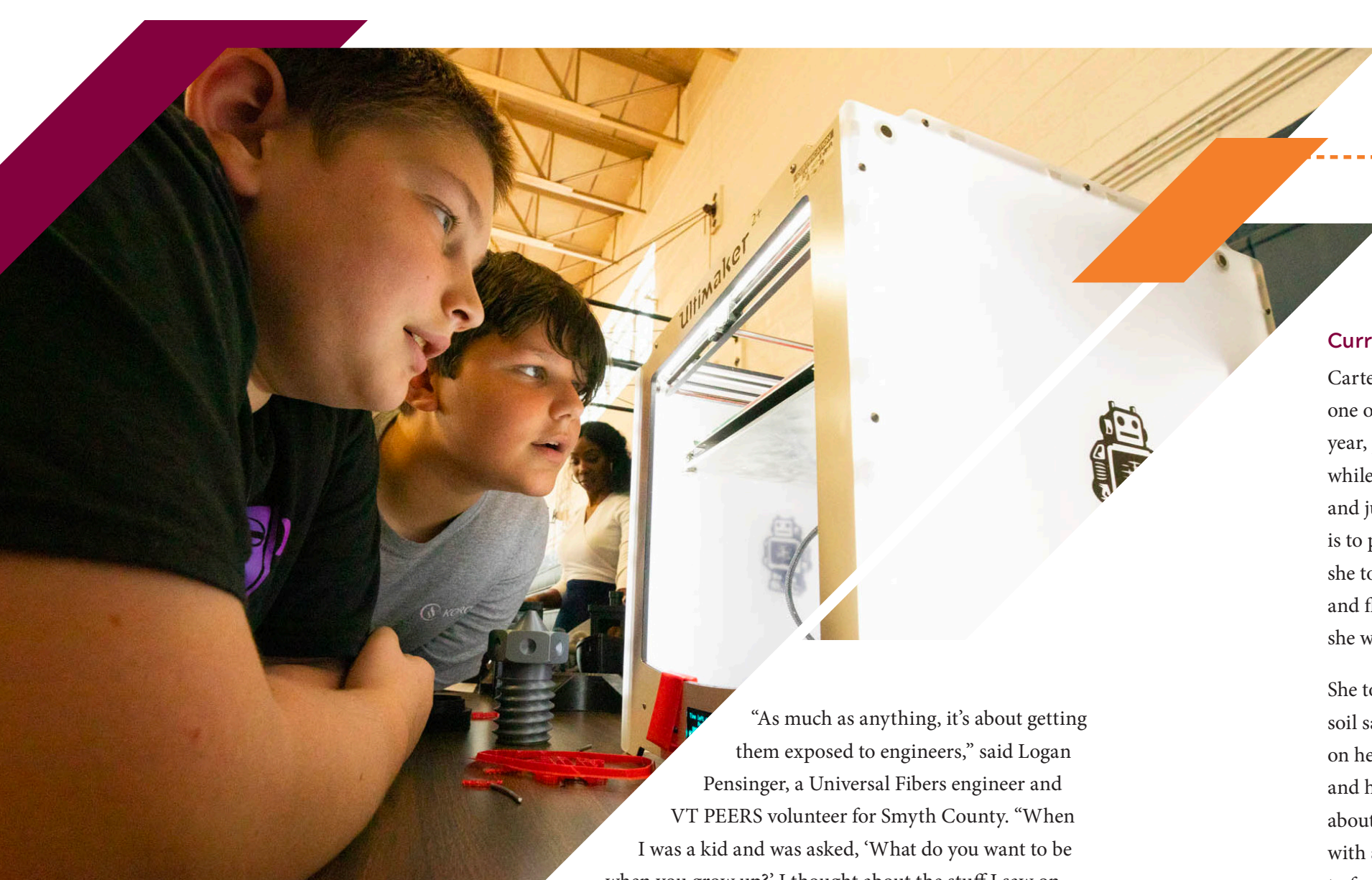
just not tenable. We need to think about how to do it differently – how to be more broadly engaged in the education of youth in our communities."

Looking up to local engineers

In the fall, Carter and other Smyth County teachers run an activity with program partners called "Balls of Energy." Students drop bouncy balls from different heights onto foam, wood, and carpet to test each material's damping qualities – its ability to dissipate energy, draining the bounce from the ball. If you picked up the carpet squares for a closer look, you'd find them to be 18 inches by 18 inches with tight, thin pile, each square produced in a plant one county over. That plant belongs to a company unknown to Carter and her students until 2018: Universal Fibers.

The Bristol-based program partner sends its engineers to Smyth County schools to help instruct in-classroom activities. They float around the room, field questions, bring extra resources like carpet squares, and describe how concepts the kids learn – like damping – apply to their jobs.





“As much as anything, it’s about getting them exposed to engineers,” said Logan Pensinger, a Universal Fibers engineer and VT PEERS volunteer for Smyth County. “When I was a kid and was asked, ‘What do you want to be when you grow up?’ I thought about the stuff I saw on a daily basis. Okay, I want to be a doctor. A firefighter. The stuff that engineers do behind the scenes – people aren’t necessarily aware of it. Especially at that age.”

That’s particularly the case for manufacturing, said Pensinger’s colleague and fellow volunteer, Ranae Anderson. “With this program, kids are able to see the other side of manufacturing, that it’s not what your grandparents’ manufacturing used to look like,” she said.

Pensinger is from Bristol, Virginia, but he didn’t discover Universal Fibers until after he left to study chemical engineering at Virginia Tech in 2009. While working on his senior design project, he called the company for its expertise on plastic recycling. The manager who picked up later offered him a job. But that first encounter took place only after Pensinger stumbled upon the company in a quick online search, long after he’d chosen to study engineering. VT PEERS helps Universal Fibers remove chance from its connections to potential talent and make links earlier. Industry partners Fostek and Celanese aim for the same in Bedford and Giles counties.

“The kids are able to see: here’s a job in my own area that I can be involved with, and I can make a good living, have flexible hours, and be able to stay,” said Anderson.

Curriculum designed for and by teachers

Carter’s October genetic engineering activity was one of the first in which she took the lead. Last year, program staff would run activity instruction, while Carter observed, managed the classroom, and jumped in as she wanted. Grohs said the goal is to put her in the driver’s seat this year. When she took point, Carter ran the activity at a tight and fluid pace, as if she’d always had the role. And she wove in context.

She told her students about the importance of soil samples to farmers. Carter talked about life on her own farm, a 100-acre property that she and her husband, Michael, bought last year. It’s about a mile from school and perched on a hill with a view that stretches out to town. There, the Carters grow alfalfa and orchard grass for hay to feed the animals they raise. Carter told her students about the farm’s recent switch back to growing grasses after a brief stint with pumpkins. Her family needed their soil tested to learn how it had changed. Her students were bobbing up and down as pumpkins and grass to illustrate the transition when the bell rang.

The VT PEERS curriculum is designed to work in a culturally relevant context like Carter’s. It’s this context that fosters sustained interest in engineering, said Holly Matusovich, an associate professor in the Department of Engineering Education and a member of the research team.

“Engineering is so many things, it’s hard to pin down,” she said. “We need to talk about it in meaningful ways that make sense to the people who are living and working in a community.”

