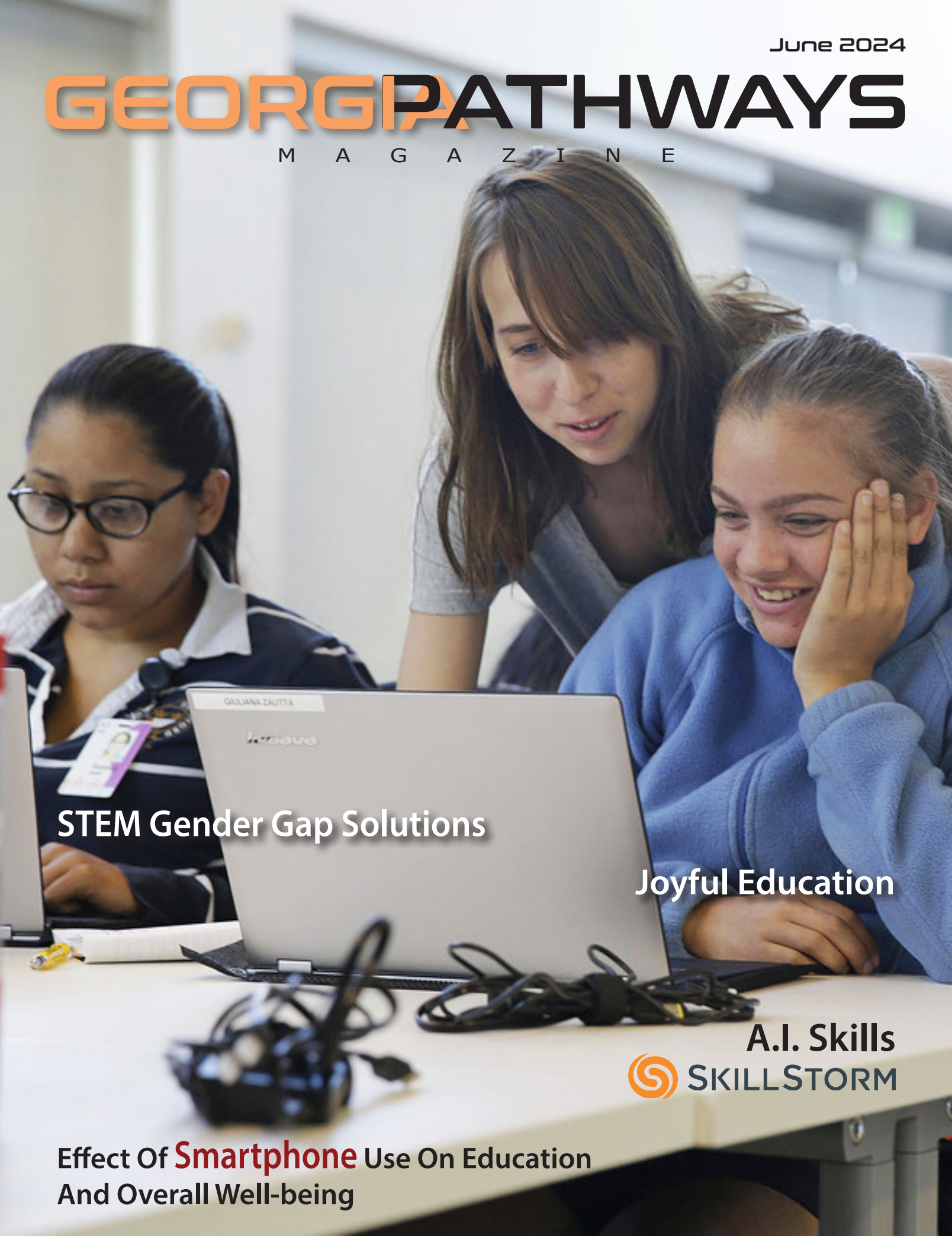
June 2024

GEORGIA PATHWAYS

MAGAZINE



STEM Gender Gap Solutions

Joyful Education

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SKILLSTORM

Effect Of Smartphone Use On Education And Overall Well-being

The Technology Association of Georgia Education Collaborative (TAG-Ed) strengthens the future workforce by providing students with relevant, hands-on STEM learning opportunities and connecting them to Technology Association of Georgia (TAG) resources.

Formerly the TAG Foundation, TAG-Ed is a 501(C)(3) non-profit organization formed by TAG in 2002. Later, the organization's name was re-branded to TAG Education Collaborative to facilitate our role as the leaders for K-12 STEM education in Georgia.

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As artificial intelligence systems expand into more industries, having a workforce proficient in these technologies is becoming a necessity. A 2023 survey, which involved nearly 13,000 employees, revealed that while 86% required AI training, only 14% received it. More than 60% of executives believed they would need to replace or retrain a quarter of their workforce.

To address this issue, companies can invest in providing upskilling and reskilling opportunities for their current employees, thereby creating a skilled internal talent pool tailored to their specific needs. By investing in the upskilling and reskilling of their existing workforce, employers can build a strong internal talent pool tailored to their specific needs.

The good news for job seekers is the skills needed in AI don't require a four-year degree. Students can begin developing fundamental AI skills in high school, providing them with a competitive advantage when joining the workforce. Many recent graduates proficient in AI systems are also expected to be hired to address the skill gap.

This approach not only addresses the talent gap but also enhances employee retention and satisfaction. Employees are more likely to stay with a company that invests in their professional development, leading to reduced turnover rates and a more experienced and knowledgeable workforce.

