Southern Research

STEM Education Outreach

YEAR IN REVIEW | FISCAL YEAR 2022

Breaking Barriers to Move Science: A Celebration of STEM Innovation in Alabama

2022 will be remembered for the nonstop whirlwind of educational outreach experiences we hosted on our campus and across the state and the significant investments we made in our youth and educators — investments that advance our mission of moving science, priming a talented future workforce, and growing STEM ecosystems throughout Alabama and beyond. Yet another hallmark of the year is our continued success in making STEM programs appealing and accessible to all students, especially those who may once have believed STEM careers were beyond their reach.

Our experiential learning approach challenged a legion of early learners to think critically and solve complex problems using science and engineering principles. Our Drone Academy program opened the door for high school students to dabble in engineering design and construction, 3D printing, and electrical engineering principles while working a project from its conceptual and planning phases through to its execution. We engaged young minds by offering field trips for middle and high school classes to Southern Research's STEM Education Outreach Center to study topics like infectious diseases, solar power, and antibiotic resistance in a real lab setting.

We launched "Alabama STEM Explorers," an Emmy Award-nominated series of televised programs delving into an array of STEM-related topics with spotlights on careers related to each field of study. Over 100,000 people tuned into the show each week, expanding our reach to the more rural parts of our state.

Our team believes we are sowing the seeds of STEM literacy each and every day as we connect with Alabama's students and educators. The numbers presented in this Annual Report — though impressive — don't adequately account for the impact our programs have as they ripple through the communities we serve.

For that reason, I encourage you to read what others say about our programs. Indeed, 100% of educators surveyed would recommend a Southern Research STEM field trip to their peers. A biomedical engineering student at the University of Alabama at Birmingham credits her involvement with our team and our programs for nudging her into pursuing a career in the sciences. These and the many other testimonials validate our work. We are changing lives and driving progress. As we continue to introduce young people to STEM-related topics and fields, we not only expose them to a world of possibilities, but also, we lay the foundation for a skilled workforce pipeline critical to the success of Alabama businesses and industry — one critical to the success of our future.

I want to thank my team for their energy and their passionate dedication to the advancement of STEM literacy, as well as their wholehearted commitment to accelerating STEM equity in all communities.

The future is bright for Alabama, and we are proud to be a part of its success. We hope you will join us on our journey forward as we continue to move science and make Alabama a model for the nation in providing quality STEM experiences for all.

Kathryn Lanier

Kathryn Lanier, Ph.D.
STEM Education Outreach Director

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STEM Education

We activate the next generation of scientists through our STEM education programming, field trips, in-class demonstrations and camp activities. Our experts create fun laboratory experiments and STEM experiences with real-world applications.

TOTAL IMPACT FOR FISCAL YEAR 2022:

114,476 LEARNERS

123 SCHOOLS

57 FIELD TRIPS

24 SCHOOL VISITS

47 SCHOOL DISTRICTS

7 UNDERGRAD RESEARCHERS

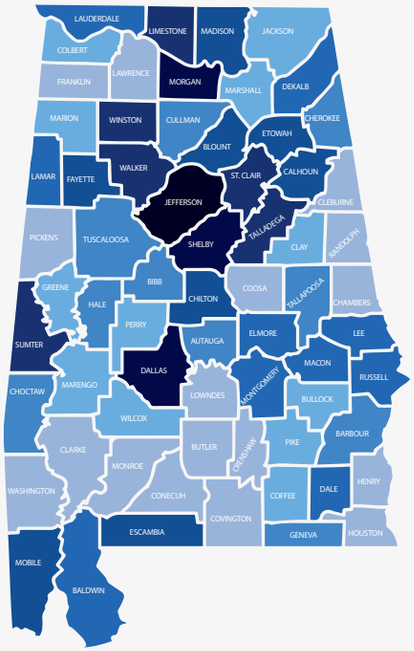
26 TV EPISODES

17 STEM INTERNS/ CO-OPS

6 SUMMER ACADEMIES

3 PROFESSIONAL LEARNING WORKSHOPS

9 COMMUNITY OUTREACH EVENTS



ALL TIME IMPACT: FISCAL YEARS 2018-2022

58,883 STUDENTS

200,605 LEARNERS

50 COUNTIES

314 SCHOOLS FROM 87 DISTRICTS

872 TEACHERS

146 FIELD TRIPS

78 SCHOOL VISITS

49 STEM INTERNSHIPS/CO-OPS

100% of teachers surveyed would recommend a Southern Research STEM field trip

"Seeing students step out of their comfort zone, be confident enough to answer questions, and collaborate with peers they normally would not collaborate with."
— Clay Chalkville High School