ENGINEERING IS SO MANY THINGS, IT’S HARD TO PIN DOWN. WE NEED TO TALK ABOUT IT IN MEANINGFUL WAYS THAT MAKE SENSE TO THE PEOPLE WHO ARE LIVING AND WORKING IN A COMMUNITY.





Before the school year starts, teachers and partners attend a summit held by VT PEERS at Virginia Tech. They use that time to guide curriculum design with input on Virginia Standards of Learning subjects they hope to cover – each activity must tie into an SOL, a critical planning metric for teachers – as well as subject matter with which they and their students can identify.

Activities like “Mountain Roads” have since become part of the curriculum. The engineering design challenge has students construct a road around a mountain within a given set of constraints. As kids create open-ended solutions and problem-solve like engineers, teachers can relate the roads to the winding Appalachian curves that their students may navigate going to and from school.

The Virginia Tech team is studying these activities and the collaboration itself, looking for ways to improve them, and with additional funding, expand upon them. Early this year, Grohs also received a CAREER award from the National Science Foundation to build out support for and study the trajectories of middle schoolers that have engaged with VT PEERS, as they enter high school in Giles and Smyth counties. Grohs will work with educators outside the science domain, like librarians and technology teachers, to enable students to continue exploring their interest in engineering.

“Virginia Tech should be a recurrent resource, collaborator, and encourager of youth, teachers, and school systems in these regions,” said Grohs.

Ranae Anderson wants the same for Universal Fibers in Smyth County schools.

“We’ve been in their backyard for 50 years, but they didn’t know we were here. We didn’t know we had anything to offer them. Being a partner in the program has helped change that.” ■

In Summer 2020, Virginia Tech was awarded the 2020 Excellence in Faculty Community Engagement Award, for “efforts to build community capacity for integrating engineering in rural middle school science classrooms” through the VTPEERS program. Read the award announcement at bit.ly/FacultyCommEngage.

Photos by Peter Means, article by Suzanne Irby. Adapted from the VT News article published in February 2020. Watch videos and more at bit.ly/RuralEngineer.

BREAKING THROUGH WITH RESEARCH-BACKED INSIGHTS

OUR GRADUATE STUDENTS MAKE AN IMPACT

In Breakthrough, a short film series produced by Science Friday and the Howard Hughes Medical Institute, a dozen women in science share what they do.

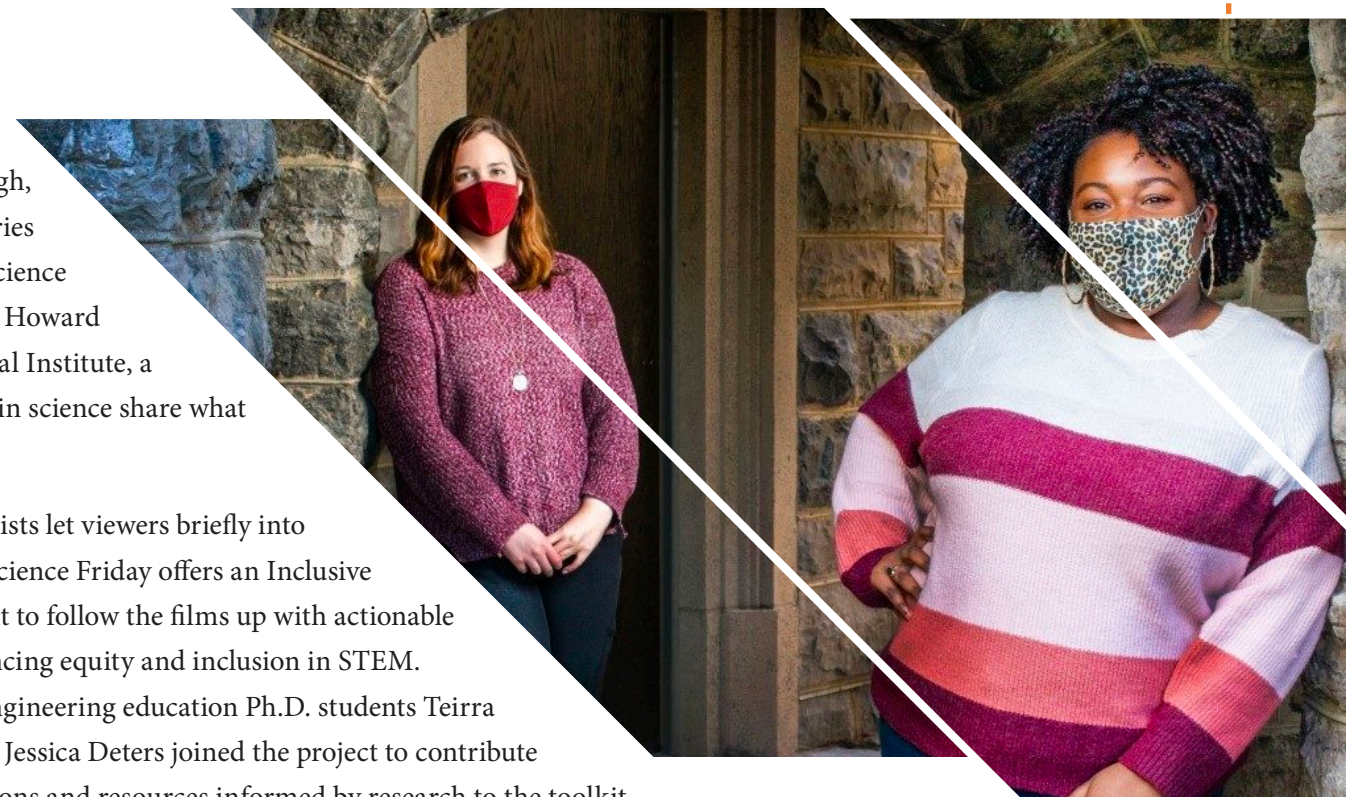
As these scientists let viewers briefly into their worlds, Science Friday offers an Inclusive Action Tool Kit to follow the films up with actionable steps for advancing equity and inclusion in STEM. Fourth-year engineering education Ph.D. students Teirra Holloman and Jessica Deters joined the project to contribute recommendations and resources informed by research to the toolkit.

Both see the combined films and toolkit as a jumping-off point for inclusive action in STEM.

“Breakthrough is putting the really innovative work that these women are doing at the forefront and starting conversations around that,” Deters said. “And then we’re able to come in with this toolkit and be like, now here’s how we can make it possible for more women to do that work.”

The steps laid out in the first section of the toolkit, focused on creating change, are targeted at those who instruct and lead in STEM fields of higher education — faculty, administrators, and staff — while the second section is designed to be a resource for minoritized students that are navigating that system. Topics covered in the toolkit include addressing underreported identities in national datasets, equity in the application process, safe community spaces, and mentorship.

“These are the topics that got us motivated to pursue our degrees, but also, it’s an opportunity to showcase some of that knowledge that we’ve been able to pick up along the way,” Holloman said. “And it’s a balance of: yes, here’s a place to start, but it also doesn’t stop here. This is a multifaceted, complex, systemic issue. There isn’t one mentoring program you could implement that’s going to make everything all better. There are lots of moving pieces that have to happen.”



USING THE TOOLKIT AS A GUIDE TO LOOK THROUGH, HOW CAN YOU USE THESE TIPS TO IMPROVE THE EXPERIENCES OF YOUR STUDENTS?