To help employers address this need, TAG-Ed partnered with Georgia Artificial Intelligence in Manufacturing (Georgia AIM), to fulfill the mission of the equitable development and deployment of talent and innovation in AI for manufacturing. From broader talent development initiatives to industry- and region-specific projects, Georgia AIM works to realize AI advancement across Georgia and beyond.

Also, TAG-Ed now offers specialized certification courses to meet the growing demand for AI skills. TAG-Ed provides fundamental and advanced AI tech certification courses in CompTIA and Microsoft Azure. CompTIA certifications offer comprehensive coverage of core IT skills, focusing on machine learning, data analysis, and other essential AI components. Similarly, Microsoft Azure certifications concentrate on cloud computing and AI integration, providing learners with the expertise to implement and manage AI solutions.

By taking advantage of TAG-Ed's certification courses, individuals and companies can bridge their AI skills gap. Visit tagedonline.org/skillstorm/ to learn more about these opportunities.

Larry K. Williams
President
TAG / TAG-Ed

Larry K. Williams serves as the President and CEO of the TAG and the TAG Education Collaborative. TAG-Ed's mission is to strengthen Georgia's future workforce by providing students with relevant, hands-on STEM learning opportunities by connecting Technology Association of Georgia (TAG) resources with leading STEM education initiatives.

Massachusetts Institute of Technology

The Gender Gap in STEM Continues Beyond 2023

Clara Piloto
Director of Global Programs, Director of Digital Plus Programs
MIT Professional Education

Despite progress in gender equity and growing interest over the last decade in computer science, engineering, math, and statistics among both men and women, the underrepresentation of women in the Science, Technology, Engineering, and Mathematics (STEM) fields continues to persist. In 2023, the gender gap in STEM remains significant, with women making up only 28% of the STEM workforce.

If we look at places worldwide where we might hope to find better news, the statistics give us pause. The figure stands at 24% in the United States,[ii] 17% in the European Union,[iii] 16% in Japan,[iv] and 14% in India.

This disparity is concerning, as it leads to a lack of diversity and inclusion, and ultimately limits the potential of the STEM industry. Addressing existing underrepresentation is critical as the world grapples with economic, environmental, geopolitical, societal, and technological risks. Closing the gender gap will not only bolster sustainable tech-enabled growth and innovation but is also deemed an economic necessity.

Examining the Stumbling Blocks

The gender gap in STEM has been attributed to several long-standing and deeply entrenched realities, including the following:

Stereotypes: Many individuals still associate STEM fields with masculine qualities, leading to stereotypes that can discourage girls and women from pursuing STEM education and careers.

Lack of role models: Women remain underrepresented in STEM leadership positions, which makes it harder for girls and women to find role models and mentors in the field.

Unconscious bias: Unconscious biases in hiring, promotion, and grant funding can disadvantage women and lead to their disproportionately low representation in STEM.

Work-life balance imbalance: STEM careers can be demanding, and some women may opt out or choose to work part-time to handle family responsibilities, which can impact career advancement.

Implementing Strategies:

There are various strategies that can be implemented to close the gender gap in STEM. These include:

- Encouraging girls to pursue STEM education: It is essential to introduce girls to STEM subjects early on to help dispel the stereotypes associated with STEM and provide them with role models. Programs like Girls Who Can Code, Black Girls Code, and Million Women Mentors have been successful in inspiring girls to pursue STEM education.

- Creating inclusive workplaces: Companies and institutions can work toward creating inclusive workplaces by identifying and addressing unconscious biases and fostering a culture of inclusivity. This can be achieved by implementing diversity and inclusion policies, offering mentorship and sponsorship programs, and providing flexible work arrangements.

- Promoting female role models: Having visible female role models in STEM is crucial to inspiring and encouraging girls and women to pursue STEM careers. Organizations should prioritize diversity in their hiring and promotion practices to increase representation at all levels of leadership.

- Providing professional development opportunities: Initiatives that include training, mentorship, and networking events can help women develop the skills and confidence needed to succeed in STEM fields.

- Addressing structural barriers: Breaking down structural obstacles, such as the gender pay gap, lack of family-friendly policies, and gender bias in grant funding is crucial in closing the gender gap in STEM. Companies and institutions should work toward creating policies that address these issues and promote gender equity.

- Encouraging women to stay in STEM careers: It is important to create a supportive environment that spurs women to remain in STEM careers. This can be accomplished by offering mentorship and sponsorship programs, providing opportunities for career

advancement, and creating flexible work arrangements.

Reaping the Benefits:

Closing the gender gap in STEM fields can have numerous benefits for the global community.

Promoting diversity and inclusion: Gender equity can foster diversity and inclusion, leading to more innovative solutions to societal challenges.

Economic growth: Losing the gender gap in STEM can help address the skills gap in the STEM workforce, leading to economic growth and job creation.

Improved research: Increasing gender diversity in STEM fields can lead to improved research outcomes, as diverse perspectives can provide unique insights into research questions.

Improved products and services: Greater gender diversity in STEM fields can lead to the development of products and services that better meet the needs of all consumers.

Social progress: Narrowing the gender gap in STEM can contribute to broader social progress, as greater gender equity can lead to a more just and equitable society.

Closing the gender gap in STEM is a complex issue that requires a multifaceted approach—from instilling confidence in girls within families to creating incentives for women to join and stay in STEM. We have the collective opportunity to elevate human endeavor by empowering women with the freedom of choice in educational tracks and career trajectories.

Ultimately, through a more inclusive economy, we can unlock the full potential of STEM-related industries and tackle the world's most pressing challenges.

