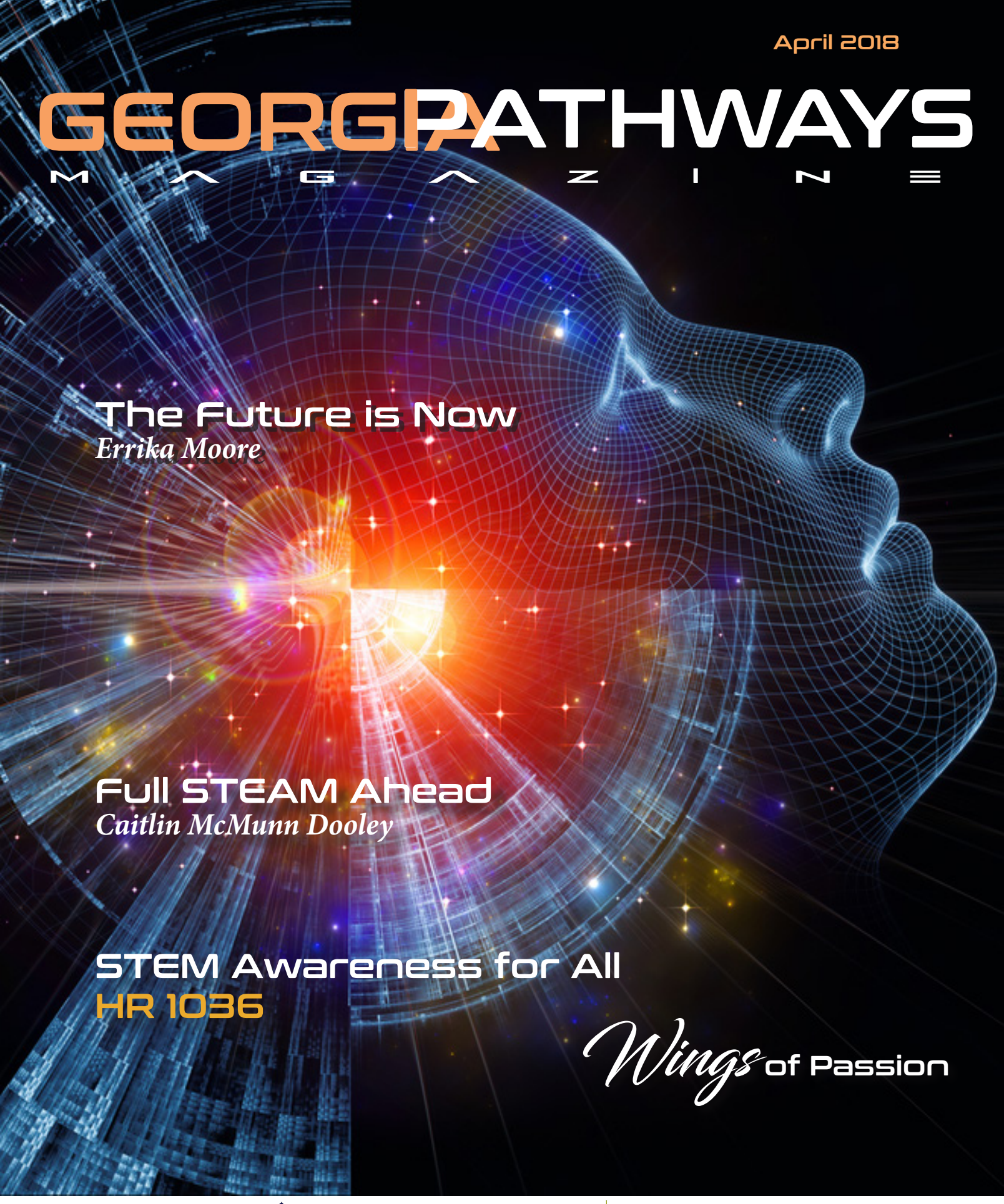
April 2018

GEORGIA PATHWAYS
MAGAZINE



The Future is Now
Errika Moore

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STEM Awareness for All
HR 1036

Wings of Passion

TAG Technology Association of Georgia

TAG | TAG-Ed Education Collaborative

Georgia Institute of Technology
Office of the President

Dear Friends:

We at the Georgia Institute of Technology welcome *Georgia Pathways STEM Magazine* as an important new voice in support of improving Science, Technology, Engineering, and Mathematics education at all levels in our state. We share that mission.