"I am so thankful that the activities were accommodating for my students with learning disabilities. Seeing them participating with their peers was great!"
— University Charter School

"The entire day was memorable! This was the first science-related field trip these students had ever been on and they loved it. Thank you for the experience!"
— Locust Fork High School

"Students, who generally have a short attention span, were very engaged."
— Carver High School

"Berkeley LOVED all of the hands-on experiments. She has never had a camp where she jumped in the car telling me about everything and how much she loved it"

Cultivating STEM Experiences for Students Across Alabama

Middle- and high-school classes across Alabama are delving into topics like infectious diseases, antibiotic resistance, solar power, and wind energy at field trips offered by Southern Research's STEM Education Outreach Center. The first field trips at Southern Research launched in 2018 and now occur throughout the school year. "We are booked solid," said Liz Johnson, Ph.D., the STEM Student Experiences Lead at Southern Research. "We have students here from all over the state."

The programs offered aim to supplement the content students learn in their science and engineering courses while providing real-world context in an engaging setting.

"It's the atmosphere," Johnson said. "It's a different experience from your typical school lab since students are in a space where scientists work. Students walk in and say it's like being at Disney World or Google headquarters. They come in, put on lab coats, and get in a mindset that says, 'Hey, you are capable. You can do well in STEM. You can have a STEM career.' In 2022 alone, the Southern Research STEM center hosted 57 field trips with students across Alabama. Some schools have made multiple visits.

"I have had the opportunity to take my students ranging from seventh-grade Life Science to seniors in AP Biology on field trips to Southern Research, and it has never disappointed," said Peggy Harris, chair of the science department at Locust Fork High School in Blount County. Students have come back to me every year stating that Southern Research field trips were the highlight of the year."

Harris praised the Southern Research STEM team for presenting STEM subjects in a way that is so engaging and accessible that "students feel comfortable interacting with them." And it's not because the subject matter is easy.

Harris' classes have attended field trips on antibiotic resistance and infectious diseases. She said students left with an understanding of how ELISA tests determine whether a patient has a particular infection and how to use PCR and gel electrophoresis to identify if a bacteria sample has an antibiotic-resistant gene. "My students get the opportunity to see and use equipment that real scientists use and that my students typically only see in pictures and hear about in class," Harris said. The encounters energize the members of the STEM team almost as much as the students.

"It's so refreshing to see students come in and be amazed and excited," Johnson said. "While they are here, it's not about test scores and demands. It's just opportunities to be curious and explore and learn. We challenge our students, and they rise to the occasion."

The field trips are aligned with the state education curriculum and also with the cutting-edge work that is taking place at Southern Research in the energy and biomedical fields. Programs include such subjects as:

- Antibiotic-Resistant Bacteria: Not Just a Phage!
- Green Engineering: Shedding Some Light on Photovoltaic Cells
- The Three Seas: Cabbage, Chemistry, and CO2
- Infectious Diseases: How to Track and Diagnose Viral Outbreaks

Kathryn Lanier, Ph.D., the Director of the STEM Center, said the COVID-19 pandemic has made the infectious disease trips especially topical and timely. "With the pandemic, the vast majority of the public got to see science unfold," Lanier said. "That has even further solidified the importance of what we do." But bringing students to Southern Research generates benefits that go far beyond COVID-19. It helps Southern Research showcase its scientists, build connections with the community, and encourage what could be the next generation of STEM professionals.

And if they don't grow up to be scientists? A visit to Southern Research is still no waste of time.

"Not everyone who comes through the program will be a scientist, and that's OK," Johnson said. "All students can benefit from a strong foundation in science, and it can help them make informed, data-driven decisions for themselves, their families, and their communities."