To understand STEM...

...you must DEFINE STEM, but you cannot define an acronym using the words it stands for; you must define the words the acronym represents.

Universities and organizations around the world continue to debate what a STEM career is. There is no doubt that "every career" uses STEM skills and this observation remains the focus of STEM Magazine.

Science: "The systematic accumulation of knowledge" (all subjects and careers fields)

Technology: "The practical application of science" (all subjects and careers)

Engineering: "The engineering method: a step by step process of solving problems and making decisions" (every subject and career)

Math: "The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions" (every career will use some form[s])

For a moment, set aside any preconceived notions of what you think a STEM career is and use the above dictionary definitions to determine the skills used in any career field you choose.

These definitions are the "real" meaning of STEM and STEM careers.


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Share this issue with your students, peers, parents and industry professionals you know. Make this a new monthly connection for curiosity, interaction, college prep and career development.

Many parents really enjoy this content as they too pursue their personal life-long learning goals.

Industry and government leaders need to know about this resource as their future employees decide and prepare how to spend their careers.

OAK RIDGE National Laboratory

Noah Miller: Intern working to make pellet inspection for Pu-238 Supply Program faster, safer

By Kristi Bumpus /ORNL

Maybe it was the career technical program at Knoxville's South-Doyle High School, where Noah Miller gained a strong foundation in mechanical engineering, coding and computer-aided design before he ever graduated. Maybe it was South-Doyle's First Robotics Club, where he learned to build and program and still actively volunteers.

Or maybe it was the fascination with space Miller has had since childhood, voraciously consuming news about space travel and exploration, watching launches and even recordings of launches.

Most likely, it was a combination of all these things that put Miller on the path to developing an automated pellet inspection system for Oak Ridge National Laboratory's Plutonium-238 Supply Program.

Miller, who is majoring in mechanical engineering at the University of Tennessee, began a Science Undergraduate Laboratory Internship, or SULI, at ORNL in spring 2023. During his SULI, a 10-week paid internship sponsored by the Department of Energy's Office of Science, Miller was matched with Joe McVeigh, a remote operations infrastructure engineer in the Isotope Science and Engineering Directorate's Radioisotope Science and Technology Division.

McVeigh thought Miller would be a good fit to help develop a new system for the Plutonium-238 Supply Program, which produces neptunium pellets used as the irradiation target material for Pu-238 production under a contract with NASA. The resulting

Noah Miller, back right, assists members of Knoxville's South-Doyle High School First Robotics Club with a demonstration at ORNL's 2023 Take Your Child to Work Day. Credit: ORNL, U.S. Dept. of Energy

Pu-238 is used to power radioisotope thermoelectric generators for deep-space exploration.

Before loading the radioactive neptunium pellets into irradiation targets, each pellet is individually inspected within a glovebox by workers who measure them for consistent size and look for defects. Not only is the process time-consuming, but it also exposes the workers to radiation.

That's why Miller has focused on developing a mechanized scanner, mounted on the glovebox, that could do the same thing faster and with less radiation exposure to humans. This equipment has long been used in manufacturing but hasn't been applied to examining radioactive materials within the Pu-238 Supply Program.

"I like doing stuff that hasn't been done before, trying to figure out problems," Miller said. "And knowing this was

actually going to be used to support the manufacturing process to make plutonium-238 going into space travel was another big draw."

At the end of the SULI, Miller had momentum, leading McVeigh to recommend him for a 16-week ORNL-sponsored Undergraduate Research Student Internship, or URSI. When the URSI ended, Miller applied for a yearlong Education Collaboration at ORNL, or ECO, internship, which now allows him to work part time while taking classes at UT and full time during the summer.

"Noah's experiences with the First Robotics Club gave him a base of knowledge in electromechanical design, vision systems and systems thinking, which, coupled with engineering courses, really prepared him to work on this project," McVeigh said. "He has exceeded expectations with his critical thinking and hard work."

Miller's goal is to design a 3D line scan camera that can measure the diameter and height of each pellet and look for defects.

"It should be able to do pretty much everything a human can," Miller said. "There are some defects that might be harder for the camera to detect, so we may need a secondary camera for those."