Georgia Tech plants the seeds for future STEM success by cultivating science and technology education through our CEISMC (Center for Education Integrating Science, Mathematics, and Computing) programs that involve more than 19,000 Georgia K-12 students and 1,700 teachers each year. CEISMC's approximately 55 programs include transformative student enrichment, teacher professional development, school-university partnerships, innovative curricula, and evaluations that cultivate and inspire student engagement. Georgia Tech Professional Education's High School Math Program offers advanced mathematics students in Georgia high schools the opportunity to take online courses including calculus, linear algebra, applied combinatorics, and other advanced STEM courses via live video or internet feed.

Another way we reach beyond our campus is through the K-12 InVenture Challenge, which this year engaged more than 3,700 students. Our state finals were held in conjunction with our undergraduate InVenture Prize competition. This year we had 90 teams from more than 60 elementary, middle, and high schools throughout the state. Some will go on to represent Georgia in the National Invention Convention and Entrepreneurship Expo at the Henry Ford Museum in Dearborn, Michigan. And chances are some will catch a spark that inspires them to come to Georgia Tech. It's happened before!

Through our strategic plan, "Designing the Future," and our forward-looking plan for the development of the future of STEM education, we are helping prepare and encourage the many talented students with whom we interact. We join with *Georgia Pathways STEM Magazine*, a new venture by the Technology Association of Georgia (TAG) and the TAG Education Collaborative (TAG-Ed), in support of a culture that will empower the entrepreneurs, inventors, and STEM workforce of the future.

Regards,

G. P. "Bud" Peterson
President

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TAG
Technology Association of Georgia

As this issue reaches you, we are gearing up for one of the most important days of the year – Georgia STEM Day!

Since 2013, when Georgia STEM Day first began, we have been asking – how are you celebrating? This year, on May 4, the entire state will be joining the celebration as schools, educators, students, organizations and companies host a wide and engaging variety of STEM activities and engagements.

Every year this amazing effort has grown as our leaders, educators, teachers and students find new ways to adopt, create and enjoy STEM education opportunities. In fact, since its inception, the number of STEM Day participants has grown to 275,000. More than one million students have been engaged, and the number of STEM Day partners has grown to 35.

These numbers are a testament to the critical importance Georgia places on STEM education. We are fortunate that our leaders, educators and businesses understand the value in making STEM education opportunities easily and widely available to all students. Our state understands that by making this collective effort, we are truly building the workforce and workplace of the future.

Pathways to STEM careers ultimately are vital to our economy and by celebrating Georgia STEM Day together, we ensure that those pathway opportunities are clearly marked and ripe for success.

It's easy to join in the fun! Teachers can incorporate STEM activities in their classrooms, students can become involved in STEM learning inside and outside of the classroom, and colleges and universities can partner with the TAG Education Collaborative (TAG-Ed) on activities, speakers and volunteer opportunities. Visit https://www.tagedonline.org/programs/georgia-stem-day/ for more information and to register.

You can also read, enjoy and share this latest edition of Pathways magazine. Inside this issue you will find inspiration for the activities and opportunities being created around STEM education every day across this state.

I hope you will find your way to celebrate with us!

Larry K. Williams
President
TAG-Ed

Larry K. Williams serves as the President and CEO of the Technology Association of Georgia (TAG) and President of the TAG Education Collaborative (TAG-Ed). 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.

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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From the Executive Director

TAG | TAG-Ed Education Collaborative

It's truly an EXCITING time in our state. Atlanta continues to rise up the list of technology hubs in the country, just in March our legislators passed a resolution that will help to ensure equitable access to information regarding STEM initiatives and it's never a more exciting time than Spring which represents a time of renewal and refreshing.

