



Tennessee STEM Education Center

Science · Technology · Engineering · Math

MIDDLE TENNESSEE STATE UNIVERSITY

Message From The Director

Dear MTSU Faculty, Staff, and Administrators,

As we close out another exciting and impactful season here at the Tennessee STEM Education Center (TSEC), I want to take a moment to reflect on the remarkable accomplishments of our team and the vibrant community we serve. This newsletter captures just a few of the ways we are advancing STEM education locally and statewide.

This fall, we proudly contributed to STEAM-A-Palooza at the Tennessee STEAM Festival, where families explored hands-on science with our Oobleck exhibit. We also collaborated with educators at the Innovative Educator Workshops, equipping K-12 teachers with tools to integrate STEM and AI into their classrooms. Events like these exemplify our commitment to inspiring curiosity and creativity.

Our partnerships continue to yield powerful results. The LEADS initiative, funded by a \$3 million NSF grant, is developing data literacy leaders in middle school STEM education. Meanwhile, our PROPS for DBER program supports postdoctoral researchers as they explore groundbreaking methods in STEM education. Additionally, the Raider Roundup welcomed over 500 students to explore agriculture and STEM, with engaging activities like the Pet Nutrition Workshop led by Dr. Kevin Ragland.

We're also proud of our involvement in STEAM nights at local schools, which brought interactive projects to hundreds of students and families. Dr. Ragland's indoor drone demonstrations at Cartwright Elementary's first-ever STEAM Night sparked excitement for engineering and technology. These efforts, alongside many others highlighted in this newsletter, reflect the breadth of our mission to empower educators and inspire learners.

Finally, I'm thrilled to welcome Lindsay Randolph as our new Center Coordinator. Her passion for student success and STEM education will further enhance our work. As we look ahead, I invite you to explore opportunities to connect with us and join our mission to advance STEM education.

Thank you for being a part of this journey. Together, we can continue to inspire, innovate, and empower the next generation of STEM leaders.

Warm Regards,

Gregory Rushton, Ph.D.
Director, Tennessee STEM Education Center



(L to R) Gregory Rushton, Kevin Ragland, Izzie Rushton, and Lindsay Randolph at the TSEC Christmas party

Tennessee STEM Education Center

TENNESSEE FESTIVAL



Banners from the Tennessee STEAM Festival



Melanie A. McQuiston demonstrating how to make Oobleck

STEAM-A-Palooza 2024: Sparking Curiosity, Inspiring Careers

On Saturday, October 12, 2024, the Discovery Center held the Tennessee STEAM Festival (TSF) with its signature event, STEAM-A-Palooza. This free outdoor celebration brought together local artists, scientists, and engineers to ignite curiosity and inspire future careers in Science, Technology, Engineering, Arts, and Mathematics (STEAM).

Attendees of all ages engaged in a dynamic array of hands-on activities, exploring topics like robotics, environmental conservation, cosmetics, and meteorology. Among the highlights, the Tennessee STEM Education Center (TSEC) proudly contributed by hosting the engaging and educational Oobleck Experience. This interactive exhibit captivated kids and families as they discovered the intriguing properties of non-Newtonian fluids. Through tactile experiments and demonstrations, participants not only deepened their understanding of science but also got to take some Oobleck home as a keepsake of their learning adventure.



Lucas Davis (Right) teaching participants about the properties of Oobleck



Finished Oobleck

The Tennessee STEAM Festival, founded by the Discovery Center at Murfree Spring in 2017, continues to inspire Tennesseans statewide. Even during the pandemic, the festival adapted with virtual programming and has since evolved into a hybrid model, offering both in-person and online events hosted by museums, schools, community centers, and organizations across the state.

TSEC's contributions to events like STEAM-A-Palooza exemplify the festival's mission: connecting curiosity with careers. By fostering early interest in STEAM fields, these initiatives aim to address workforce gaps and prepare future generations for opportunities in Tennessee's fast-growing economy. Research from the National Science Festival Alliance highlights the impact of such programs, showing a significant increase in awareness of STEAM careers among participants.

In 2024, the Discovery Center celebrates 37 years of community impact, continuing its commitment to shaping a vibrant future for STEAM education and career pathways in Tennessee. Through innovative partnerships and programs like the Tennessee STEAM Festival, the center and its collaborators are empowering the next generation to explore, dream, and build.

Innovative Educator Workshops Empower Middle Tennessee Teachers with STEM Strategies

On November 6, 2024, 60 elementary educators from across Middle Tennessee convened at the Miller Education Center on MTSU's campus to participate in the Innovative Educator Workshops. The event, aimed at enhancing elementary STEM education, provided attendees with a diverse range of learning opportunities focused on STEM integration and instructional strategies.

The lineup of workshops included:

- **Computer Science + LEGO = Transformative Data Collection**

Led by Annemarie Lampright, STEM Coordinator for Lawrence County Schools, this session explored innovative ways to merge computer science concepts with LEGO-based activities for dynamic data collection.

- **Transforming Science Practice through Storylines**

Facilitated by Stephanie Finley, 6-8 Science and STEM Specialist, and Vickie Stem, K-5 Science and Social Studies Specialist, both from Rutherford County Schools, participants learned how to utilize storylines to revolutionize science teaching methods.

- **AI in the Classroom: Practical Strategies for Engagement and Efficiency**

Cara Wade, STEM and Instructional Technology Coordinator for Sumner County Schools, shared practical techniques for incorporating artificial intelligence into classrooms to boost engagement and streamline instruction.

- **Force and Motion: Engaging Minds with Real-World Science!**

Annie Head, a K-5 STEM/Science Curriculum Consulting Teacher from Clarksville-Montgomery County Schools, presented hands-on activities to bring the principles of force and motion to life.