The toolkit's order of focusing first on providing recommendations for higher education leadership was intentional, the pair explained. While the document gives strategies to help students alleviate some of the issues they may be experiencing while pursuing their degree in a STEM field, it places the onus on those who lead and teach for the big, systemic fixes.

"If you're coming to this as someone with power — a faculty member, a staff member, an administrator — think about: What do you have power over?" said Deters. "What spaces do you control? And in what

ways can you influence student experiences? Using the toolkit as a guide to look through, how can you use these tips to improve the experiences of your students?"

As a researcher, Deters is investigating how core beliefs and values held in engineering affected student and faculty experiences as engineering programs adapted to COVID-19 this year. Holloman is studying race-conscious student support programs in engineering and how program leaders navigate and adapt to varying external forces, like political climate and resources, within higher education environments. While these individual research efforts and other projects fill a lot of their time, Deters and Holloman were drawn to the Breakthrough toolkit for a chance to share their knowledge in a different, more tangible way.

"We're both really motivated by the idea of improving diversity, inclusion, and equity in STEM," said Deters. "This just seemed like a really good opportunity to communicate that work broadly. So rather than writing that conference paper or journal article, I think this style of publication is something that's designed to be understandable for everyone, accessible to everyone."

The two found that in working on the toolkit, they could pull from four years of daily conversations and experiences they shared with students and faculty in the Department of Engineering Education, including dialogue on inclusive action within the department itself.

"We have our own equity and inclusion committee within our department, and I'm able to be a part of that committee," said Holloman. "I get to see how faculty actively engage in trying to make change within the department. ...It's one thing to be able to have all this knowledge, but it's another thing to know how to actually put it into action. As a graduate student, being able to watch that happen in a space where I still feel comfortable expressing my thoughts and opinions is a really cool one." ■

Photo by Peter Means, article by Suzanne Irby. Adapted from the VT News article published on Nov. 12, 2020. Read the full story at: bit.ly/PHDBreakthrough.

EXPERIENTIAL LEARNING THROUGH UNDERGRADUATE RESEARCH

In Spring 2020, 10 first-year students were selected to work together on undergraduate research projects under the guidance of Dr. David Gray and Dr. Holly Matusovich. Supported by a grant from the [VT Center for Excellence in Teaching and Learning](#), the work aims to provide direct experience for early undergraduate research (first or second-year students).

According to Gray, he focuses a lot of mentoring the students through the process, including the group aspect. He wants the students to get used to teams, the pace of research, and even the real-world applications of their work.

Students were grouped to work on one of four semester-long research projects. The tasks and the roles assigned to the students formed stand-alone projects that can be scoped and executed over the course of a semester to provide a holistic introduction to research. The following four projects include their summaries, as submitted by the student researchers.

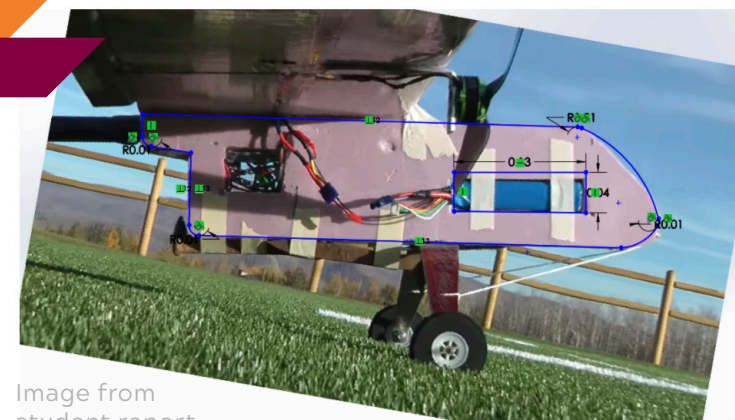


Image from
student report

AUTONOMOUS DRONE CONTROL (AUTODRONE)

The autonomous drone project seeks to develop an autonomous, fixed-wing craft that is capable of surveying infrastructure for inspection by civil engineers. We will take a standard RC plane and add the ability to control it from a computer by plotting points on a map and to form topographical maps of the areas it flies over with a camera. During flight,

the plane should output real-time sensor readings to give us the speed, attitude, heading, and position with reference to the base station. The plane should then fly the course and then return to base where we can download the data it collects and create the topographical map post-flight.

ACOUSTO-OPTIC NONDESTRUCTIVE INSPECTION (AONDI)

The acousto-optic non-destructive inspection (AONDI) system works by visualizing scattering of ultrasonic surface waves upon interaction with surface or subsurface defects in a material. Large-area, optical characterization of the scattering mechanisms is the defining feature of the technique, as it enables dramatic increases in measurement throughput over competing technologies (ultrasonic pitch-catch, radiographic, etc.).

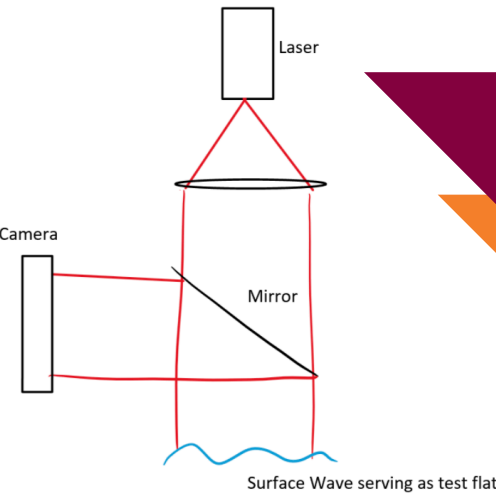


Image from student report

GROWING AN INCLUSIVE COMMUNITY IN ENGINEERING ED.

The department’s new strategic plan calls for a more inclusive community, and for fostering a culture of mutual trust and respect while creating a safe environment (priorities two and three). To help guide this work, the Equity & Inclusion committee was assembled in early 2020, with the following areas of responsibility:

- review teaching, advising, and supervising policies and practices to identify opportunities to promote equity and inclusion;
- facilitate the education and training of department personnel on issues of equity and inclusion;
- share useful information about equity and inclusion;
- monitor departmental culture and climate;
- provide consultation to department personnel and other department committees (e.g., grad, undergrad, search); and
- report committee activities to the college.

In October 2020, the committee created and distributed a needs assessment survey to personnel and graduate students. Through the assessment, the committee hoped to learn: how far members of the department believe we are away from our desired state & identify what needs to be done to get closer to that state.

Overall, those who responded to the survey “believe there is still work to be done in [cultural competence],” as there seems to be more awareness than implementation with this work. The department looks forward to building a systematic approach to cultural competence development and culture of curiosity and debate.

The E&I Committee will report in April 2021 on current work, future plans, and useful equity and inclusion resources.

NEST THERMOSTAT AI (NESTAI)

The nest thermostat artificial intelligence (NESTAI) is a system that works with a nest thermostat to keep a set area at the correct ambient temperature. This system uses a Raspberry Pi and a temperature node to ensure that the ambient temperature is being accurately met. The Raspberry Pi also takes into account exterior temperatures within its algorithms to set the nest thermostat to the ideal temperature the user would like.



Image from NEST product listing

SOLID-STATE HEAT SWITCH

A heat switch is a mechanism that controls the flow of heat, either autonomously or manually, into and out of a system. Heat switches are already applied in real-world applications using manual power or paraffin wax. The goal of this research project is to develop a passive, autonomous solid-state heat switch based on a second-order magnetic phase transition in gadolinium.