Here at TAG-Ed we're excited to see a renewed energy around annual efforts like Georgia STEM Day because it means we're finding new and innovative ways to deliver a VERY important message. It means we're all working to create new ways to INSPIRE Science, Technology, Engineering and Math in our students. I say that because we've been using the term "STEM" since the 1990s. In fact, a 2016 article by the Marick Group stated that "In the 1990s, many education councils, such as the National Science Education Standards and the National Council of Teachers of Mathematics, helped guide U.S. educators' classrooms with standards and guidelines that shaped their curriculum to better prepare K-12 students in STEM. And the 1990s was also one of the first times an acronym was used to define the topic of STEM. The National Science Foundation originally called it SMET but later changed it to STEM in 2001."

It was coined by Dr. Judith Ramaley when she was assistant director of the education and human resources directorate at the National Science Foundation (NSF) from 2001 to 2004. And according to her 2009 quote in the Pittsburgh Post-Gazette, she did so because "…science and math support the other two disciplines and because STEM sounds nicer than SMET. The older term subtly implied that science and math came first or were better. The newer term suggested a meaningful connection among them." And I couldn't agree more about the synergy amongst them all.

So as we work collectively to retain and build interest amongst our Georgia students… lets also remember to share with them that STEM is more "far-reaching" than they think. There's a natural tendency to actually limit what STEM represents. But because it's STEM…organizations like NSF also include agricultural sciences, biology, physical sciences, psychology, economics and other natural and social/behavioral sciences to name a few. In other words…the boundaries are LIMITLESS! And many career pathways are actually rooted in STEM.

So every time we take the opportunity to encourage ALL students to have a new or a renewed interest in STEM it's an exciting day for TAG Education Collaborative. Enjoy some of the images from Georgia STEM Day 2018 at #GASTEMDay

Sincerely,

Erika Moore

Executive Director
TAG Education Collaborative

"THE FUTURE IS NOW-

by *Errika* Moore

---- *What a Difference an Internship Makes"*

Recently, U.S. News Education shared that "…businesses are increasingly realizing that they too can benefit from building relationships with high school students who are motivated enough to seek them out." And in fact, "High School students are progressively finding that the real-world experience of an internship can offer a significant boost to their college and career success."

Internships.com states that "High School internships are the best way to bridge the gap between going to school and landing a great job. Internships can help provide valuable work experience by learning the ropes from more experienced professionals."

Former TAG-Ed Intern Andrew Oliveira couldn't agree more. As a recent graduate of Georgia Tech (CS '17 with a specialty in Artificial Intelligence and Information Networks), Andrew knows firsthand how his internship influenced his career pathway. His internships with TAG-Ed and SunTrust Bank allowed him to develop his affinity for computer science.

He was already an active participant in FIRST Robotics, when the TAG-Ed Director encouraged to apply for the program. As a result of his TAG-Ed internship he became a skillful graphic designer. And subsequently a web designer resulting from his internship with SunTrust Bank. In fact, having to build a website gave him exposure to a new interest area and encouraged him to pursue programming classes.