REQUEST A FIELD TRIP AT:
SOUTHERNRESEARCH.ORG/STEM

Teaming Up with UAB to Nurture Future STEM Pros

SOUTHERN RESEARCH'S STEM EDUCATION CENTER AIMS TO HELP YOUNG PEOPLE SEE THE FUN – AND THE CAREER POTENTIAL – IN SUBJECTS LIKE SCIENCE AND MATH

The center hosts young people with field trips throughout the school year to help supplement their classroom experiences. Its Drone Academy – a series of weeklong summer camps – offers high schoolers an opportunity to get hands-on experience with 3D printing and engineering design. In that, Southern Research has a vital partner in the School of Engineering at the University of Alabama at Birmingham.

UAB engineering students make up most of the STEM Ambassadors who work with the Southern Research STEM team to teach at the summer camps. "Drones are right up their alley," said Jeffrey Holmes, M.D., Ph.D., Dean of the UAB School of Engineering.

Kathryn Lanier, Ph.D., the Director of STEM Education at Southern Research, said the partnership benefits the UAB students who are teaching and the high-school campers who are learning.

"If you work in STEM, you will be an ambassador for your field. We want our college students to get in that mindset while still in school," Lanier said. "This is particularly important for young people who have historically been underrepresented in the field. I'm proud that 80 percent of our STEM Ambassadors have been women or people of color."

UAB engineering students also make weekly trips to the camps to present different projects they are working on, Holmes said. One example included UAB students who built and flew a model airplane as part of a national competition. Holmes said they brought their plans, a video of the competition and spare parts to pass around.

As high school students learn more about science and engineering, college students get a chance to develop important career skills. "They're practicing their presentation skills to someone besides their classmates or professors," Holmes said. "The students always have great questions."

Lanier said the relationships between ambassadors and campers at Drone Academy go beyond academics.

"The undergraduates help us execute the camps day to day, but they also serve as mentors on life questions as well as science," Lanier said. "They're really valuable to the students."

Lanier said the same goes for Holmes. "He also comes once a week to visit with students," she said. "He's so personable and will eat lunch with the students and answer their questions."

He also remains available to the campers as a resource. "If they email him, he will email them back in a heartbeat," Lanier said.

The partnership provides a potential pipeline of students for the engineering school. Holmes said he met at least two of his engineering students at Drone Academy at Southern Research. But Holmes' involvement isn't entirely selfish.

"The STEM lab was something I saw when I interviewed here. I knew that was something I wanted to connect with," Holmes said. "I'm just so excited about everything they do. I've been on their field trips, and they do a great job. We would love to keep expanding the partnership."

Jeff Holmes, UAB

"YOU TURN PEOPLE LOOSE ON THIS KIND OF CHALLENGE, AND NO TWO PEOPLE ARE GOING TO COME UP WITH THE SAME ANSWER."

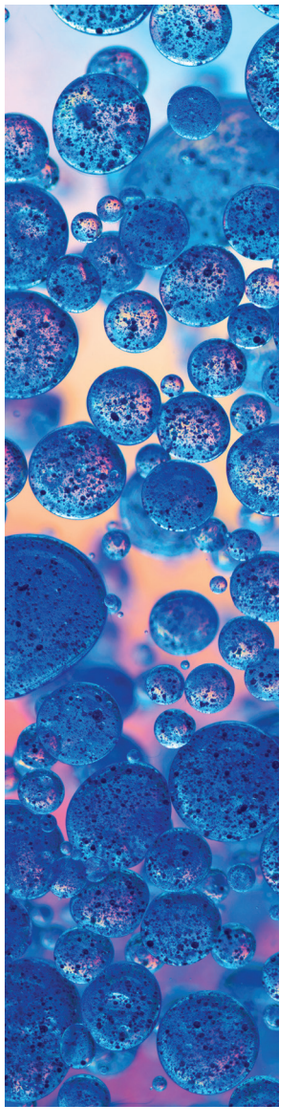
In one engineering class at UAB, the semester-long project was to design another summer camp for Southern Research. The result was Rover Academy – a camp allowing high-school students to program an autonomous car to get through a maze.

The camp was tested on a group of students, and Holmes still gets excited as he talks about the results. "You turn people loose on this kind of challenge, and no two people are going to come up with the same answer," he said. Students tried various approaches – some tried programming the car to follow step-by-step directions, while others trained it to follow the lines on the maze.

"They learned it's easier to write the program than it is to make it work," he said. "But some students got their rovers to go through the maze."