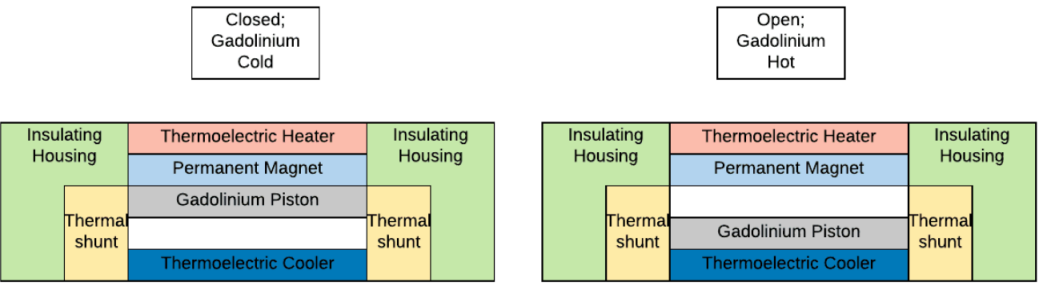


Image from student report

EQUITY & INCLUSION COMMITTEE

- Homero Murzi (chair)
- Walter Lee
- Maia Greene-Havas
- Teirra Holloman
- Julia Brisbane

A SEMESTER LIKE NO OTHER

TEACHING UNDERGRADUATES IN FALL 2020

Spring 2020 brought about a sudden and unexpected change in the way we engaged with our students due to the COVID-19 pandemic. Despite the unique and unprecedented circumstances, instructors in our undergraduate courses and our academic advisors were able to remain committed to providing students with the motivation and support that they needed as they continued to engage in the learning process. We took a primarily student-centered approach in all decisions regarding changes to course curricula as we adapted to the sudden shift to a remote learning environment, which from feedback we can see students greatly appreciated.

We made the conscious and collegial decision to enable asynchronous delivery of learning experiences, supplemented by virtual office hours, being mindful that our students may not necessarily have ready and reliable access to the technology needed

to engage synchronously with course activities. Instructors provided learning resources that students could access at their preferred time and pace through the Canvas learning management system, and thought of creative ways to engage with their students virtually through pre-recorded videos that share elements of the instructor's daily life and optional virtual office hours.

Instructors modified assignments and deliverables to adapt to the new environment, and focused not only on achieving the learning outcomes of the more technical aspects of the course but on students' health and well-being as well.

For example, students taking Foundations of Engineering who could no longer come together to build and fly drones were asked to develop a brochure describing their designs, supplemented by guided design walkthroughs. Some students chose to still build prototypes – and instructors provided virtual guidance and support to allow them to do that.

Beyond achieving these critical outcomes, instructors facilitated ways for students to process the unusual circumstances they found themselves in by encouraging students to reflect and facilitating a creative outlet to express their perceptions and experiences, through such media as drawings, photographs, poems, songs and videos.

Likewise, our advising team adapted their operations to ensure that they were able to support students' needs. The entire advising process shifted to virtual delivery, and appointment times were modified to ensure that advisors were able to engage with as many students as possible.

The team continued to guide students on concerns related to academic processes and decisions especially as new grading options were made available by the university, and creatively disseminated information on changes to academic processes and policies by developing infographics and advising packets.

Most of all, we listened to our students and their needs as we all went through a semester like no other. A common sentiment expressed by students was how much they missed the campus that they had just moved into a few months ago, but like any true Hokie they now call home. In response, Professors of Practice Matt James and David Gray took time to provide the next best thing - a virtual tour of the places they surely miss.



Watch Matt James' and David Gray's video at bit.ly/Sp20ENGVideo

ISING TO THE ONLINE CHALLENGE: HIGHLIGHTS OF TEACHING UNDERGRADUATES

With the shifting of undergraduate classes in the General Engineering program to an online format for all of 2020, we needed to adopt new methods to achieve our key goal of maximizing student interaction. Faculty made extensive use of synchronous teaching using Zoom and associated tools.

As our core courses play a crucial role in helping students select their majors, instructors have worked closely together to make sure our offerings are consistent, while utilizing new technology to synthesize creative solutions. This approach has been instrumental in our success this past year, as faculty engaged with students in ways that complement their strengths.



Dr. David Gray

I try to engage the students as I would colleagues in a faculty/staff meeting or colloquia. When we meet, I ask how things are going outside of class, and I reciprocate by bringing in challenges and triumphs of my own. I tell the students that teaching is hard online, that my car broke down last week and I had to get it towed, that it was my daughter's birthday. I try to knock down any wall between who I am as Dr. Gray, and who I am as David Gray. I let them know that we are all struggling, and that it's hard for everyone, and we are all going to make mistakes.

To teach algorithms, I have the students write the instructions for making jelly toast. The students are to assume they have a piece of toast, some butter, a jar of jelly, and a knife. I give them 4 minutes to write their instructions on a piece of paper. During an in-person lecture, I have a student volunteer come up and actually try to make jelly toast using the instructions the students have written. It's comical and impossible. Since managing a Zoom screen and handling the toast demonstration is not feasible in COVID online formats, I had my daughters help. I used my laptop to lead the Zoom lecture, but also dialed in using my cell phone on a tripod tuned to our dining room table... Then I read the instructions to my daughter and had her try to make the jelly toast. So, the students got their volunteer and got to see that I have a family and we eat food!

Dr. Diana Bairaktarova

I use the sketching option in Zoom during class time and assign students in random groups to exercise sketching together on one sketch in real time just as global design firms do working in real time on joint design. I also use a Spatial Vis app – students have been enjoying it and finding the sketching problems there to be very helpful.



Dr. Wm. Michael Butler

We did this icebreaker with teams where in the Zoom Breakout rooms the newly formed teams had to use the whiteboard to, as a team in 16 minutes, come up with a food emoji for the one food everyone in the group liked and then come up with a catch-phrase for the food. (The Burger King catch-phrase was given as an example.) They then reported that back to the larger class. While they worked, I would poke my head into the various groups to see how it was going and start to get to know the groups. It seemed to work well.



Dr. Jennifer Benning

Tasking students to develop and present “bad” power point slides as a team helped them prepare for a presentation and practice slide sharing and presenting in Zoom, and highlighted the importance of good communication skills in a way that was entertaining and fun for the students. It also built a sense of a community in the class.



Dr. Ben Chambers

The online format has its challenges, but also allows for a lot of interesting and new ways to engage and connect with students. When we teach from home, we have easy access to items from our lives that humanize and connect us. My puppy has joined class a few times, to the great joy of many of the students. We're well accustomed to seeing cats walking across desks at this point, but having a puppy step on the keyboard is something else. We're also all able to grab props from our desks to share a bit of ourselves. I've had impromptu moments where I've pulled tools like an airbrush and triangular screwdrivers in to illustrate a point or help answer a student question. It's also a nice break and source of levity at times, to do a costume change, or even just put on a different hat.



2020 RESEARCH GRANTS

National Science Foundation

Supplement: “vObjects – Understanding their Utility to Enhance Learning of Abstract and Complex Engineering Concepts,” \$29,642

PI: D. Bairaktarova

RAPID: “Assessing the Reactionary Response of High School Engineering Teachers to COVID-19,” \$163,678

PI: D. Bairaktarova

CAREER: “Engineering Pathways for Appalachian Youth: Design Principles and Long-term Impacts of School-Industry Partnerships,” \$724,031

PI: J. Grohs



Photo by Peter Means, from
“Discovering the Rural Engineer.”