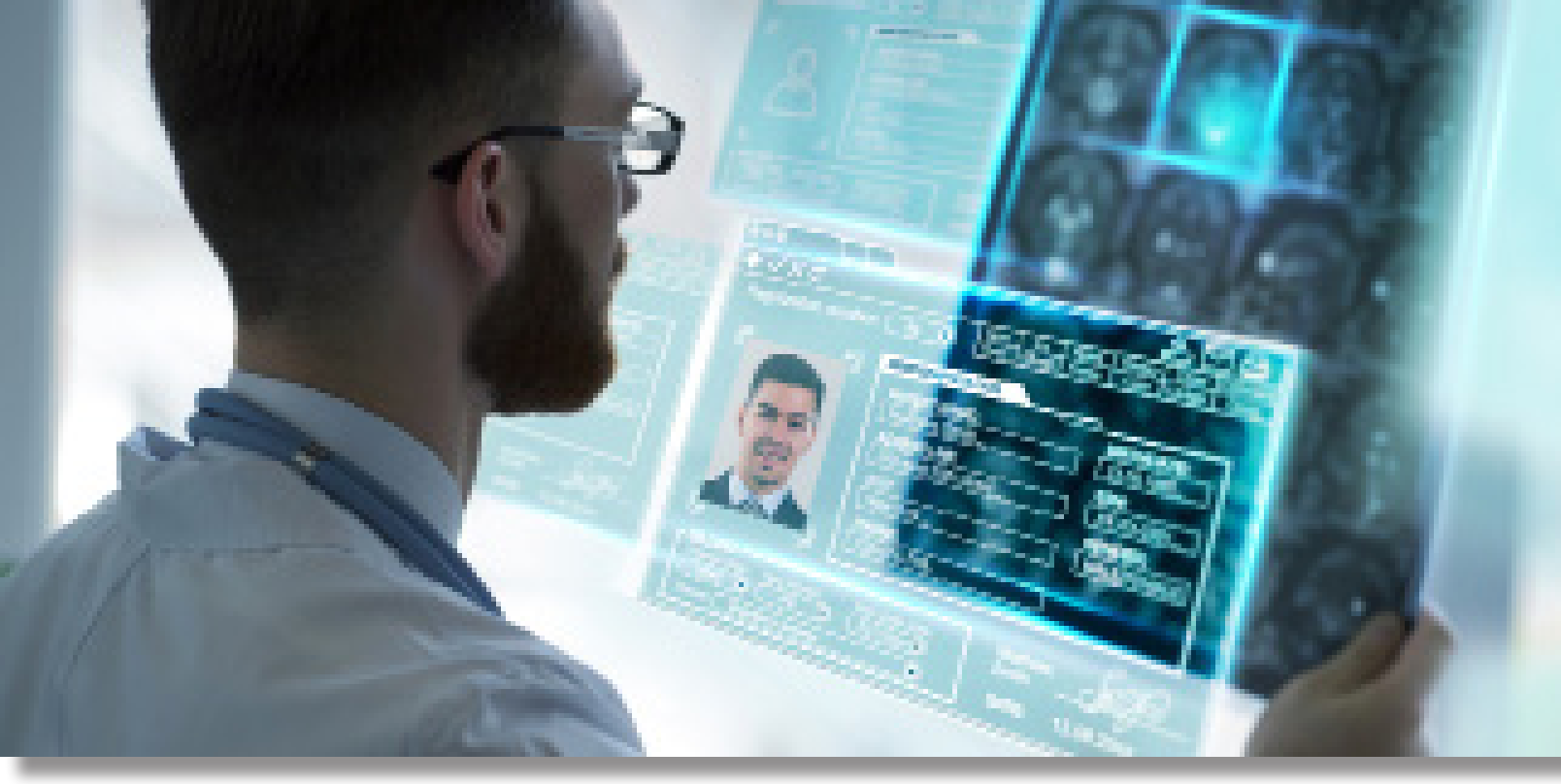
In 2012 his college pathway began at Georgia State pursuing a career as a graphic designer. But through continued internships at places like State Farm and coding competitions when he transitioned to Georgia Tech he realized that he was developing a much deeper connection to computer science and computational skills. This also produced two additional side-effects that weren't expected: 1) an increased self-worth and 2) confidence in his abilities. Andrew began to realize that he through his work and his contribution, he too could add value to an organization. And he wants current high school students to know that their

"voice as a high school student has value." So, "find that voice and explore and share their ideas." For him, this epiphany inspired him to continually hone his skills and his "craft" to increasingly add more significance over time.