Holmes envisions a future where the engineering school operates the Rover Academy as a complement to Southern Research's Drone Academy. "We could coordinate with Southern Research and provide these experiences for more students, maybe using the same STEM Ambassadors," he said. "When we work in these partnerships, it's more sustainable in the long run."

From STEM Lab to a Promising Career in Biomedical Engineering



Kamari Marzette stood in the ribbon cutting picture for the new Southern Research STEM lab in 2018. The young student was just out of braces, and she was a quiet, shy girl who you might not have pegged as a rising star.

But you'd have been wrong.

Four years later, Marzette is now a freshman in biomedical engineering at the University of Alabama at Birmingham -- and she is already well into her second year of work in cancer research. As a high school intern, her work at UAB's O'Neal Comprehensive Cancer Center was significant enough to be published and credited in a research paper.

"Watching her grow up has been so rewarding," said Kathryn Lanier, Ph.D., the Director of STEM Education at Southern Research, who remains in contact with Marzette. "I think Kamari is going to conquer an empire."

Marzette's success stems from her initiative, as well as support and encouragement from her family, teachers and other mentors throughout her life.

But she gives a good deal of credit to Southern Research, where she spent multiple summers attending and working at Drone Academy camps, where high school students get a chance to dabble in engineering design and construction, 3D printing, and the application of electrical engineering principles.

At Southern Research, Marzette said, she developed a passion for research and honed her skills in the STEM lab.

"I could honestly go on and on about my four years at Southern Research because they definitely molded me into the person I am," she said. "I would not be where I am today without all the opportunities I have been given and the foundation laid for me at Southern Research."

Among other things, her time at Southern Research connected Marzette with UAB.

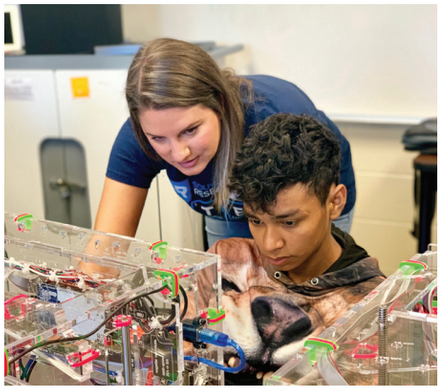
Many UAB School of Engineering undergraduates serve as STEM Ambassadors at Southern Research during the weeklong Drone Academy camps. They help the high-school campers in the lab and interact with them informally over lunch, where the students can ask questions about college, career and life.

UAB's Engineering Dean Jeffrey Holmes, M.D., Ph.D., began participating in the camps in 2021, and Lanier encouraged Marzette to eat lunch with him one day. He often spoke with Marzette about her interest in biomedical engineering. "I saw her week after week, and she continued to ask me questions," Holmes said. As the summer wound down before Marzette's senior year in high school, she asked Holmes about the chance to work as an intern in a biomedical engineering lab at UAB. He connected her with two opportunities, and she worked in UAB's O'Neal Comprehensive Cancer Center lab during the fall and spring semester of her final year in high school.

"My lab researches how mechanical forces interact with tumor cells and how that makes them grow, metastasize, and respond to chemotherapies," said Mary Kathryn Sewell-Loftin, Ph.D., an assistant professor in biomedical engineering at O'Neal who supervised Marzette. "Kamari specifically worked on understanding how ovarian cancer cells respond to anti-cancer drugs when we change how the cells' feel' forces around them."

Marzette was "an absolute rock star in the lab," Sewell-Loftin said.

"She learned protocols super quickly, helped everyone with their experiments whenever she



> "I would not be where I am today without all the opportunities I have been given and the foundation laid for me at Southern Research."

could, and became confident enough in her skills that she could do entire experiments on her own," Sewell-Loftin said. "Kamari was also wonderful to work with, and she taught some of the other students in my lab (undergraduates in biomedical engineering) the protocols and analysis techniques she learned."

Toward the end of the fall semester, Holmes stopped by the lab to check on Marzette and asked her to explain her work to him. She outlined the science and the implications of her work with such skill that Holmes was taken aback.

"If an undergraduate senior had given that summary, I would have been impressed," Holmes said. "But for a senior in high school to give that summary after two months in the lab, I was blown away."