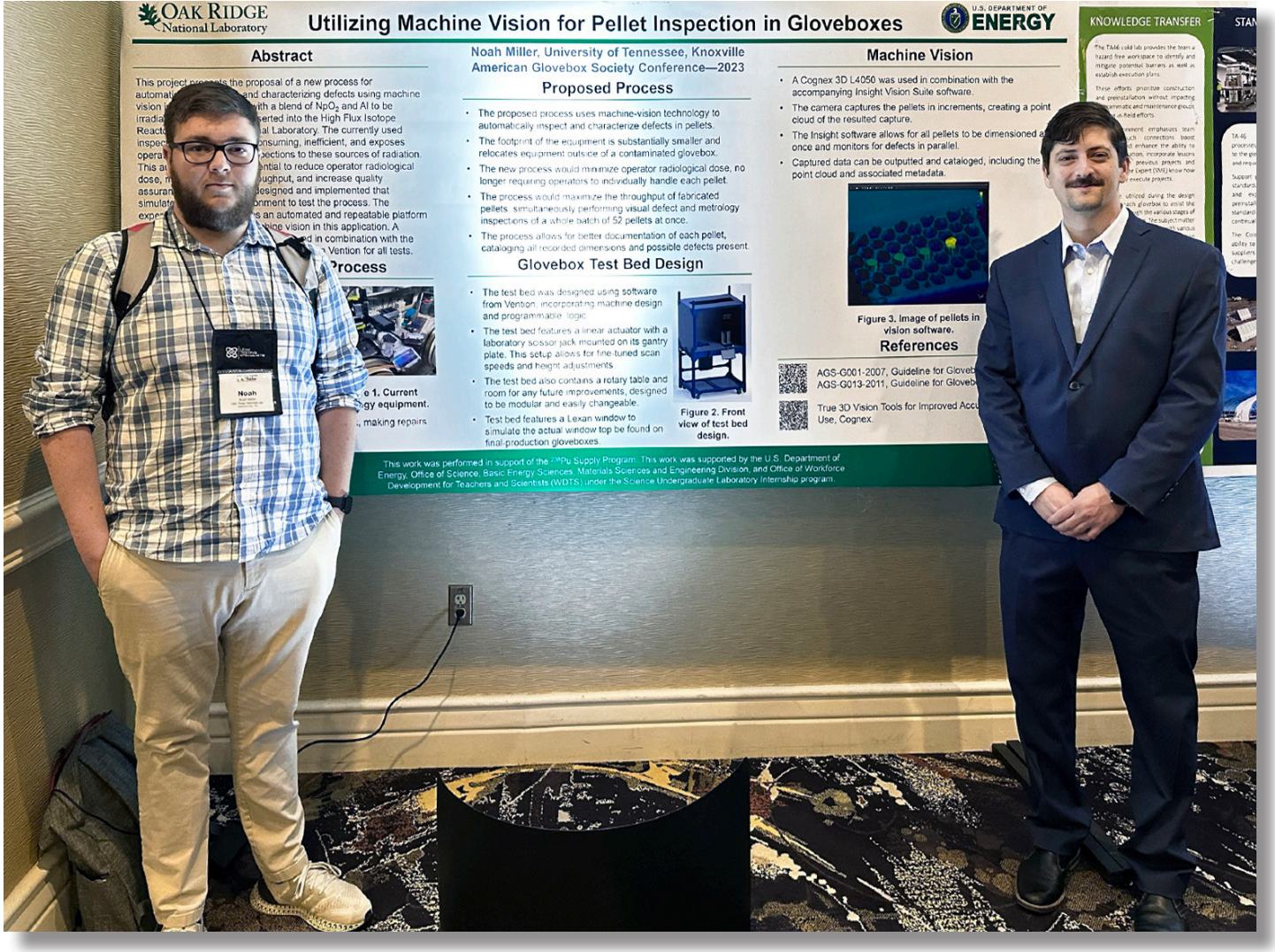
His research allows him to do both coding and building.

"I like the mechanical side better, but I don't mind coding," he said.

With input from McVeigh and Michael DeVinney, a design engineer with ORNL's Fission and Fusion Energy and Science Directorate who has served as technical adviser for the machine learning aspects of the project, Noah has designed and built a testbed glovebox for his machine-vision system. That glovebox is operating in a test lab.

"Successfully integrating custom equipment systems in a glovebox is not trivial," McVeigh said. "Noah has learned a lot about systems thinking during his time here. During this term, we are working to continue the development of this application and work toward qualification for use in our facility." Miller hopes that will happen by his planned college graduation, in 2026. After that, he said, he'd love to pursue a career at ORNL.

"I love the atmosphere here," he said. "It's a very supportive environment." Miller got to attend the American Glovebox Society's annual conference with McVeigh, who is president-elect for the national organization, and said McVeigh is always willing to answer his questions and provide guidance.



ORNL intern Noah Miller, left, and his mentor, Joe McVeigh, stand with their poster at the American Glovebox Society conference in 2023. Credit: ORNL, U.S. Dept. of Energy

"Noah's resume caught my eye when I saw that he was involved with the First Robotics Club when he was at South-Doyle High School," McVeigh said. "I had volunteered in 2016 to support the students on their project. I was very impressed by those students and got to understand the engineering-centric exposure that they get.

"When I saw that Noah was still participating as a mentor in that club, I knew that we had a similar passion for service. I had four internships in college and never really had a good experience, so I am especially driven to help attract and retain talent that can support my projects at the lab while providing a developmental and fun experience."

Knowing firsthand the difference it can make, Miller plans to mentor others just as he's been mentored. He already finds his work with the South-Doyle First Robotics Clubs both fun and fulfilling.

"I go out during the week and coach the kids," he said. "I'm teaching them

stuff I'm learning now in college."

Miller said being in the robotics club and South-Doyle's career-technical education program helped him start college ahead of the curve, since he came with a background in computer-aided design and other skills that UT doesn't cover until a few years into the degree program. He sees a bit of himself in some of South-Doyle's current students.

"Some of them will come up to me, and I can see the interest, just like I had," he said. "They're solving problems the same way I was looking at things."

UT-Battelle manages ORNL for the Department of Energy's Office of Science, the single largest supporter of basic research in the physical sciences in the United States. The Office of Science is working to address some of the most pressing challenges of our time. For more information, please visit

energy.gov/science

Effect Of Smartphone Use On Education And Overall Well-being

By Ilya Iskhakov, Dhanlaxmi Patel, and Vera Bulakhova
Touro College of Pharmacy-NY Doctor of Pharmacy candidates

Ninety two percent of Americans or around 309 million US individuals own a smartphone[1]. Among the younger population of ages 18-29, there was a reported 100% cell phone ownership with 96% being smartphones.[1,3] According to the American Association of Colleges of Pharmacy (AACP), the age range of pharmacy students 25 years and younger was reported to be around 48% and students 26-30 years were reported to be around 38.6%.