As Andrew's story becomes less of an anomaly, companies are recognizing the importance of these eager students in their workforce ecosystem. A recent article in the Detroit Press shared a quote from Christian Cousin, a mechanical engineering student from Cape Coral, Fla., co-invented such groundbreaking technology during his 12 week internship at Eaton Valvetrain in Marshal that the company was inspired to file multiple patents and created a product prototype now used by a customer. Cousins stated "Interns have this need to make a difference. We don't just want to sit around designing stationary objects in a warehouse. A company has to be aggressive."

Phoebe Wall Howard the author of the article, shared that potential employers are seeing greater hunger today among students. And quoted Larry Bennett, director, vehicle technologies and innovation at Eaton, as stating "They're willing to take career risks, rather than go into large well-established companies that provide the security of a long career of 30 years." Because the fact is, billionaire tech leaders Elon Musk of Tesla and Mark Zuckerberg of Facebook are the role models. Cousins, Bennett and Hall are all VERY perceptive of today's reality.

And here's the other "internal" aspect to all of this, students like Andrew know and believe that they wouldn't have either the powerful skill sets or their current role without the benefit of internship experiences. Andrew made a point to share that he "owes TAG-Ed a lot!"



At the end of the day you don't know what you don't know. And for Andrew, exposure meant exposure to technology, exposure to the business community (which in turn meant exposure to an enhanced business acumen) and exposure to something more than just the conversations with his high school classmates. Relatable and relevant experiences literally changed Andrew's trajectory and established his pathway to STEM leadership.

Assistant Principal, Chaney Mosley at Nashville Big Picture High recently blogged on Education Week that "since more than 40 percent of college students in public four-year institutions change their major at least once, high school students need authentic exposure to careers that will allow them to make better informed decisions when identifying a major. Securing an internship while in high school allows students to discover their interests and experience the world of work before it costs them time and money in college." And as companies are increasingly competing for STEM talent, (and this need for talent continues to outpace the production of that talent) more companies are expanding and diversifying how they recruit and secure talent from the pipeline via high school internships.

In essence, they're guiding, shaping and impacting the FUTURE…....

.....***TODAY!***

FULL STEAM AHEAD:

The Benefits of Deep Learning

By Caitlin McMunn Dooley, Ph.D.,
Deputy Superintendent of Teaching and Learning, Georgia Department of Education

Walk into a STEAM (Science, Technology, Engineering, Arts, and Mathematics) School certified by the Georgia Department of Education (GaDOE), and you might see hydroponic tanks that can cleanse water with plants and minerals. You might see students designing a new invention to automatically feed fish over weekends and breaks by using simple machines hooked up to small computers. You might hear voices from community partners who have been welcomed into the school to work with students to solve real-world problems. You might feel the energy of creative thinking and effortful learning.

These voices and student problem-based activities are the result of many years of technical assistance, leadership training, and collaborative efforts. Local CTAE (Career, Technical and Agriculture Education) Directors, building-level Principals, STEM- or STEAM-lead teachers, and GaDOE staff work in conjunction with industry and community partners. These collaborations are essential to creating STEAM/STEM curriculum. Academic and CTAE teachers collaborate to integrate course content, hands-on projects and student learning opportunities come alive. Students can see the strong relationships between what is being taught in classroom activities with real-world project simulations and events.

The Georgia Department of Education's STEAM and STEM school certification programs are in high gear, addressing community partnerships, industry connections, and deep learning throughout the state. To date, over 60 schools have earned STEM Certification and six have STEAM Certification. This is no easy feat! The schools go through a rigorous process of review, feedback, and improvement. You can see the list of certified schools here: http://stemgeorgia.org/

They also learn more about how to relate to others, communicate and express their ideas, and critically evaluate and revise their thinking. We call this "deep learning."

How can deep learning improve educational outcomes?

Deep learning goes beyond memorizing facts or regurgitating procedures, and we know that memorization is likely to fade quickly.

Why are STEAM and STEM so important for today's schools?