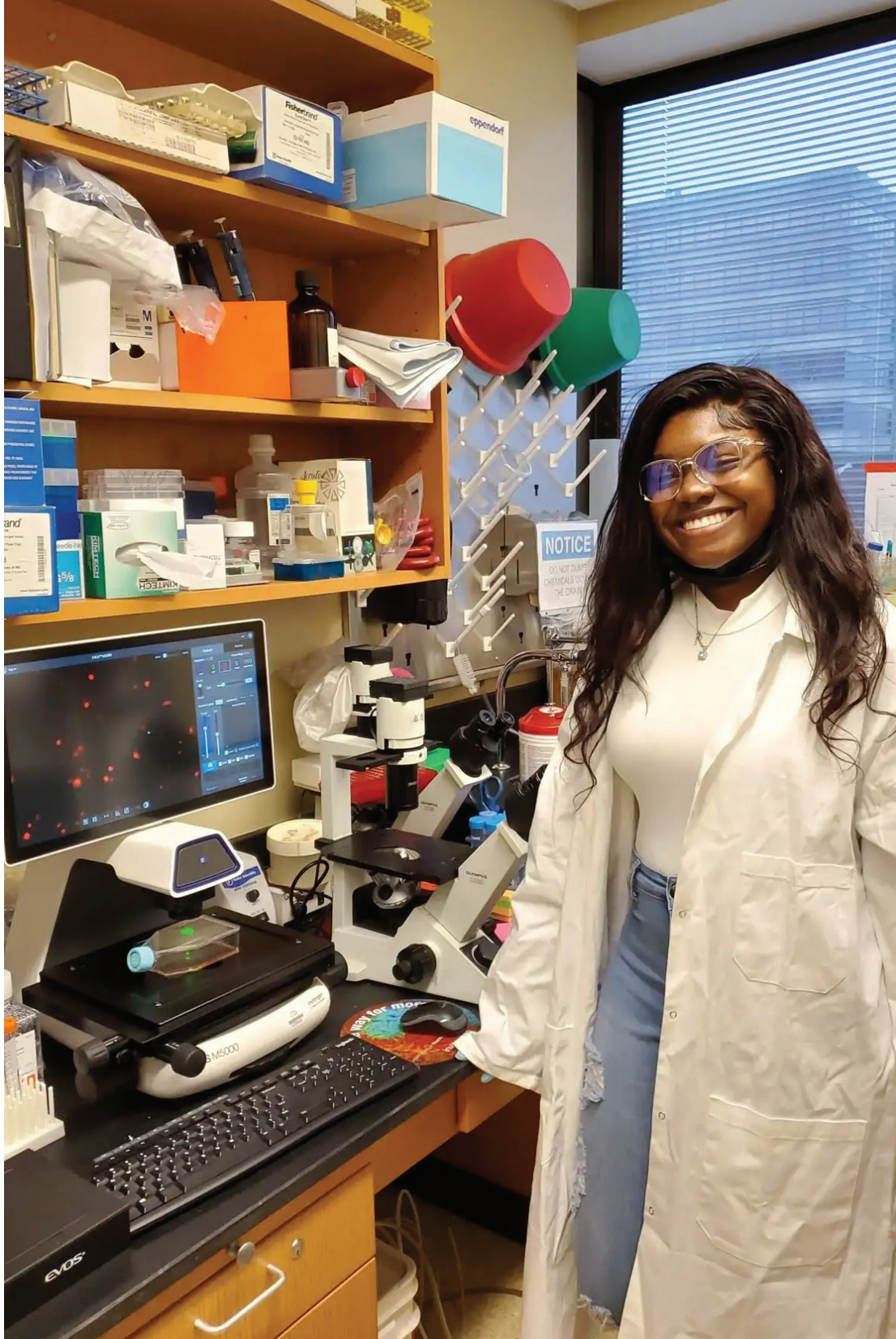
As Marzette's high school career came to an end, she continued talking with Lanier, Johnson, and Holmes about her options for college. Although she hadn't considered herself a future Blazer, she ultimately decided to pursue her degree at UAB, where she continues to work in cancer research.

She doesn't know where her studies will ultimately lead, but she knows that wherever she goes, she'll benefit from her time at Southern Research and the connections she's made.

"I learned many lab and research protocols, as well as many engineering principles from being in the STEM outreach lab during many drone academies," Marzette said. "Not only did I learn many things about STEM, but I learned critical soft skills about being in a professional environment and working with new people that I will take with me for life."