- **From Story Time to STEM: Engineering Adventures with Children's Literature**

Also led by Cara Wade, this session showcased how children's literature can inspire STEM-based engineering challenges in elementary classrooms.

- **Virtual Field Trip Backpack for Teachers**

Trent Cheeves, Instructional Technology Coach for Murfreesboro City Schools, guided educators through creating virtual field trip experiences to enrich their teaching.

These workshops were made possible through a generous \$35,000 grant secured by Dr. Kevin Ragland and the Middle Tennessee STEM Innovation Hub. The grant, provided by Battelle Education via the Tennessee STEM Innovation Network, supports professional development initiatives for K-12 educators, fostering innovative strategies to advance STEM teaching and learning.



Teachers code a Lego robot to collect live weather data



Participants learn about effectively implementing AI

TSEC Participates in MTSU School of Agriculture's 7th Annual Raider Roundup

The MTSU School of Agriculture and Collegiate FFA continue their commitment to advancing agricultural education through the annual Raider Roundup event. This initiative has grown significantly, attracting hundreds of high school students to Middle Tennessee State University to explore various facets of agriculture, science, and education.

On October 2, 2024, the 7th annual Raider Roundup welcomed 575 high school students to the MTSU campus. The event spanned multiple facilities, including the Tennessee Livestock Center, Stark Agribusiness and Agriscience Center, Horticulture Center, and Academic Classroom Building. Students participated in demonstrations, subject-specific competitions, and interactive workshops, many of which were facilitated by MTSU partners like the Tennessee STEM Education Center (TSEC).



Students learning about pet food and its ingredients

TSEC participated in the event by leading the Pet Nutrition Workshop. The event was led by Dr. Kevin Ragland, TSEC Associate Director, alongside Melanie McQuiston, TSEC Program Assistant. Attended by 40 students, the workshop offered an engaging deep dive into the pet food industry. Participants learned about pet food ingredients, essential nutrients, palatability testing, and interpreting pet food labels. Dr. Ragland's Dachshund, Sunshine, brought an interactive element to the workshop, assisting with palatability testing and captivating the students.

Following the workshop, students participated in a competition to demonstrate their knowledge, with top performers receiving recognition and awards from the MTSU School of Agriculture and Collegiate FFA.

Raider Roundup continues to exemplify the power of collaboration between MTSU's departments and external partners. The event not only showcases the university's dedication to agricultural education but also inspires and equips the next generation of agricultural professionals.



***Dr. Kevin Ragland and his
Dachshund, Sunshine***

TSEC Brings Innovation to Local STEAM Nights

The Tennessee STEM Education Center (TSEC) recently joined forces with local schools to inspire curiosity and creativity at two engaging STEAM nights. These events highlighted the exciting integration of Science, Technology, Engineering, Arts, and Mathematics in education. On October 15, 2024, TSEC participated in Christiana Middle School's annual STEAM night, where students and families explored hands-on projects designed to spark innovation and problem-solving.

On December 12, 2024, TSEC joined Cartwright Elementary for its first-ever STEAM Night and Winter Festival. This brand-new school in Bedford County welcomed over 500 attendees to celebrate the evening, making the inaugural event a tremendous success. Families, teachers, and community members came together to explore creative activities demonstrating how STEM and the arts combine to enrich learning.

Both events featured interactive projects that encouraged student engagement, fostering excitement around STEAM disciplines. One of the highlights was Dr. Kevin Ragland's demonstration of indoor drone technology, where students had the chance to pilot a drone, sparking interest in engineering and technology.

TSEC's involvement in these events underscores its mission to inspire young learners and support educators by showcasing innovative, hands-on learning experiences. By connecting with the community, TSEC continues to empower the next generation of problem-solvers and innovators.



Cartwright Elementary's first STEAM night attracted over 500 attendees



Dr. Ragland helps a student at Cartwright Elementary pilot a drone

TSEC Partners with Public Libraries to Expand STEM Education

The Tennessee STEM Education Center (TSEC) proudly participated in the Tennessee Public Library Management Institute on September 12, 2024, at Fall Creek Falls State Park. This event brought together public library directors from small to medium-sized libraries across the state for an immersive professional development experience.

Dr. Kevin Ragland, TSEC Associate Director, led a session highlighting innovative ways public libraries can collaborate with STEM centers and hubs throughout Tennessee to enhance their STEM programming. Dr. Ragland emphasized the transformative potential of these partnerships to make STEM education more accessible to communities.

TSEC staff members Sherry Schafer and Ashlee Schafer joined Dr. Ragland to facilitate engaging, hands-on activities. Librarians explored a variety of STEM tools and techniques, including:

- Using bots to teach elementary coding, introducing interactive programming for younger audiences.
- Engaging the olfactory system with sensory-based STEM activities.
- Measuring pH and soil moisture, promoting environmental science education.
- Flying indoor drones, offering an exciting glimpse into engineering and technology.