Virginia Rural Health Association

“Appalachian Center for Hope - Strategic Plan Coordination Assistance,” \$19,999

PI: J. Grohs

Center for Excellence in Teaching and Learning

“Undergraduate Research in General Engineering,” \$4,400

PI: D. Gray, co-PI: H. Matusovich

Corning Foundation

“CENI Educators’ Network,” \$4,500

PI: L. McNair

Collaborative Research with Purdue: “Intersections between Diversity, Equity, and Inclusion (DEI) and Ethics in Engineering,” \$49,339

PI: A. Katz

Supplement: “Gatekeepers to Broadening Participation in Engineering: Investigating variation across high schools comparing who could go versus who does go into engineering,” \$87,324

PI: D. Knight, co-PIs: J. Grohs, H. Matusovich

CAREER: “Responsive Support Structures for Marginalized Students: A Critical Interrogation of Navigation Strategies,” \$570,901

PI: W. Lee

Collaborative Research with University of Texas-Dallas, Rowan University & Arizona State University: “Rising Doctoral Institute,” \$370,948

PI: H. Matusovich

RAPID: “COVID-19, Remote Ethnography, and the Rural Alaskan Housing Crisis,” \$200,000

PI: L. McNair PI, co-PI T. Nicewonger

Supplement: “Liberatory from the Ground Up: An Ethnography of Maker Spaces Achieving Diverse Participation” \$48,000

PI: L. McNair

Collaborative Research with Stevens Institute of Technology: Research Initiation: “Market-driven design concept formation in undergraduate engineers,” \$8,074

PI: N. Pitterson

PUBLICATIONS

Artiles, M. S., & Matusovich, H. M. (2020). **Examining Doctoral Degree Attrition Rates: Using Expectancy-Value Theory to Compare Student Values and Faculty Supports**. *International Journal of Engineering Education*, 36(3), 1071–1081.

Ashwin, P., & Case, J. M. (2020). **Undergraduate education in South Africa: To what extent does it support personal and public good?** In C. Callender, W. Locke, & S. Marginson (Eds.), *Changing higher education for a changing world* (pp. 223-235): Bloomsbury

Ayer, S., Hartless, J., Wu, W., London, J. (2020). **Comparison of Building Design Assessment Behaviors of Novices in Augmented- and Virtual-Reality Environments**, accepted to the *Journal of Architectural Engineering*, 26(2), 1-11.

Bairaktarova, D., & Pilotte, M. (2020). **Person or thing oriented: A comparative study of individual differences of first-year engineering students and practitioners**. *Journal of Engineering Education*, 109(2), 230–242.

Barlow, A., Brown, S., Lutz, B., Pitterson, N., Hunsu, N., & Adesope, O. (2020). **Development of the student course cognitive engagement instrument (SCCEI) for college engineering courses**. *International Journal of STEM Education*, 7, 1-20.

Case, J. M. (2020). **Engaging the Normative with the Analytical in Higher Education Research**. In *Locating Social Justice in Higher Education Research* (pp. 139-150): Bloomsbury.

Chambers, B.D., Kuhar, T.P., Leskey, T.C., Reichard, G., Pearce, A.R., (2020) **Negative Gravitaxis in Overwintering Halyomorpha halys (Hemiptera: Pentatomidae)**. *Journal of Agricultural and Urban Entomology* 36 (1), 109-114

Chambers, B.D., Leskey, T.C., Cullum, J.P., Kuhar, T.P, Pearce, A.R., (2020) **Cavity Tightness Preferences of Overwintering Halyomorpha halys (Hemiptera: Pentatomidae)**. *Journal of Economic Entomology* 113 (3), 1572-1575.

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Davis, K., Ghaffarzadegan, N., Grohs, J., Grote, D., Hosseinichimeh, N., Knight, D., Mahmoudi, H., & Triantis, K. (2020). **The Lake Urmia vignette: A tool to assess understanding of complexity in socio-environmental systems**. *System Dynamics Review*, 36(2).

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Grohs, J., Lesko, H., Brantley, J., Schilling, M., Paradise, T., Carrico, C., Matusovich, H., & Kirk, G. (2020). **Prioritizing Relationships and Supportive Infrastructure in a University-School Collaboration Through and Beyond COVID-19**. In R. Ferdig, C. Mouza, R. Hartshorne, E. Baumgartner, & R. Kaplan-Rakowski (Eds.), *Teaching, Technology, and Teacher Education During the COVID-19 Pandemic: Stories from the Field*. Association for the Advancement of Computing in Education.

Grote, D.M., Knight, D.B., Lee, W.C., and Watford, B.A. (2020). **Exploring impacts of policy intersections on transfer student access: Findings from conversations with street-level bureaucrats**. *Education Evaluation & Policy Analysis* 42(4): 576-602.

Grote, D.M., Knight, D.B., Lee, W.C., and Watford, B.A. (2020). **Navigating the curricular maze: Examining the complexities of articulated pathways for transfer students in engineering**. *Community College Journal of Research and Practice*.

Kajfez, R. L., & Matusovich, H. M. (2020). **The Role of Identity in Understanding Graduate Teaching Assistants: A Mixed Methods Analysis**. *International Journal of Engineering Education*, 36(3), 1049–1061.

Katsioloudis, P. J., & Bairaktarova, D. (2020). **Impacts of Scent on Mental Cutting Ability for Industrial and Engineering Technology Students as Measured Through a Sectional View Drawing**. In: Škilters J., Newcombe N., Uttal D. (Eds.) *Spatial Cognition XII*. *Spatial Cognition 2020*. Lecture Notes in Computer Science, vol 12162. Springer, Cham.

Katz, A., Reid, K., Riley, D., Van Tyne, N., **Overcoming Challenges to Enhance a First Year Engineering Ethics Curriculum**. Submitted to *Advances in Engineering Education*, Fall 2020.

Kinoshita, T. J., Knight, D. B., Borrego, M., & Wall Bortz, W. E. (2020). **Illuminating systematic differences in no job offers for STEM doctoral recipients**. *PloS One*, 15(4), e0231567.

Knight, D.B., Davis, K.A., Kinoshita, T.J., Ogilvie, A.M., Twyman, C. (2020). **The Rising Sophomore Abroad Program: Early experiential learning in global engineering.** *Advances in Engineering Education*, 7(3).

Knight, D. B., Grohs, J. R., Bradburn, I. S., Kinoshita, T. J., Vaziri, S., Matusovich, H. M., & Carrico, C. (2020). **Illuminating inequality in access: Variation in enrollment in undergraduate engineering programs across Virginia’s high schools.** *Journal of Engineering Education*, 109(4), 665–684.

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Matusovich, H., Gillen, A., Carrico, C., Knight, D., & Grohs, J. (2020). **Outcome Expectations and Environmental Factors Associated with Engineering College-Going: A Case Study.** *Journal of Pre-College Engineering Education Research (J-PEER)*, 10(1).

McCall, C., Shew, A., Simmons, D. R., Parette, M. C., & McNair, L. D. (2020). **Exploring student disability and professional identity: navigating sociocultural expectations in US undergraduate civil engineering programs.** *Australasian Journal of Engineering Education*, 25(1), 79-89.