"It has been a joy watching Kamari develop and mature into a brilliant, confident, and capable young woman," said Liz Johnson, Ph.D., the STEM Student Experiences Lead at Southern Research, who mentored Kamari during the summers. "I'm so excited to continue supporting Kamari as she sets out to change the world."

"Kamari will forever be a part of the Southern Research STEM team," Johnson said. "We can't wait to see how she continues to move science."



Science Hits the Airwaves

The Southern Research STEM team works daily to expand youngsters' interest and knowledge about science, so when an opportunity came to reach an even broader audience, the team jumped at the chance.

The result was "Alabama STEM Explorers," a series on Alabama Public Television this past year. Reaching more than 100,000 viewers each week, the show used fun activities to explore a variety of STEM subjects and to highlight a wide range of STEM careers.

The project grew out of the Alabama STEM Council, which was formed in 2020 to advise Gov. Kay Ivey on ways to improve STEM education, career awareness and workforce development across Alabama.

"It has been such an honor to be a part of the Alabama STEM Council and to chair the communications working group," said Kathryn Lanier, Ph.D., the Director of STEM Education at Southern Research. "The idea for Alabama STEM Explorers was born in the early days of the council, and it's been incredibly rewarding to see its impact." The show featured Lanier at Southern Research, her counterpart at HudsonAlpha Institute for Biotechnology in Huntsville, and youth co-hosts who helped carry out experiments and demonstrations on everything from sound waves and static electricity to genomics and gravity.

The creative challenge was creating visual activities – like making a vortex in a bottle to explain tornadoes – that would communicate science subjects to the full spectrum of people who might tune in on a Saturday morning.

"Communicating across a digital device presents its unique challenges—where you're creating experiences that engage not only young viewers but also their parents and grandparents who are watching alongside their children," Lanier said. "If you lose the attention of either audience, the channel is changed, and an opportunity to advance science is lost."

Lanier crafted episodes suitable for all learners, whether they were fourth-grade students in Wilcox County or an 86-year-old grandmother in Mountain Brook.

While the assignment was tough, Lanier and the Alabama STEM Explorers team were up to the challenge – and their work did not go unnoticed.

Two of the 26 episodes – one focused on density, another on weather and climate – were nominated in the 2022 Southeast Emmy Awards in the "Children/Youth/Teen - Long Form Content" category.

While Alabama STEM Explorers didn't bring home an award, Lanier hopes the nomination will "shine a light on the importance of STEM programming for everyone—no matter their age, race, ethnicity, age, or economic status."

In addition to highlighting a different science-related topic, each 30-minute episode included career spotlights of people from all walks and demographics working in STEM fields. That helped to meet one of the key goals of the Alabama STEM Explorers, to promote greater diversity in the field.

The message went beyond gender and race to highlight that STEM careers are possible across the spectrum of education, from high school to technical certificates and beyond. "You don't have to have a Ph.D. to have a STEM career," Lanier said.

Lanier is proud of the show's recognition and even the occasional recognition she gets in the grocery store from viewers.

But what she likes best is that all the episodes are still available on the Internet (https://stemcouncil.alabama.gov/alabama-stem-explorers-show-episodes/), that they can still be a resource to STEM teachers, that they highlight 50 STEM professionals, and that they can still inspire kids of all kinds.

"We have a STEM-rich state, and we want young people to see Alabama professionals that look like them in all these roles," Lanier said. "We want them to say, 'That could be me.'"

"We want them to say, 'That could be me.'"

Meet the Team

Kathryn Lanier, Ph.D.
STEM Education Outreach Director

Liz Johnson, Ph.D.
STEM Student Experiences Lead

Molly Langston
STEM Education Associate

DeMarius "Shon" Essex
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Our Commitment to STEM

Our Mission

Our mission is to prime a talented future workforce and invest in the growing STEM ecosystem by empowering students, educators, and communities. As a force for innovation, we are fostering the next generation of scientists, engineers, and entrepreneurs by providing a unique blend of meaningful real-world experiences that ignite a passion for discovery.

Our Vision

We are committed to driving positive change in our world by promoting science, engineering and entrepreneurship through education and research. Our goal is to bridge the gap between knowledge and opportunity, empowering the next generation of scientific leaders. By investing in our future workforce and the Alabama STEM ecosystem, we seek to create a more inclusive and equitable society that is driven by innovation.

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