Participants practice basic coding with Finch bots

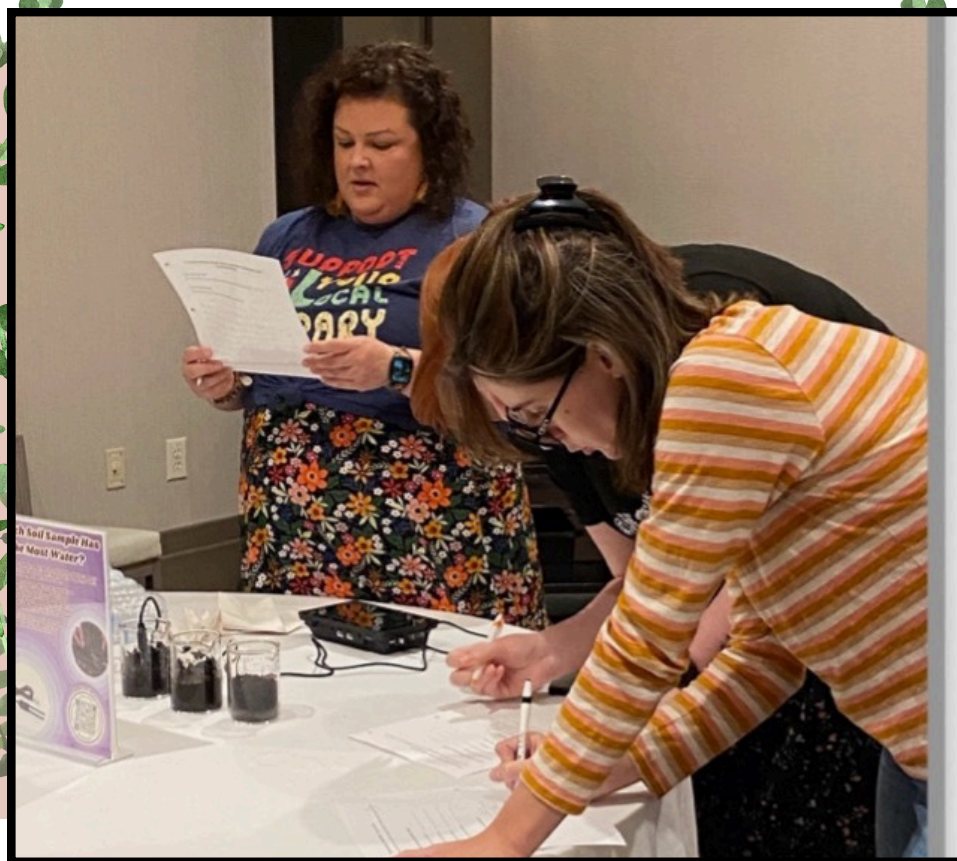


Librarians learn about teaching coding using indoor drones

These activities showcased practical methods for integrating STEM into library programs, encouraging librarians to adopt innovative approaches for their patrons.

The Tennessee State Library and Archives sponsors the three-year Public Library Management Institute. It is designed to equip directors of small and medium-sized libraries—particularly those without MLS degrees—with essential management skills. The program is part of a broader training initiative that includes workshops from Tennessee Regional Libraries and resources from private and government organizations.

TSEC's participation underscores its commitment to empowering educators and community leaders, bridging gaps in STEM education, and inspiring curiosity through collaboration with public institutions.



Institute participants use Vernier probes to evaluate moisture of soil samples

Recent Activity

MTSU STEM Education Research Faculty Lead Grant to Prepare Postdocs in STEM

An interdisciplinary team of STEM education research faculty at MTSU received funding from the National Science Foundation (NSF) to support the professional development of a cohort of three post-doctoral fellows. These efforts are led by Dr. Grant Gardner (Biology) and supported by Dr. Liz Barnes (Biology), Dr. Sarah Bleiler-Baxter (Mathematics), Dr. Jennifer Kaplan (Mathematics), and Dr. Gregory Rushton (Chemistry, TSEC). Our cohort includes post-doctoral fellows that have terminal degrees in a STEM discipline, but who are interested in pursuing careers in Discipline-Based Education Research (DBER): Dr. Mary Foley (Biology), Dr. Cassandra Mohr (Mathematics), and Dr. Andrew Puente (Chemistry). The emerging field of DBER is scholarship that reflects the priorities and practices of a particular STEM discipline while being strongly informed by research on learning and cognition. As this is a relatively new field, little is known about best practices for training academics in this field. While we prepare these post-doctoral fellows for future success as DBER researchers over the next two years, the leadership team will also study the programmatic activities that most support effective development of these scholars. In the remainder of this article, we have invited each of the post-docs to share a little bit about themselves and how they have engaged in the PROPS for DBER program so far.

Dr. Andrew Puente:

I received my Ph.D. in Chemistry from Vanderbilt University in Nashville, TN, where I utilized computational chemistry to model the spectroscopic properties of chiral, organic molecules. I received my A.B. in Chemistry and Mathematics from Wabash College, where I learned the utility of computational chemistry early on in my undergraduate career. While at Vanderbilt, I fell in love with teaching chemistry at all levels, from general chemistry to physical chemistry. I am excited to join the PROPS4DBER team as a postdoc and work with the wonderful faculty here at MTSU. My current research focuses on understanding the role of mathematics in the scientific disciplines. Mathematics remains a significant barrier for many undergraduates in their studies with their science courses requiring very flexible modeling skills and quantitative proficiencies. This is especially complicated by the different mathematical “dialects” that each scientific discipline has, which further confuses undergraduates who must “translate” across their courses. This work is motivated by seeing many of my students struggle to connect their mathematical skills along with their chemistry knowledge, oftentimes because they learned mathematics without the crucial context they will need in their future courses.

Dr. Cassandra Mohr:

I received my Ph.D. in Mathematical Sciences from Northern Illinois University, where my research focused on convex optimization algorithms. I also hold a Master's degree in Mathematics Education as well as Bachelor's degrees in Mathematics and Spanish. While I have worn many hats and pursued many interests throughout my academic career, my greatest passion is supporting students in their math journey; I eagerly anticipate the opportunity to hone my skills and further this mission through the PROPS4DBER program. One of my current projects is aimed at advancing research in improving the culture of teaching in STEM fields. This research, which prioritizes the use of strength-based reflexivity, offers a unique opportunity to challenge current norms in higher education while supporting the advancement of STEM teaching practices.