Ogilvie, A. M., & Knight, D. B. (2020). **Engineering transfer students’ reasons for starting at another institution and variation across subpopulations.** *Journal of Hispanic Higher Education*, 19(1), 69-83.

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Paretti, M. C., Kotys-Schwartz, D., Ford, J.D., Howe, S., Ott, R. (2020). **Leveraging capstone design experiences to build self-directed learning.** *International Journal of Engineering Education*. 36(2): 664-674.

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Reeping, D. and Grote, D.M. (2020). **Effects of large-scale programmatic change on electrical and computer engineering transfer student pathways.** *Institute of Electrical and Electronics Engineers (IEEE) Transactions on Education*.

Reeping, D. & McNair, L. (2020). **Looking Ahead: Thinking In Systems To Uncover Faculty Mental Models Situated In Curricular Change.** *Advances in Engineering* 8 (2), 22 pages. ISSN: 1941-1766.

Rikakis, T., McNair, L. et al. (2020). **The Calhoun Discovery Program – A Pilot IPPD Curriculum.** In Arnold, A., Lindsey, A., McCoy, A., Khademian, A., Lockee, B., Adams, C., ... & Contomanolis, M. (eds.) *Adaptive Life-Long Learning for an Inclusive Knowledge Economy*. Blacksburg, VA: Virginia Tech.

Wall Bortz, W. E., Knight, D. B., Lyles, C. H., Kinoshita, T., Choe, N. H., Denton, M., & Borrego, M. (2020). **A competitive system: graduate student recruitment in STEM and why money may not be the answer.** *The Journal of Higher Education*, 91(6), 927-952.

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Yones, R., & Bairaktarova, D. (2020). **ViTA: A platform-independent automatic grading tool for two-dimensional CAD drawings.** *International Journal of Mechanical Engineering Education*, 1-23.

DOCTORATES

AWARDED IN 2020



Dr. Kirsten Davis

“Pursuing Intentional Design of Global Engineering Programs: Understanding Student Experiences and Learning Outcomes”

March 10, 2020



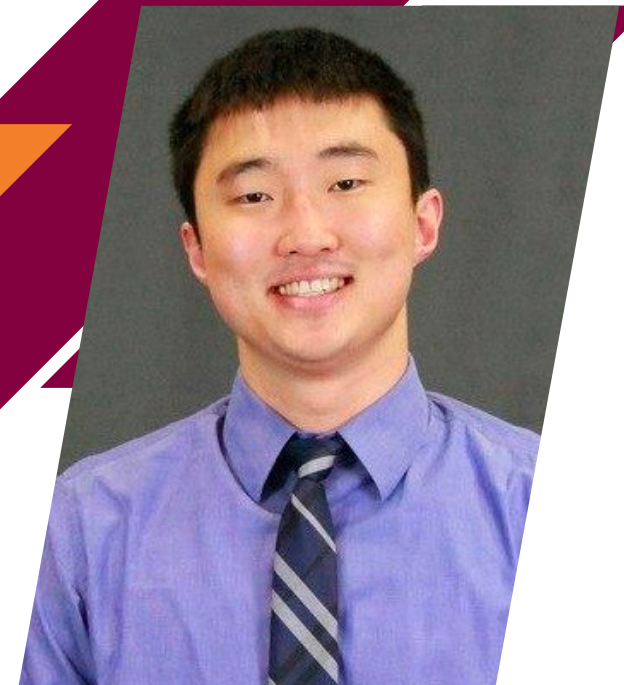
Dr. Cynthia Hampton

“Agency to Change: A Narrative Inquiry of White Men Faculty in Engineering Engaged in Broadening Participation Work”

December 15, 2020

Where are they now?

Read more at: pages 57-59.



Dr. Timothy Kinoshita

“An Exploration of the Enrollment and Outcomes of the Virginia Governor’s STEM Academies”

August 3, 2020



Dr. Adetoun Yeaman

“Understanding Empathy in the Experiences of Undergraduate Engineering Students in Service-Learning Programs”

May 12, 2020

Dr. Desen Ozkan

“Transdisciplinarity on Paper: How do cross-disciplinary faculty translate university initiatives into the classroom?”

May 13, 2020



Dr. Elizabeth Spingola

“Understanding the Relationships Between Disability, Engineering, and the Design of Engineering Course Websites Through Disabled Engineering Students’ Perspectives”

March 4, 2020



NSF CAREER AWARDS

DR. WALTER LEE

TO EXAMINE SUPPORT STRUCTURES FOR MARGINALIZED STUDENTS IN ENGINEERING

For Walter Lee, an aspiration to "uncover information that will better inform university efforts to support undergraduate engineering students, particularly students of color," led to his pursuit of a five-year project to better understand how marginalized students navigate undergraduate engineering programs.

This year, Lee was awarded a Faculty Early Career Development (CAREER) Program award from the National Science Foundation for this work.

In order to foster learning environments that empower students to access resources that will lead to their success, universities are making an effort to extend student support toward promoting equity and increasing retention and graduation rates among engineering students. The current lack of diversity in engineering is a catalyst for support that focuses on underrepresented groups, such as Black and Latinx students. At Virginia Tech, this effort is led by the Center for the Enhancement of Engineering Diversity, for which Lee serves as assistant director for research.

According to Lee, prior research work "reveals the need for more responsive student support tailored to individual students' needs." His research will compare support systems and navigational strategies for undergraduate engineering students across multiple institutions and examine students' perspectives on how effective and appropriate different navigational strategies are. Doing so will enable him to examine the responsiveness of university environments.

"I was excited and honored," Lee said of receiving the award. "Receiving this support will help my research team continue exploring more effective avenues for promoting equal access to educational resources in undergraduate engineering programs."

Through this project, Lee hopes that university investments and resources will be used more intentionally to broaden participation in engineering.

The NSF CAREER program is considered one of the most prestigious awards in support of early-career faculty who have the "potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization."



DR. JACOB GROHS

TO STUDY ENGINEERING PATHWAYS FOR APPALACHIAN YOUTH

Jacob Grohs believes that teachers and their school systems, universities, and companies are uniquely positioned to come together and create positive engineering experiences for students.

Through the Virginia Tech Partnering with Educators and Engineers in Rural Schools (VTPEERS) initiative, funded by the National Science Foundation, Grohs is working with teachers in rural middle schools and engineers in industries in their communities to create engineering learning experiences for students. This year, Grohs received a Faculty Early Career Development (CAREER) Program award from the National Science Foundation (NSF) to take this work further.

Grohs' five-year project will contribute to knowledge on how students develop, maintain, or shift engineering interest pathways as they engage in sustained engineering activities, facilitated through collaborations between their schools and industries in their communities, in the classroom, and beyond.

The project will introduce young people in rural communities to locally available engineering careers — educational experiences that seem to be limited at this time. It will involve collaborative partnerships between engineers in local manufacturing companies and school teachers, who will come together to co-develop innovative engineering learning experiences for more than 2,500 students from counties in Appalachia.

Grohs' research will determine whether and how different groups of rural youth develop and maintain interest in engineering career pathways from middle school through the period after high school graduation, using cluster analyses and qualitative methods. To accomplish this, the project will collaboratively engage with teachers and engineers to facilitate hands-on engineering activities, and have conversations with students to understand the factors that influence their career interests and decisions.

Engineers and formal and informal educators will plan and implement educational innovations that will facilitate opportunities for rural youth to use engineering and computer programming skills throughout their middle and high school years.