In this 19 to 29-year-old age range, 70% reported using phones for entertainment or when bored, 32% reported being frustrated when the phone was taking too long to load content, 30% reported using a smartphone to avoid interacting with other people, and 32% reported turning off the phone for some time to take a break from it.[2,3] In general, smartphone use is negatively correlated with psychological well-being.

According to Harwood et al, higher levels of involvement with smartphone devices are associated with depression and stress.[4]

Smartphone use in the classroom is often a source of distraction as it leads to multitasking and can prevent critical thinking which ultimately interferes with the learning process. In 2022, Huey and Giguere examined the effect of smartphone use on classroom performance such as course comprehension, mindfulness, and anxiety in undergraduate students in New York City.[5]

The experimental group was told to leave their smartphones with a faculty before each lecture, while the control group was given no instructions on smartphone use. Course comprehension was measured by a 10-item questionnaire which assessed how students feel about the content of the lecture.

Anxiety was measured on a 7-item questionnaire with students reading their anxiety levels after the lecture. The mindfulness was rated on a 10-item questionnaire which assessed students' state of mind and focus during the lecture. The results showed that the use of smartphones in the classroom setting harmed course comprehension as well as anxiety and mindfulness. This is important to note as a positive psychological mindset is important to a functional learning environment.

A study conducted in two pharmacy schools in the US by Cain et al. (2019) evaluated challenges in communication when without a mobile phone, the feeling of losing connection, difficulties in accessing information, and the inconvenience caused by not having a mobile phone using the Nomophobia Questionnaire (NMP-Q).[6]

The term NOMOPHOBIA or NO MOBile PHone PhoBIA is used to describe a psychological condition when people have a fear of being detached from mobile phone connectivity.) The results showed a similar average level of nomophobia across the two schools with more than half of the respondents (56.8%) reporting a moderate level of nomophobia, a quarter (24.5%) reporting mild and another 18.2% reporting severe levels of nomophobia.

Another cross-sectional study among pharmacy students in Thailand assessed smartphone use during the weekdays and weekends, as well as the purpose of smartphone use.7 The study reported that almost half of the respondents (49%) were addicted to their smartphones by using it more than 5 hours/day. The average smartphone use during weekdays was 7 1/2 hours and around 8 hours on weekends. The most common uses for smartphones were social networking, education, and entertainment.

The most commonly reported health-related problems that were associated with extended smartphone use were insomnia, anxiety, headaches, and stress. The findings could have implications for how we approach technology use in educational settings, particularly in fields like pharmacy where students may rely heavily on their smartphones for learning and communication.

Recent studies have shown the widespread issue of smartphone addiction among university students, showing a complex interplay of psychological, social, and behavioral factors. Research by Cunjia Liu in 2023 evaluated the impact of smartphone addiction on first-year university students in China using a survey design. The study found that factors like self-control, fear of missing out, procrastination, academic burnout, social anxiety, and self-esteem directly influenced smartphone addiction.[8]

Another cross-sectional study by Liu et al. in 2022 focused on smartphone addiction among freshmen medical students in China[9]. The study identified 39.7% as having smartphone addiction (measured using the Smartphone Addiction Scale - Short version). Factors associated with addiction included professional identity, poor mental health, smartphone use before sleep, and perceived study pressure. A cross-sectional study by Karki et al. in 2020, among medical students in Nepal found that 36.8% of participants were addicted to smartphones, with another 37.6% reporting phubbing. Self-acknowledgment of addiction emerged as the most significant predictor[10].

In the digital age, the use of smartphones has become ubiquitous, especially among college students. This widespread use has sparked interest in understanding whether smartphone addiction mirrors the patterns seen in drug addiction. In 2020, Ceo et al. conducted a study among Korean University students to determine the changes of neurotransmitters with internet and smartphone addiction[11].

The results indicated that overuse of internet and smartphones can result

in elevated levels of a neurotransmitter called Gamma-Aminobutyric Acid (GABA) in a part of the brain known as the anterior cingulate cortex (ACC).

This is similar to the increase in GABA levels seen with the consumption of substances such as alcohol, benzodiazepines, and barbiturates. The ACC is involved in various cognitive processes, such as decision-making, impulse control, and emotional regulation. An increase in GABA levels in this region could potentially decelerate signal processing, which might contribute to addiction symptoms.

In addition, GABA and Glx (glutamate and glutamine) levels were correlated with clinical scores obtained using standard psychological tests.

The abnormal GABA level or disrupted balance between GABA and Glx in the ACC may contribute to understanding the biochemical and molecular basis of Internet and smartphone addiction and the associated comorbidities that could be used to devise appropriate treatments.

Smartphone use is undeniably prevalent in the modern society. However, these studies show the need for targeted prevention and intervention strategies to advocate for a balanced approach to smartphone use, promoting its benefits for academic enhancement while mitigating the risk of addiction. Among pharmacy students, if there is an addiction to smartphones, this can negatively impact their productivity as well as medication safety as they may

have to forego the use of smartphone while in the pharmacy or during clinical rotations. This can eventually impact the optimal patient outcomes.

As one of the most trusted healthcare professions, this is not a risk we should take. Thus, pharmacy schools need to invest in further research to identify appropriate strategies that can be implemented to improve ideal use of smartphones and overall general well-being in the classrooms.

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AI Skills: The New Currency in Today's Job Market

The AI revolution is here. Ever since ChatGPT arrived on the scene in late 2022, artificial intelligence has been reshaping the way we live and work. What does that mean for tech professionals looking to compete in a changing labor market?