Dr. Mary Foley:

While earning a bachelor's degree in biology from the University of Kentucky, I had the opportunity to work in an evolutionary biology lab, which sparked my love of research. Performing biological research helped me understand the world around me better and gave me perspective on how all life is connected. This made me want to pursue a career in research. My master's degree in Microbial Biology is from Rutgers University. There, I investigated the function of an unknown protein in *S. aureus*. Then, I returned to the University of Kentucky and earned a Ph.D. for my research on freshwater mussel ecology. As a graduate teaching assistant and undergraduate mentor, I loved helping students learn to do research. That led me to pursue this biology education post-doctoral research position at MTSU, where I currently work with Dr. Liz Barnes. Her research focuses on understanding how biology students communicate about culturally controversial science topics like vaccines, evolution, and climate change. We're developing a research course for undergraduate students where they will perform science communication research while learning effective science communication skills. I'm excited about this project for two reasons: 1) I will be learning about effective communication strategies alongside the students, and 2) the results of their research will inform us of better ways to teach science communication to undergraduates in the future. I hope our course provides tools for students to communicate science in a way that helps people understand their impact on the environment and the well-being of others and empowers them to recognize their ability to make a difference.



Dr. Grant Gardner



Dr. Andrew Puente



Dr. Cassandra Mohr



Dr. Mary Foley

Unlocking the Future: Dr. Jaishree Ranganathan Discusses the Transformative Role of AI in Education



Dr. Jaishree Ranganathan

In the Academic Classroom Building at MTSU on November 22nd, Dr. Jaishree Ranganathan, Assistant Professor of Computer Science and Associate Director faculty partner at TSEC, recently delivered an engaging presentation on the transformative role of artificial intelligence in education along with Faculty from History and Information Systems and Analytics. Sponsored by the American Association of University Women (AAUW), the President’s Commission on the Status of Women (PCSW), and the League of Women Voters (LWV) the talk highlighted opportunities, challenges, and concerns of using AI. The presentation sparked meaningful discussions about the potential and challenges of integrating AI into educational settings. This event was open to the public and served the university community.



Dr. Jaishree Ranganathan presenting to students, faculty, and staff

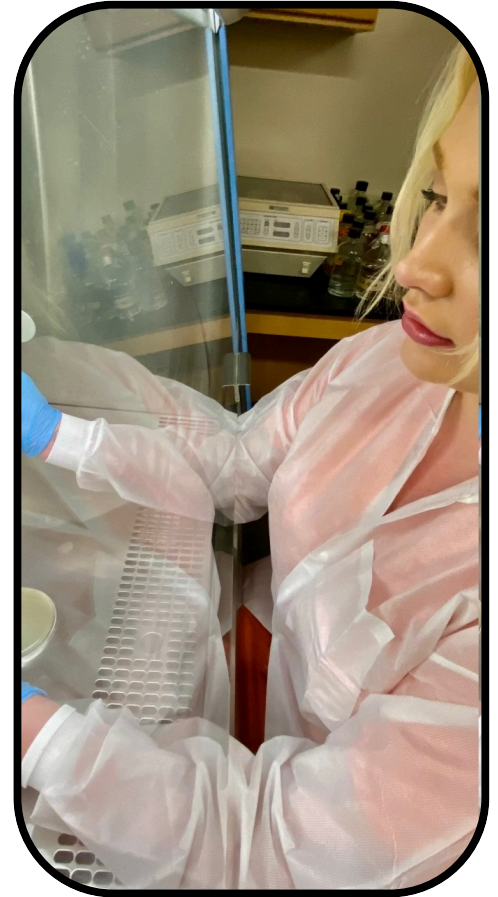


(L ro R) Dr. Jaishree Ranganathan, Dr. Lisa Swart, and Dr. Sam Zaza (on screen)

Empowering STEM Accessibility: TAPDINTO-STEM's Journey Toward Inclusion and Reflection at MTSU

The NSF INCLUDES Alliance: The Alliance for Students with Disabilities for Inclusion, Networking, and Transition Opportunities in STEM (TAPDINTO-STEM) is a collaborative research project funded by the National Science Foundation. MTSU Professor, Dr. Sarah Bleiler-Baxter, directs the TAPDINTO-STEM program at MTSU, supported by STEM Faculty Mentor, Dr. J.C. Saunders, both from the Department of Mathematical Sciences. Nine student fellows participated in the program in Fall 2024. As a group, we have been purposeful in learning about various disabilities and how they impact undergraduate STEM students. One of the resources we have utilized in doing so is The DO-IT (Disabilities, Opportunities, Internetworking, and Technology) Knowledge Base through the University of Washington. The DO-IT website “contains over 800 Case Studies, Promising Practices, and Q&As regarding accessibility of technology, college, graduate school, and careers for individuals with disabilities.” Our TAPDINTO-STEM group was

inspired by the content and structure of the cases, so we decided to create a few of our own for the MTSU campus based upon the experiences of our student fellows. In this newsletter article, we present the first of several cases, authored by TAPDINTO-STEM fellow, Michaela Harrison, to be printed in the TSEC newsletter: Sally and Instability Surrounding Her Unforeseeable Future. We hope that the questions for faculty and students will be used as a reflection tool by STEM stakeholders across MTSU who are interested in better supporting students with disabilities.