“This project is about scaffolding opportunities where students explore ways their individual passions might align with engineering work and how those passions are both supported by and contribute to their home communities,” Grohs said.

For Grohs, learning what works well for sustaining interest in engineering careers also means collectively understanding and dismantling systemic barriers to access. He said that for the VTPEERS team, “that effort starts by building

long-term relationships with teachers and with regional industry and together investing our time over several years with these youth as they envision their future.”

The NSF CAREER program is considered one of the most prestigious awards in support of early-career faculty who have the “potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization.”

HONORS & AWARDS



Dr. Mayra Artilles
2020 Outstanding
Dissertation Award



Dr. Diana Bairaktarova
W.S. "Pete" White Award for
Innovation in Engineering Education

XCaliber Award for Excellence in
Technology Assisted Teaching
and Learning



Dr. Holly Matusovich
Incoming Editor for "Advances
in Engineering Education"

Promoted to Professor



Alice Noble
VT Academic Advising Initiatives'
Navigate User of the Month

Advisor of the Month



Dr. Ashley Rae Taylor
2020 Outstanding
Doctoral Student



Dr. Kirsten Davis
2020 Outstanding Graduate
Teaching Assistant



Maia Greene-Havas
2020 Alumni Award for Excellence in
Undergraduate Academic Advising

2020 Certificate of Merit of the
Outstanding Advising Award - Primary
Advising Role from NACADA

2020 Faculty/Staff Award Recipient
for Undergraduate Advising



Dr. Jacob Grohs
Dean's Award for
Excellence in Teaching

Promoted & Tenured at
Associate Professor

Elise Moreau & Andrew Grove
Second place in Ethics in Engineering
Case Competition, advised by Dr. Butler



UNDERGRADUATE SCHOLARSHIPS

The H. Powell Chapman Jr. Memorial Award (for Excellence in Engineering Graphics) was established in 1952, an annual award to provide students in Engineering Fundamentals with a monetary award for technology in the classroom. This award was combined with the 1983 Harry News Jones II Endowed Scholarship Fund in 1986; both awards provided support to undergraduate students in their first year in the College of Engineering.

2019-20 RECIPIENTS

Jenna Sims (Fall) & Ashley Livingston (Spring)
Harry New Jones II Scholarship

Matthew Trang
H. Powell Chapman, Jr. Award

2020-21 RECIPIENTS

Claire Seibel
Harry New Jones II Scholarship

Hailey Foreman
H. Powell Chapman, Jr. Award



Matthew James, P.E.
Dean's Award, Certificate
of Teaching Excellence

Promoted to Associate
Professor of Practice



Dr. David Knight
2020 Faculty/Staff
Award Recipient for
International Education



Dr. Walter Lee
Dean's Award, Faculty Fellow

Promoted & Tenured at
Associate Professor

COMINGS & GOINGS

HOW THE DEPARTMENT CHANGED IN 2020



Jeffrey Connor
Associate Professor Emeritus,
Posthumously Awarded
December 2020

A member of the Virginia Tech community since 1999, Jeff Connor made significant contributions to the engineering fundamentals and engineering education programs. He co-developed curriculum in the early part of the engineering plan of study, including 10 hands-on discovery modules and early first-year curricular reform.

Connor also participated in the American Society for Engineering Education First-Year Program Division where he published multiple ASEE papers from 2002 to 2010, as well as an ASEE First Year Engineering Experience paper in 2015.

He led or co-led two of the first large National Science Foundation grants received by the Department of Engineering Education: Bridges to Engineering Education at Virginia Tech and Spiral Curricular Reform.

In the classroom, Connor was dedicated to ensuring that all Virginia Tech first-year engineers had a fundamental understanding of the foundations of engineering. He developed a textbook, "Engineering: A Primer," which was written to help students in their engineering success and intended for Virginia Tech students to access at little to no cost.

He taught thousands of engineering students in a variety of undergraduate courses ranging across the engineering fundamentals and engineering education curricula as well as civil engineering, AutoCad, and surveying.

Connor died on May 23, 2019, following a long illness.



Dr. Richard Goff
Associate Professor Emeritus
December 2019

EMERITUS STATUS

A member of the Virginia Tech community since 1996, Richard Goff was the founding director of the Frith First-Year Engineering Design Lab, the primary laboratory space utilized by thousands of first-year engineering students to this day. He also co-developed and led the precursor to the Rising Sophomore Abroad Program and served as a former director of the National Science Foundation Industry/University Cooperative Research Center for e-Design.

Goff also served as a team member on the first two National Science Foundation grants received by the Department of Engineering Education and served as part of a large NSF-funded coalition (SUCCEED).

In the spirit of Ut Prosim (That I May Serve), Goff championed the Real Outreach eXperiences In Engineering project and enabled more than 1,000 first-year engineering students to engage in community service projects.

Goff also supported the Baja SAE student team as its faculty advisor for nine years and served the engineering fundamentals program (now the Department of Engineering Education) as course coordinator from 1998 to 2003.

In the classroom, Goff has taught thousands of undergraduate engineers within the first-year, second-year, and graduate programs in engineering, consistently receiving strong teaching evaluations. He also advised several students on doctoral dissertations and helped them develop solid research programs, leading to careers in academia and industry. He was the author or co-author with colleagues and graduate students of over 100 peer-reviewed publications.

Goff served for eight years as assistant department head and received multiple university awards for his teaching and service, including the W.S. Pete White Chair for Innovation in Engineering Education, the William E. Wine Award for a History of Exemplary Teaching, the Diggs Teaching Scholar Award, and the Sporn Award for Excellence in Teaching of Engineering Subjects.

EMERITUS STATUS

NEW ARRIVALS

Dr. Juan David Ortega Alvarez

Dr. Alvarez joined the department as an Instructor in Fall 2020. For several years after earning his engineering degree in 2001, Alvarez’s professional duties included working full-time as a process engineer at a chemical company and teaching engineering courses as an adjunct instructor.

In 2009, he left a seven-year long career in industry—interrupted only by his time abroad earning a master’s in engineering—to become a full-time faculty member, mostly in pursuit of one goal: professional and personal fulfillment. To be sure, the most gratifying experience he has had in his career is participating in the intellectual development of students and earning their gratitude.

Propelled by this motivation, Alvarez chose an academic life focused on quality engineering teaching, which ultimately led him to pursue a Ph.D. degree in Engineering Education. Teaching engineering and scholarly exploring ways to excel at the job are his professional passions.

Dr. Dustin M. Grote

Grote is a Postdoctoral Research Associate in Engineering Education; his supervisor is David Knight. His role involves conducting research for a Graduate Student Funding project funded by the National Science Foundation and investigating transdisciplinary, industry-relevant student learning opportunities with the Calhoun Center and General Education Destination Area pathways courses.



Learn more about
Dr. Ortega’s work at
bit.ly/JuanABio



POST-DOCTORAL COMPLETION

Dr. Chanee Hawkins Ash

Dr. Ash served as a Postdoctoral Research Associate from 2018 to 2020; her supervisor was Jeremi London. She contributed to multi-phase research funded by NSF aimed at broadening the participation of underrepresented groups in Engineering and Computer Science; conducted fieldwork; contributed to technical publications, reports, and presentations; and supervise, advise, coach, and mentor graduate level students through conducting research and developing publications.

She currently works as the Director of Research & San Francisco Programs at the Teaching Well, a non-profit focused on educator wellness.