TV pundits and talking heads love to get riled up about whether robots are coming for our jobs — but the truth is that AI will probably create more jobs than it eliminates. And one thing's for sure: understanding how AI works, and mastering AI skills, will be the key to success in tomorrow's ever-changing world of work.

New research shows that a growing number of companies are asking for AI skills in job descriptions — including non-tech roles. And a survey of HR professionals released last month shows that job candidates with AI skills ask for more money during the interview process — and tend to get it once they're hired. Simply put, AI is going to be underpinning nearly every job out there. That's why staying ahead of the latest in AI development is so important.

Building AI skills doesn't just mean learning how to engineer prompts for ChatGPT. It's everything from programming to data modeling and analysis to mastering concepts like machine learning and natural language processing. And if there's anything certain in our fast-paced economy, it's that building AI fundamentals today will translate to career opportunities tomorrow and beyond.

That's where SkillStorm comes in. In partnership with TAG, we offer Microsoft Azure AI courses that are instructor-led, career-aligned tech certification courses and will help you build the AI skills that employers need. From the basics of AI and machine learning to a comprehensive understanding of how to design, deploy, and maintain AI solutions, you'll learn everything you need to accelerate a career in the economy's hottest fields.

It won't be long before all kinds of jobs, all across the economy, require AI skills. And starting now is the best way to accelerate your ascent up the career ladder. Build those skills today and you'll lay the foundation for opportunity for years to come — and set yourself up for success in an AI-driven future of work. Register today to get started with a career in tech.

Encouraging Students to SOAR to New Heights:

The Impact and Importance of Providing Accessible STEM Opportunities for Students Through The Eyes of an Educator

By Maria (Miller) Hoxmeier, M.Ed.

Think about the moment you knew what you wanted to be when "you grew up." How did you decide what your passion was? Who or what encouraged you to pursue your dreams? Maybe it was a trusted educator, coach, or parent. Or maybe it was a single, immersive experience which sparked an interest for you. When students (of all ages) have the opportunity to explore, to investigate, and to learn about different areas of subject matter, it allows them to discover what their true passions are (and are not).

The opportunity to experiment with areas of interest outside of the classroom can have a substantial impact on young scholars. Middle and high school students are frequently asked to think about their futures starting in their

early teen years; "What career or profession interests you the most?" which on its own, can be an overwhelming question for many. Students should not be expected to determine their futures without the opportunity to explore. Allowing them to step into an environment to ask questions, learn, and determine their interest level can have a large impact on their educational journey.

A school's resource library should go beyond the classroom and a step further than shadowing or observing. The real learning occurs when students are truly immersed; using their hands and their minds to discover something new. So what are we, as educators, providing for students to help them navigate their futures? Which experiences or opportunities can we share that would supply the largest impact for them?

Student investigation through real-world experiences can contribute to a student's decision in determining their career pathway. These beneficial experiences allow for student inquiry and can spark engagement in powerful ways. Students who are specifically interested in STEM (Science, Technology, Engineering, and Math) content or subject matter can find opportunities to experiment with their interests in a number of ways, but narrowing down the options to find the best resources can pose a challenge.

School districts and educators are continuously working to provide STEM access to K-12 students with the hope of sparking an interest at an early age, as there is an increasing demand for young graduates to enter STEM professions. There are a limitless number of resources waiting to be shared with students, but providing these opportunities can come with time, facilitative, and budgetary constraints for educators and for students. There is a high level of importance and a need to provide accessible STEM opportunities for students that eliminates those barriers.

One distinctive STEM opportunity that is accessible to students across the United States is STEM Flights. STEM Flights is a national nonprofit organization that provides a free, individualized flight experience for 6th-12th grade students throughout the U.S.

Our mission at STEM Flights is to provide an opportunity for students to experience a flight alongside an experienced pilot mentor with the hope of inspiring students and encouraging STEM career exploration. Our goal with each flight is to provide a powerful experience that is free and accessible to all students and alleviates the financial burden of learning about aviation, aerospace, and flight at a young age.

The experience creates a foundation of STEM for students that sparks their curiosity and encourages them to dream about their future. We have seen how a single flight experience can change a student's life during their hour in the sky. Even if a student completes their flight but has no desire to become a pilot, we continue to witness the value of providing this real-world experience for interested students. We know that STEM Flights yields more than a single flight experience for our young learners. It becomes part of their story and an accomplishment they might not have been able to accomplish otherwise. Throughout the flight experience, we see students gain a new sense of confidence that helps them continue on their STEM journey.

As the Director of Education, I collaborate directly with district leaders, educators, directors, and organizations all around the United States to share information about STEM Flights and what we provide for students. There have been countless times I have heard the phrase "I wish we had this when I

was a kid!" not only because it sounds thrilling to take a private flight, but also because the need to explore, to learn, and experience new things continues throughout life, no matter how old we get.

Students should have a foundation of learning within their school setting, but should also have the opportunity to investigate through real-world experiences to feed their curiosity. Educators can encourage exploration by sharing resources that align with student interests. Providing an opportunity such as STEM Flights could help students to be inquisitive, to try something new, and to see the potential of opportunities available to them.

Any 6th-12th grade student can apply for a STEM Flight. This is not an experience only for future pilots. We encourage any student interested in the field of STEM to apply. The first step for students is to complete an online application that includes a letter of recommendation from a trusted adult. Students are then asked to complete an online Mission of choice where they able to select from four different Missions: 1) Commercial Aviation, General Aviation, and Military Flying 2) Climate, Weather, and Environmental Sciences 3) Drones, Physics, and Advanced Air Mobility or 4) Aerospace Engineering: Coding and Design.