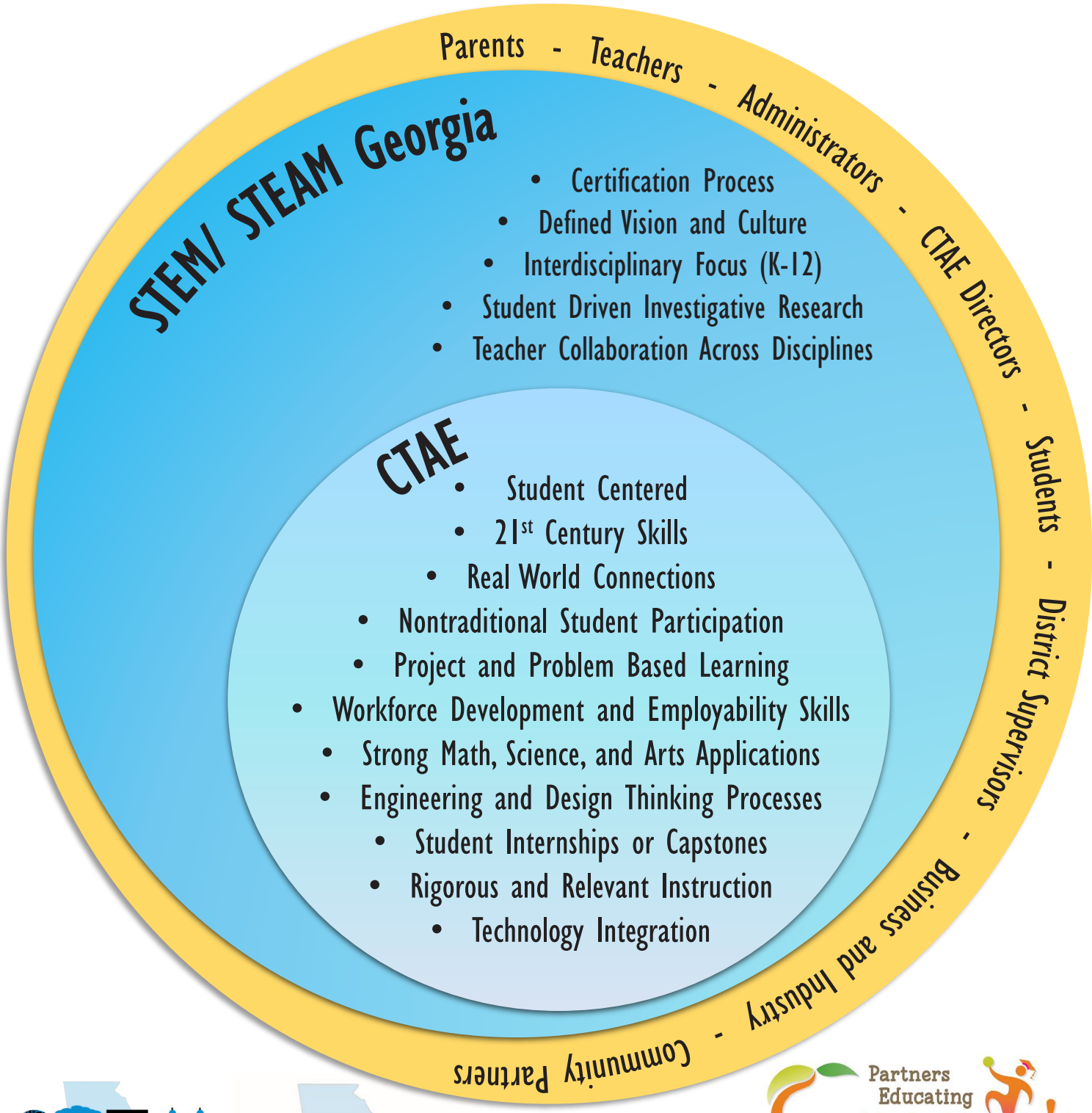
Today's schools must prepare students for work and life in society that is digitally savvy, globally competitive, and connected internationally and locally. School leaders and teachers have new challenges. They are preparing students to be digital producers in this new society. In certified schools, students learn to think creatively, utilize entrepreneurial skills, design solutions, and be savvy citizens in an increasingly digital world.