Dr. Cassandra McCall

Dr. McCall is a 2017 Engineering Education Ph.D. graduate. Her dissertation focused on “Advancing from Outsider to Insider: A Grounded Theory of Professional Identity Negotiation.” She served as Postdoctoral Research Associate from 2017 to 2020, working with supervisor Lisa McNair.

She currently works as an Assistant Professor in the Engineering Education Department at Utah State University. As a civil engineer and engineering educator with Stargardt’s Disease (genetic eye disorder), she conducts research that explores how student experiences and relationships influence how they become civil engineers.



Dr. Mayra Sharlenne Artiles Fonesca

Dr. Artiles is a 2019 Engineering Education Ph.D. graduate. Her dissertation focused on “Choice in the Advisor Selection Processes of Doctoral Engineering Programs.” She completed her Postdoctoral Research Associate work in 2020; her supervisor was Holly Matusovich. Artiles currently works as an Assistant Professor of Engineering at Arizona State University.

Her research expertise includes engineering doctoral education structure, experiences of underrepresented minorities in doctoral engineering programs, and doctoral student motivation and persistence. Her research methods specialty is qualitative data analysis.

FULBRIGHT SCHOLAR 2020

Dr. Lena Gumaelius

From October 2019 to February 2020, Dr. Gumaelis worked as a visiting scholar on a Fulbright Study/Research Award. She served as a researcher in Dr. Marie Paretti's group, focusing on student identity related to engineering career choices and sustainability. She also joined Dr. Jenni Case's research group on organization of higher education, with a focus on engineering education.

Gumaelius is the Deputy Vice Chancellor of Mälardalen University in Västerås, Sweden and an Associate Professor of Learning in STEM at the Royal Institute of Technology (KTH) in Stockholm, Sweden.



Matthew Cheatham

Matthew Cheatham joined the advising team in Fall 2019 on a temporary position to assist in accommodating enrollment overshoot. An energetic and committed member of the department, his contributions to advising over 300 General Engineering students are sincerely appreciated.

Cheatham currently serves as a Construction Manager I at Industrial Turnaround Corporation (ITAC) in Chester, Virginia.

Dr. Michelle Soledad

Dr. Michelle Soledad currently serves in a lecturer position in the Department of Engineering Education at Ohio State University.

In just over one year as the Director of International Engagement and Communications, she made an enormous impact on many aspects of the VT Engineering Education operation. She developed a range of approaches and systems for how the department interfaced more effectively with the College over communications, and published multiple articles through VT news.

Soledad's central involvement in department Advisory Board work focused on building a fundraising connection. She also balanced the incredibly complicated work of the department study abroad program when so many changes were needed due to COVID. Additionally, prior to the start of the pandemic, she supported the hosting needs of graduate students and the international visitors our department was hosting more proactively.



DEPARTURES

Carolyn Ballard

Carolyn Ballard joined the advising team in Fall 2019 on a temporary position to assist in accommodating enrollment overshoot. She fit well into the department, and brought a wealth of regional knowledge that she brought from her experience in K-12 advising locally.

She currently serves as an academic advisor in the College of Agriculture and Life Science with the Department of Animal and Poultry Science.



Learn more about the Dept. of Animal & Poultry Science at apsc.vt.edu!

Holly Lesko

Holly Lesko joined the department as the Program Director for our VTPeers program in July 2017. She spent her time cultivating strong relationships with the numerous school partners and led the day-to-day programmatic work of designing curriculum, facilitating workshops, and regularly documenting and sharing impacts of the project. In December, Holly transitioned to a new role as the Public Health School Liaison for the New River Valley Regional Commission.

Since August 2017, Lesko and the VTPEERS team has worked with an incredible 22 teachers of sixth-eighth grade science classrooms and their over 1900 middle-school students from seven schools across three counties, volunteer engagement with 24 graduate students, three undergraduate students, and 31 professionals from industry partners. Dr. Jake Grohs, PI on the NSF project noted: “numbers don’t do justice to the authentic lasting relationships Holly has built with these partners – relationships that will continue to benefit the region as she transitions to her new critical role at the Regional Commission as liaison between schools, the NRV Public Health Task Force, and the Health Department.”



Dr. Kenneth Reid

Kenneth Reid joined the Engineering Education department as an Associate Professor in 2014, after completing a six-year tenure as the Director of the First-Year Engineering Program at Ohio Northern University.

In addition to his responsibilities as a professor, Reid tackled the Assistant Department Head (Undergraduate Programs) role, where he helped managed the budget for the undergraduate program, including the laboratories. He led efforts in curriculum development and instruction of the first-year courses. During Summer 2017, Dr. Reid was the acting Engineering Education Department Head.

Dr. Reid currently serves as an Associate Professor, the Associate Dean and Director of Engineering at the University of Indianapolis.



MOVING UP

Dr. Natasha Smith

Natasha Smith joined the Engineering Education department in 2010, as one of the first professional undergraduate academic advisors. After just two short years, she took on the role of Director of Enrollment Management.

In her role with the department, she supported the university in a range of decisions based on complex analyses of student data, which was incredibly valuable during the Fall 2020 enrollment overshoot. The Provost also appointed her to his Enrollment Advisory Committee in 2020.

She currently serves as the College of Engineering’s Director of Enrollment Management, where she’s responsible for the COE enrollment management plan, understanding the path of undergraduate engineering students and determining methods to increase retention, matriculation and graduation rates.

Dr. Smith has been at Virginia Tech since she first completed her B.S. in Business Information Technology in 2006.



2020 EXECUTIVE & OPERATIONS TEAM



Dr. Jennifer Case
Department Head



Dr. Holly Matusovich
Asst. Department Head,
Undergraduate Programs



Dr. Jacob Grohs
Asst. Department Head,
Graduate Programs



Margo Currie
Fiscal Coordinator



Hope House
Administrative Assistant



Tamara Knott
Academic Programs Manager



Monte Hager
Business Manager



Dr. Marlena McGlothlin Lester
Director of Advising



Dr. Wm. Michael Butler
Director of the Frith Lab



Angela Parvin
Grant Support Specialist



Chandler Raynes
IT Systems &
Support Manager



Dr. Diana Bairaktarova
Assistant Professor



Dr. Jennifer Case
Professor



Dr. Jacob Grohs
Associate Professor



Dr. Vinod Lohani
Professor



Dr. Jeremi London
Assistant Professor



Dr. Holly Matusovich
Professor



Dr. Andrew Katz
Assistant Professor



Dr. David Knight
Associate Professor



Dr. Walter Lee
Associate Professor



Dr. Lisa McNair
Professor



Dr. Homero Murzi Escobar
Assistant Professor



Dr. Marie Paretti
Professor

2020 TENURED & TENURE-TRACK FACULTY



Dr. Nicole Pitterson
Assistant Professor



Dr. Bevlee Watford
Professor | Associate Dean of
Equity & Engagement for COE

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Matthew James, P.E.
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Dr. Jenny Lo
Senior Instructor



Dr. Arefeh Mohammadi
Instructor



Dr. Juan David Ortega Alvarez
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NOTE

All photos taken pre-pandemic.

Article photographs taken by Peter Means. Staff headshots taken by Peter Means, Linda Hazelwood and Michelle Soledad. Advisory Board and affiliate faculty headshots provided by respective department websites or individually submitted.

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