Completing one of these Missions allows for the student to make a connection and expand on their learning before taking flight. Students are then paired with a local pilot mentor in their community to receive an individualized flight experience. Flights are available in all 50 states and take place year-round.

The student's flight takes place at a regional airport that is typically near the student's hometown. One benefit of taking an individualized flight is that the student is able to gain a true mentor in their own community through their interaction with a highly experienced pilot mentor. From start to finish, STEM Flights works to provide students with a comprehensive STEM experience that empowers them to continue their career exploration at an early age.

Although the flight itself points toward a pilot career, the STEM Flights experience is curated to motivate students to continue exploring a broad range of STEM career pathways. There is a growing demand for qualified job candidates in many areas of STEM; especially in the field of Aviation and Aerospace. Space travel and exploration will continue to be a priority, creating a need for professionals in the Aerospace industry.

Over the next decade, The Bureau of Labor and Statistics predicts that there will be a 4%-6% rise in employment for jobs in the Aerospace and Aviation industry. Directing our students' attention toward these statistics and leading them toward potential career opportunities is an important step in highlighting the options for their future.

One of the perks of working alongside students is having the opportunity to impact their lives in profound ways. There is great value when taking an interest in a student's future and supporting their ambitions. If schools, educators, and community partners continue to provide access to valuable STEM opportunities, it will continue to fuel the investigative curiosity needed to motivate the next generation of students to succeed in STEM professions.

Providing a flight experience is only one step in teaching students to soar. What other opportunities can we provide that allow students to feel inspired to make a difference in our world? The sky's the limit.

More About STEM Flights

STEM Flights, a 501c3 nonprofit organization, was founded by former F-16 Pilot Brig. General (ret) Dave Brubaker after he retired from military service. He noticed the demand for STEM jobs in the United States and how many companies overseas were winning American contracts. STEM Flights was his answer to a larger problem - inspiring kids in this country to pursue STEM careers - and he wanted to tackle that opportunity one flight at a time. All flight experiences are free for students and volunteer Pilot Mentors donate time and flight expenses to inspire the next generation.

Started in Virginia in 2018, Brubaker never realized how many kids and pilots would be interested in the program. Organic growth over the years has led STEM Flights to expand quickly over the years. The company will fly 500 missions this year with over 500 volunteer Pilot Mentors signed up to inspire kids. To learn more, volunteer, or refer a student, please visit

www.stemflights.org

or email **stemedu@stemflights.org**
with any questions.

The Neuroscience of Joyful Education

Dr. Judy Willis

"Brain research tells us that when the fun stops, learning often stops too."

Most children can't wait to start kindergarten and approach the beginning of school with awe and anticipation. Kindergartners and 1st graders often talk passionately about what they learn and do in school. Unfortunately, the current emphasis on standardized testing and rote learning encroaches upon many students' joy.

In their zeal to raise test scores, too many policymakers wrongly assume that students who are laughing, interacting in groups, or being creative with art, music, or dance are not doing real academic work. The result is that some teachers feel pressure to preside over more sedate classrooms with students on the same page in the same book, sitting in straight rows, facing straight ahead.

Supporting Good Teaching Practices with Neuroscience

The truth is that when we scrub joy and comfort from the classroom, we distance our students from effective information processing and long-term memory storage. Instead of taking pleasure from learning, students become bored, anxious, and anything but engaged. They ultimately learn to feel bad about school and lose the joy they once felt.

My own experience as a neurologist and classroom teacher has shown me the benefits of joy in the classroom. Neuroimaging studies and measurement of brain chemical transmitters reveal that students' comfort level can influence information transmission and storage in the brain (Thanos et al., 1999). When students are engaged and motivated and feel minimal stress, information flows freely through the affective filter in the amygdala and they achieve higher levels of cognition, make connections, and experience "aha" moments. Such learning comes not from quiet classrooms and directed lectures, but from classrooms with an atmosphere of exuberant discovery (Kohn, 2004).

The Brain-Based Research

Neuroimaging and neurochemical research support an education model in which stress and anxiety are not pervasive (Chugani, 1998; Pawlak, Magarinos, Melchor, McEwan, & Strickland, 2003). This research suggests that superior learning takes place when classroom experiences are enjoyable and relevant to students' lives, interests, and experiences.

Many education theorists (Dulay & Burt, 1977; Krashen, 1982) have proposed that students retain what they learn when the learning is associated with strong positive emotion.

Cognitive psychology studies provide clinical evidence that stress, boredom, confusion, low motivation, and anxiety can individually, and more profoundly in combination, interfere with learning (Christianson, 1992).

Neuroimaging and measurement of brain chemicals (neurotransmitters) show us what happens in the brain during stressful emotional states. By reading glucose or oxygen use and blood flow, positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) indicate activity in identifiable regions of the brain. These scans demonstrate that under stressful conditions information is blocked from entering the brain's

areas of higher cognitive memory consolidation and storage.

In other words, when stress activates the brain's affective filters, information flow to the higher cognitive networks is limited and the learning process grinds to a halt.

Neuroimaging and electroencephalography (EEG) brain mapping of subjects in the process of learning new information reveal that the most active areas of the brain when new sensory information is received are the somatosensory cortex areas. Input from each individual sense (hearing, touch, taste, vision, smell) is delivered to these areas and then matched with previously stored related memories.