Author of article, Michaela Harrison in the lab



Sally and Instability Surrounding Her Unforeseeable Future: A Case Study on Providing Accommodations and Stability for Psychiatric Mood Disorders such as Bipolar

Background:

Sally is an undergraduate student in her Junior year pursuing a Bachelor's in Basic and Applied Sciences in Biology. Sally has been clinically evaluated and diagnosed with Bipolar Disorder Type I. Bipolar Disorder is associated with episodes of mood swings that range between depressive lows to extreme manic highs. Treatment can help patients struggling with this disorder, but this condition cannot be cured. This mental health condition causes people to switch back and forth between mania or hypomania (an emotional state of being energetic and gleeful or sometimes aggressive or even delusional) or having episodes of sadness and depression. It is important to note that the Manic and Depressive symptoms that present themselves are often severe and can last anywhere from 2 weeks to 2 months

Access Issues:

- Several functional limitations are related to psychiatric disabilities that affect academic performance and may require accommodations. According to the Center for Psychiatric Rehabilitation, 1997, these are the following functional limitations that present themselves in many different and unique ways and may vary depending on the individual:
- Difficulty functioning and adjusting to medication side effects: side effects of medications affect academic performance by inducing drowsiness, fatigue, dry mouth and extreme thirst, blurred vision, hand tremors, delayed response time, and difficulty initiating interpersonal contact. This makes it especially difficult for students in need to ask for a helping hand.
- Trouble screening out environmental stimuli: an inability to block out sounds, sights, or odors that interfere with focusing on tasks. This can make attending class feel overwhelming and can be emotionally draining.
- Difficulty sustaining and maintaining concentration: restlessness, shortened attention span, distraction, and difficulty understanding and remembering verbal directions.
- Trouble maintaining stamina: trouble sustaining enough energy to spend a whole day on campus attending classes. This can present itself through unnecessary absences and late assignments.
- Difficulty handling time pressures and commitments to multiple tasks: managing assignments, prioritizing tasks, and meeting deadlines. Sometimes, there is an inability to participate in multi-task group work.
- Fear of authority figures: difficulty approaching instructors or TAs makes it difficult for them to reach out and ask for help when needed; often help is not given to these students until it is too late, and the students may need assistance way before they are able to recognize that they need help.
- Severe test anxiety: the student is rendered emotionally and physically feels they are unable to take an exam. As a result, this leads to poor test performance.

- Negatively responding to feedback: difficulty understanding and correctly interpreting criticism or poor grades. May not be able to separate a person from a task (experiences personalization or defensiveness due to low self-esteem).

Solution:

Given the uniqueness of college students and their backgrounds, experiences, and situations, it is essential to provide flexibility and solutions that allow accommodations to be made and determined on a case-to-case basis. Allowing modified school arrivals, shortened days, and scheduling of core course content during a time when the student's external stresses are low and extended deadlines are all probable solutions that can provide extra support to assist students with Bipolar and/ or other psychiatric disorders and illnesses. Providing a forgiving, self-paced workload and flexible hours allows this student to work at a rate they are comfortable with. Providing students with the resources needed to access the accommodations that the University offers helps identify students who need assistance while providing potential and viable solutions to many of the ongoing challenges that their condition presents.

Conclusion:

Attending college is a stressful time for many students. In addition to coping with the academic pressures of college, some students have to deal with stressful tasks outside their academic studies. With plenty of academic and emotional support, students can see success and enjoy the structure that a college education provides. Providing this student with customized accommodations allows room for provision when needed rather than complete failure. It is important to note that individuals with bipolar tend to reach peak performance; seemingly, the traits that are often presented with this are high energy, confidence, unconventional thinking, and a high tolerance for chaos and stress. That said, a direct consequence and effect of this is the crash- or "low" that follows. During this stage, extreme sadness and fatigue are present due to the decreased need for sleep during the manic episode(s). More often than not, patients are unable to identify whether the feelings they are experiencing are related to an episode or simply a part of their personality. In addition, it is important for the student's support system to be aware of these signs and symptoms so they can identify an episode when it presents itself. Students with psychiatric disorders may also need other on-campus support figures and community services outside of University support, such as therapists and psychiatrists. It is essential that Faculty and Staff Members stay readily prepared for unexpected behavioral changes due to the unpredictable nature of this disorder and that students are provided with easily accessible resources that can provide support when they least expect to need it.

Questions for Classmates and Faculty Members:

1. How can we positively encourage and promote the use of accommodation services to students?
 2. How can staff provide customized learning plans styles that are exclusive for students that demonstrate a need for accommodations?
 3. How can the university as a collective whole design resources that can be useful to students and that are easily accessible, especially in situations of severe or intermediate need?
-

LEADS Kickoff!

The *LEADS: Leaders in Education Advancing Data Science* grant aims to develop leaders in education to advance data science learning in middle school STEM classrooms. The National Science Foundation has awarded this 5-year project \$3,000,000. The team consists of

- **PI Greg Rushton**, Director of MTSU's Tennessee STEM Education Center
- **Co-PI Keith Gamble**, Director of MTSU's Data Science Institute
- **Co-PI Ryan "Seth" Jones**, Research Coordinator of MTSU's College of Education
- **Co-PI Kevin Krahenbuhl**, Director of MTSU's Assessment, Learning, & Student Success Ed.D. Program
- **Co-PI Kate Miller**, Research Associate at Concord Consortium
- **Aspen Malone**, Research Project Manager
- **Sydney Buvvaji**, Graduate Student



Meet the Team



Dr. Greg Rushton, PI



Aspen Malone,
Project Manager



Dr. Ryan Seth Jones



Dr. Keith Gamble



Dr. Kevin Krahenbuhl



Sydney Buvvaji



Dr. Kate Miller, Concord Consortium

On Wednesday, October 30, 2024, the team hosted a kickoff event with the project’s district partners listed below!

- Bedford County School District
- Cannon County School District
- Murfreesboro City Schools
- Warren County Schools
- Williamson County School District



Thank you to
our district
partners



For the occasion, the LEADS team treated their district partners to a catered lunch from Moe’s Southwest Grill, where they discussed the program information and next steps. Aspen Malone, the project coordinator for the LEADS team, expressed her enthusiasm for the project, saying that she thought the event went very well and is excited for what’s to come!

The program is for in-service middle school math or science STEM teachers to earn an Ed.S. in Leadership in Teaching Data Literacy. This is to further support students to develop data literacy, so they can participate in data science. The participating teachers will receive a stipend, and their tuition is fully covered by the grant.

With continued collaboration and focus on teacher leadership and data science knowledge, the LEADS team and partners are set to make a lasting impact in the education landscape, driving positive change in both the classroom and the broader educational community.

For additional stories on this project, please refer to:

MTSU’s News Story



LEADS team with district partners

WKRN’s News Story



(L to R) LEADS team: Dr. Keith Gamble, Dr. Kevin Krahenbuhl, Dr. Greg Rushton, Dr. Ryan “Seth” Jones, Aspen Malone, Sydney Buvvaji

Spotlight on TSEC Associate Director, Mary Ellen Sloane

In 2022, Mary Ellen Sloan, a Fulbright Scholar and science librarian at Middle Tennessee State University, traveled to Rwanda with a mission to improve access to knowledge and resources. Partnering with the Dian Fossey Gorilla Fund, she led the development of a library at the newly constructed Ellen DeGeneres Campus near Volcanoes National Park. Her work went beyond just building a library; it addressed deeper issues related to research equity and the importance of grey literature, which often doesn't make it into formal scholarly records.

The project focused on two main areas: research evaluation and library planning. Sloan interviewed local researchers and stakeholders to better understand their needs. This included identifying available materials, planning for new collections, and designing services to support library users effectively. She facilitated book acquisitions through partnerships like GOBI and used Fulbright's diplomatic shipping resources to ensure materials reached the new library. Along the way, she uncovered additional challenges, such as the need for a digital repository and systems to manage and share research findings more effectively.

A key focus of Sloan's work was grey literature—materials such as datasets, government reports, and other unpublished research. These often-overlooked resources are vital for advancing research in areas like conservation and education but are frequently underutilized due to limited access and infrastructure. Through interviews with five researchers across Africa, Sloan identified significant barriers, including the lack of tools for digitization and the absence of centralized systems for managing these materials. She also emphasized how grey literature could play a critical role in addressing local challenges and empowering future research.



Mary Ellen Sloane provided consultation to the Agati Library, a community library in Musanze, Rwanda.



Mary Ellen Sloane hiked to the original site of Dian Fossey's research center, Karisoke, in Volcanoes National Park.

In addition to her work in Rwanda, Sloan is a key advocate for Research4Life, a global initiative designed to close the knowledge gap between high- and lower-income countries. This program provides free or low-cost access to peer-reviewed academic content for over 13,000 institutions in 125 countries. Sloan's involvement includes working with publishers to donate databases and expanding programs like the Academic Alliance, which connects librarians, educators, and researchers across the world. Her efforts have helped increase access to over 200,000 research resources, giving underserved regions the tools they need to engage more fully in the global research community.

Sloan's work shows the value of collaboration in tackling systemic inequities. Her efforts with the Fulbright Program, the Dian Fossey Gorilla Fund, and Research4Life demonstrate how targeted initiatives can create meaningful and lasting impacts. By focusing on both immediate needs and long-term solutions, she has helped open doors for researchers and students who might otherwise be left without critical resources.

Reflecting on her journey, Sloan remains committed to advancing research equity. Whether it's building libraries in Rwanda or strengthening global partnerships, her work continues to break down barriers and create opportunities for scholars worldwide.



The library at the Dian Fossey Gorilla Fund

TSEC Welcomes A New Center Coordinator: Lindsay Randolph



Lindsay Randolph

Lindsay Randolph joined the Tennessee STEM Education Center as the new coordinator. Previously, Lindsay served as a Transfer Enrollment Coordinator at MTSU. Throughout her tenure at MTSU, she has become a strong advocate for introducing students to the wide range of academic opportunities available to them. She is excited to dive into STEM education, where she can help inspire and empower students to excel in these essential fields.

Lindsay is a native of Rutherford County and was raised in Lascassas. She is an MTSU alumni and currently pursuing a Master of Professional Studies in Strategic Leadership at the university. In her personal time, Lindsay loves hiking with her Mini Australian Shepherd, Birdie, and discovering new restaurants around Middle Tennessee.

Upcoming Events



Celebrating 20 Years of Undergraduate Research Excellence

The Tennessee STEM Education Center is excited to host the 20th annual Posters at the Capitol event on April 2, 2025, at the Cordell Hull State Office Building in Nashville. This milestone event will bring together undergraduate researchers from nine Tennessee universities to showcase their groundbreaking STEM projects.

Approximately 60 undergraduate students will present their research, demonstrating the innovative work being conducted at institutions across the state.

This annual event provides a unique opportunity for legislators to engage with Tennessee's emerging STEM talent. By meeting with students from their districts, lawmakers can witness the impressive research being conducted and better understand its potential impact on the state's economy and future workforce.

The Posters at the Capitol initiative underscores the vital role of undergraduate research in advancing STEM education and innovation. As the event marks its 20th anniversary, it continues to foster meaningful connections between Tennessee's academic institutions, policymakers, and the broader community.

Participating universities include:

- Austin Peay State University
- East Tennessee State University
- Middle Tennessee State University
- Tennessee State University
- Tennessee Technological University
- University of Memphis
- The University of Tennessee, Chattanooga
- The University of Tennessee, Knoxville
- The University of Tennessee, Martin