"Under stressful conditions information is BLOCKED from entering the brain's areas of higher cognitive memory."

For example, the brain appears to link new words about cars with previously stored data in the category of transportation. Simultaneously, the limbic system, comprising parts of the temporal lobe, hippocampus, amygdala, and prefrontal cortex (front part of the frontal lobe), adds emotional significance to the information (sour flavor is tasty in lemon sherbet but unpleasant in spoiled juice). Such relational memories appear to enhance storage of the new information in long-term memory (Andreasen et al., 1999).

Mapping studies of the electrical activity (EEG or brain waves) and neuroimaging show the synchronization of brain activity as information passes from the somatosensory cortex areas to the limbic system (Andreasen et al., 1999). This enables us to evaluate which strategies either stimulate or impede communication among the various parts of the brain (Shadmehr & Holcomb, 1997).

RAD Lessons for the Classroom

A common theme in brain research is that superior cognitive input to the executive function networks is more likely when stress is low and learning experiences are relevant to students. Lessons that are stimulating and challenging are more likely to pass through the reticular activating system (a filter in the lower brain that focuses attention on novel changes perceived in the environment).

Classroom experiences that are free of intimidation may help information pass through the amygdala's affective filter. In addition, when classroom activities are pleasurable, the brain releases dopamine, a neurotransmitter that stimulates the memory centers and promotes the release of acetylcholinem, which increases focused attention.

- *Novelty promotes information transmission through the Reticular activating system.*
- *Stress-free classrooms propel data through the Amygdala's affective filter.*
- *Pleasurable associations linked with learning are more likely to release more Dopamine.*

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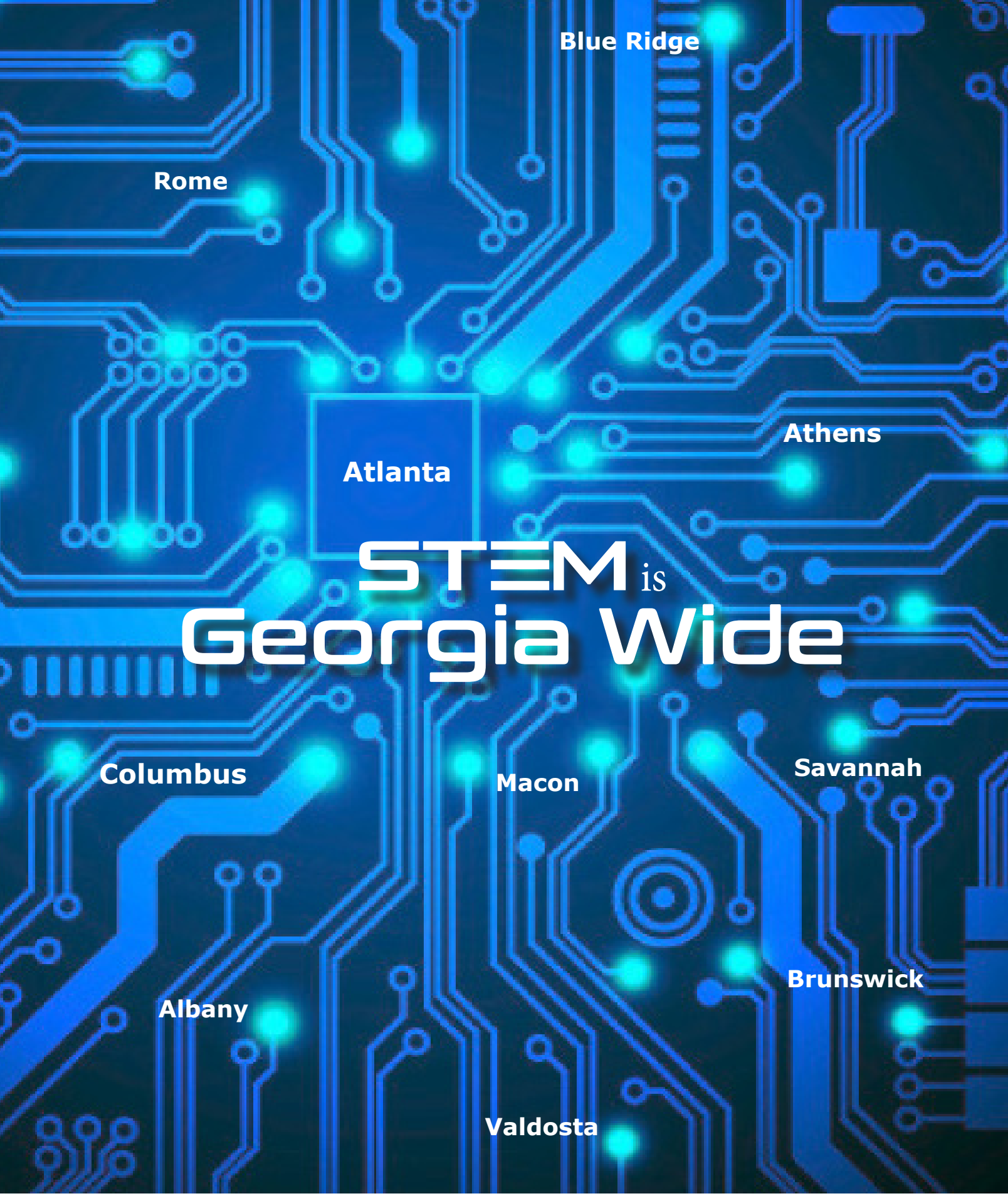

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