Tennessee State Capitol



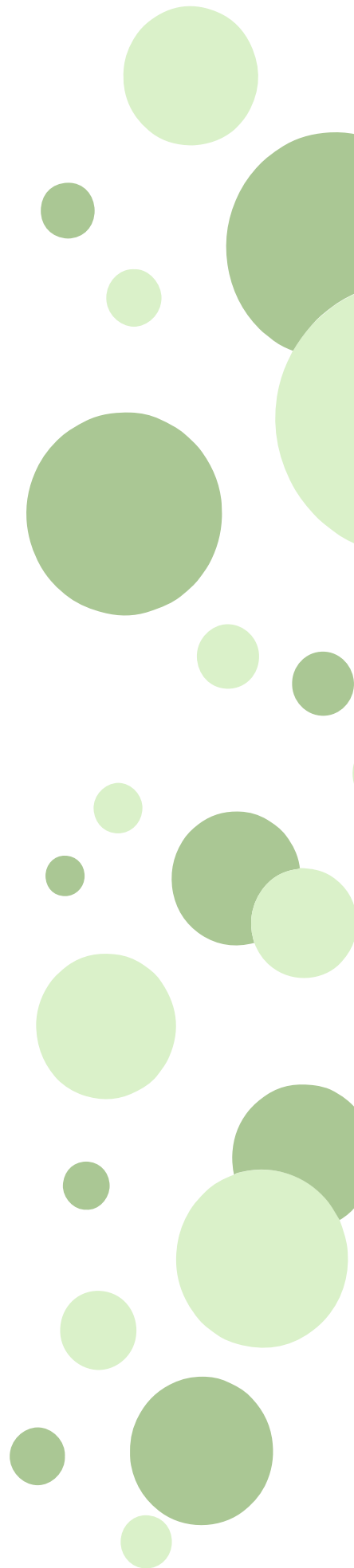
MTSU to Host Annual Regional Science Olympiad for Aspiring STEM Leaders

The Tennessee STEM Education Center (TSEC), in collaboration with MTSU faculty, staff, and student volunteers, will host the annual MTSU Regional Science Olympiad on Saturday, February 15, 2025. This exciting event invites middle and high school students to showcase their STEM talents through a series of competitive and engaging activities.

The Science Olympiad, an international nonprofit organization, is dedicated to fostering student interest in science, technology, engineering, and mathematics (STEM) by recognizing team excellence across 23 STEM-related events. Participants will explore disciplines such as biology, earth science, chemistry, physics, engineering, and inquiry, offering a diverse range of challenges designed to ignite curiosity and problem-solving skills.

Each school team, comprising approximately 15 students, spends months preparing for the competition by building teamwork and mastering STEM concepts. During the one-day regional tournament, these students will apply their knowledge and skills in a series of hands-on events. The top four teams from both the middle and high school divisions will advance to the State Science Olympiad tournament in Knoxville this April.

This event is made possible through the support of the College of Basic and Applied Sciences and a \$35,000 grant secured by Dr. Kevin Ragland and the Middle Tennessee STEM Innovation Hub. The grant, funded by the Tennessee STEM Innovation Network and Battelle Education, underscores a shared commitment to expanding STEM opportunities for young learners.



Campus In-Reach: TSEC Faculty Partners

TSEC is fortunate to have formal partnerships with faculty across STEM education on campus. One of the ways we achieve these partnerships is through the Associate Director and Faculty Fellow programs.

TSEC welcomes any permanent, full-time faculty member, from any academic unit, with a demonstrated commitment to the mission of the Center (i.e., to improve K-20 STEM education both locally and nationally by identifying and addressing critical issues that promote access, equity, innovation, and leadership).

Email [Dr. Gregory Rushton](mailto:Dr.Gregory.Rushton) with questions.

Why become a TSEC Faculty Partner?



TIME- *Do you find yourself needing more time to achieve research, outreach, and/or administrative goals in your academic life?*



SALARY- *How could additional financial support help you achieve your research, outreach, and/or administrative goals related to STEM Education?*



EXPECTATIONS- *How do expectations and accountability play a role in your professional productivity?*



COMMUNITY- *What aspects of professional community are present (or missing) from your current work in STEM Education?*

Click to Learn More about the TSEC Faculty Partner Program

Research Activity

Grants

Grants Submitted

S-STEM: Scholarships for MS and PhD Students in Data Science (S4DS), Gamble, K., Wu, Q., Wallin, J., **Rushton, G.T.**, National Science Foundation (NSF), \$1,999,076, 2025-2030.

Improving Teacher Retention and Effectiveness through Knowledge Sharing: Studying STEM Teachers in High Needs Schools across a Community of Practice, **Rushton, G.T.**, Evert, K., National Science Foundation (NSF), \$1.2 million, 2025-2028.

National STEM Teacher Corps: The Southern Alliance for Recruitment, Retention, and Renewal of Rural STEM Teachers (R4 STEM), **Rushton, G.T.**, Krahenbuhl, K., National Science Foundation, \$2.4 million, 2025-2030.

NSF Noyce Track 4: ATLAS - Advancing Teacher Leadership through Advantaging Systems, **Rushton G.**, Smith, Yow, Lotter, National Science Foundation (NSF), \$645,069, 2025-2029.

Exploring Mentorship Dynamics: Science Norms and Border Crossing for First-Generation College Students, **Hosbein, K.**, Barnes, M. E., Caputo, J., Carter, L., Johnson, S., National Science Foundation (NSF), \$1,929,758, 2025-2028.

Research Activity

Active Grants

Preparation and Refinement of Postdocs in STEM for Disciplinary-Based Education Research, Gardner, G., Barnes, E., Bleiler-Baxter, S.K., Kaplan, J., **Rushton, G.T.**, National Science Foundation (NSF), \$1.25 million, 2023-2026

Advancing the Culture of Teaching in STEM through Diffusion of Strength-Based Reflexivity (ACT-STEM). Bleiler-Baxter, S., **Rushton, G.**, Gardner, G., National Science Foundation (NSF), \$1,199,915, 2024-2029.

Agri-analytics Fellowship: An Interdisciplinary Approach to Expanding Career Pathways for Undergraduate Students. **Ragland, K.**, Jin, Y., Cui, S., Mosley, C. USDA-NIFA-REEU. \$749,443. 2023-2028.

AgXplore Professional Development Institute for Middle School Agriculture Teachers. **Ragland, K.**, Mosley, C. 2023. USDA-NIFA-PDAL. \$500,000. 2023-2026.

An Investigation of Virtual Reality Initiatives and Workforce Development. Mosley, C., **Sloane, M.E.**, Jin, Y., **Ragland, K.**, Institute of Museum and Library Services. \$549,574., 2023-2026.

Beginnings: Creating and Sustaining a Diverse Community of Expertise in Quantum Information Science (EQUIS) Across the Southeastern United States. Terletska, H., **Rushton, G. T.**, National Science Foundation (NSF), \$264,322, 2023-2026.

Collaborative Research: Exploring the Impact of Noyce Master Teaching Fellowship Programs on Teacher Retention: The Role of Motivation, Leadership, and School-Work Environment, **Rushton, G. T.**, National Science Foundation (NSF), \$214,350, 2020-2024.

Curriculum Integration Grant - President's Commission on the Status of Women, **Ranganathan, J.**, \$2,700, 2024.

Exploring Mentorship Dynamics: Science Norms and Border Crossing for First-Generation College Students, **Hosbein, K.**, Vincent-Ruz, P., Nardo, J., National Science Foundation (NSF), \$591,807, 2024-2027.

Research Activity

Active Grants

Incorporating Learning Assistants into High DFW Science Courses to Decrease DFW Rates, **Hosbein, K.**, Barnes, M. E., \$50,000, 2024-2025.

Network of the National Library of Medicine (NNLM) Region 2 Professional Development Award, **Sloane, M.E.**, \$4,000, 2024.

Noyce Track 3 LEADS: Leaders in Education Advancing Data Science, **Rushton, G.**, Kranbuhl, K., Gamble, K., Jones, S., Miller, K., National Science Foundation (NSF), \$2,990,932.

Preparation and Refinement of Postdocs in STEM for Disciplinary-Based Education Research (PROPS for DBER). Gardner, G. E., **Rushton, G. T.**, Kaplan, J. J., Bleiler-Baxter, S. K., Barnes, M. E., National Science Foundation STEM Education Organizational Postdoctoral Research Fellowships (STEM Ed OPRF), Federal, \$1,249,445., 2024-2026

Research Initiation: Embodied and Student-Centered Robotics in the Professional Formation of Engineers. Zhang, H., **Rushton, G. T.**, National Science Foundation (NSF), \$199,683, 2023-2025.

STEMulating Leaders Within the Middle Tennessee STEM Innovation Hub. **Ragland, K.**, Battelle Education, \$35,000, 2025.

Sub-award: NEXTGENERATION Inclusion Consortium: Attracting and Engaging the Underserved in the Food, Agriculture, Natural Resources, and Human Sciences Workforce. Mosley, C., **Ragland, K.**, Carter, J., Cui, S., Haruna, S. USDA-NIFA-NEXTGEN. \$901,626, 2023-2028.

Research Activity

Publications

Barth, S. G. Criswell, B. A., Smith, W. M., **Rushton G. T.** (2024). Modeling how professional development interacts with teacher leaders' outcome expectancies and school environment perceptions, *International Journal of Leadership in Education*, [DOI: 10.1080/13603124.2024.2307877](https://doi.org/10.1080/13603124.2024.2307877).

Fateh, S., Ayangbola, O. T., Reid, J. W.; Zakher, S. Kirbulut, G., Demet, Z., Phelps, A. J., Malone, A., **Rushton, G. T.** (2024). Small Group Conversations in a POGIL-based Class: How English Learners Engage in Joint Knowledge Construction Process to Reach a Shared Understanding, *Journal of Chemical Education*. In Press.

Mosley, C., **Ragland, K.**, & Jin, Y. (2024). Addressing professional development needs of middle school-based agricultural education teachers through CASE AgXplore training. Poster Session Proceedings of the Annual Research Conference of The American Association for Agricultural Education. 51(1), 305-308. Retrieved from <https://aaea.wildapricot.org/resources/Documents/National/2024Meeting/2024AAAEPosterProceedings.pdf>

Ndembera, R.; Zhu, Y.; Ray, H, G,; **Rushton, G. T.** (2024). Which factors contribute to standardized test scores for prospective general science teachers: An analysis of the Praxis General Science Content Knowledge Test. *Discover Education*. In Press.

Talanquer, V., Cole, R., & **Rushton, G. T.** (2024). Thinking and Learning in Nested Systems: The Classroom Level. *Journal of Chemical Education*. <https://doi.org/10.1021/acs.jchemed.3c00839>.

Sloane, M.E., Dollar, D., Hollier, C. (2024, November). Global engagement through the Research4Life Academic Alliance. The Charleston Conference, Charleston, S.C.

Zottola, R., Skjellum, A., Oelgoetz, J., **Sloane, M.E.**, Fleming, R., Crosby, L. (2024, December) Tennessee Research and Education Computing Collaborative. BRICCs Establishing Pathways for Regional Computing Workshop, Knoxville, TN.

Thank You to our TSEC Faculty and Staff!



Tennessee STEM Education Center

[Tsec Website](#)

[820 Fairview Ave, Murfreesboro,
TN 37132](#)

[\(615\) 904-8573](#)



Contact TSEC

Gregory Rushton, Ph.D., Director

Kevin Ragland, Ph.D., Associate Director

Lindsay Randolph, Center Coordinator

Aspen Malone, Research Project Manager

Melanie McQuiston, Program Assistant

Jaishree Ranganathan, Ph.D., Associate Director

Mary Ellen Sloane, MLIS, Associate Director

Heather Green, MSE, Faculty Fellow

Katy Hosbein, Ph.D., Faculty Fellow

Tiffany Rogers, Ph.D., Faculty Fellow

Lucas Davis, Student Worker

Stephanie Figueroa, Student Worker

Kyra Ippolito, Student Worker

Ashlee Schafer, Student Worker