STEAM and STEM provide students with an opportunity to take what they learn in each content area and apply their learning to projects, problems, and new creations. By integrating their content knowledge, they learn how to transfer academic knowledge to the real world.

Students remember and understand deep learning experiences. They can recall the projects that pulled together their academic knowledge. They can explain how they solved complex problems and how they shared their thinking with others. The transfer of academic learning to projects enables learners to develop strong interpersonal skills, communication skills, and an ability to reflect on their own learning so they can make adjustments.

Deep learning can happen in STEAM/STEM schools through the recursive design process as students conduct projects. For example, in a STEAM school, a small group of sixth graders can work together to collect and analyze data about their local river and design a way to communicate to their

Georgia STEM/ STEAM and CTAE



STEM GEORGIA

STEAM GEORGIA

Partners Educating Georgia's Future Workforce

Georgia Department of Education

CAREER TECHNICAL AND AGRICULTURE EDUCATION

community ways in which their local river water affects local agriculture. Their "call to action" can involve artistic design features that invite community members to engage and help spread the word.

How can deep learning in STEAM/ STEM Schools better prepare students for jobs?

We use many words to describe the student outcomes sought by business and industry: soft skills, competencies, work-ready skills. Researchers may even use the term non-cognitive skills. All of these terms have in common the explicit desire to ensure that graduates have the ability to communicate clearly, politely, and effectively. Graduates should be ready to apply knowledge to solve new problems and think through a process. They should be ready to transfer their knowledge from the classroom to the workplace. They should be able to show up, get the work done, listen, and support their peers. Deep learning is the process that students need to go through in order to gain these graduation outcomes.

The Georgia Department of Education's STEAM/STEM Schools have earned the right to say that they have the conditions in place for ensuring deep learning. In addition to over 60 certified schools, Georgia has more than 900 schools working toward this high level of success. GaDOE provides guidance and feedback to schools while also coordinating feedback from other school leaders, industry partners, and community partners. This service provided by the Department helps to move our schools into a new era in which schools, communities, and industry work together to ensure that every child has an opportunity to participate in Georgia's economy and assume civic responsibility.

Learn more:
Learn more about The Georgia Department of Education's STEAM/STEM Schools: http://stemgeorgia.org

Learn more about deep learning to prepare students for life and work from the National Academies: https://www.nap.edu/catalog/13398/education-for-life-and-work-developing-transferable-knowledge-and-skills

Practice guide: http://sites.nationalacademies.org/dbasse/BOTA/Education_for_Life_and_Work/index.htm

Learn more about Georgia's STEAM Asset Map, Developed by the Georgia Partnership for Excellence in Education: http://www.gasteammap.org/

For more information about the Georgia Department of Education's STEAM/STEM School Certification program, please contact Felicia Cullars at fcullars@doe.k12.ga.us or Meghan McFerrin at mmcferrin@doe.k12.ga.us.

STEM Awareness for All HR 1036

Errika **Moore**

On March 29, 2018 at 11:47 PM Georgia General Assembly unanimously adopted House Resolution 1036 which was sponsored by State Representative Dar'Shun Kendrick (D-Lithonia). This resolution urges the state of Georgia to fund a computer science education public awareness campaign and other purposes. She championed this effort because she believes "Georgia is a national leader in the tech industry. And to maintain our competitive advantage, we must ensure all Georgia students have the exposure and opportunity to take part in the ever growing technology industry. With greater public awareness of computer science education through a comprehensive statewide campaign, the opportunities for Georgia students will be limitless."

This comprehensive statewide campaign would include a summit, counselor and administrator awareness and enhancing awareness for curriculum options for students (and their families) in an effort to encourage students to enter computer science careers. The passing of this legislation has sparked interest, energy and hope around the state. Just recently CEISMC's (Center for Education Integrating Science, Math and Computing) Educational Outreach Manager, Alba Gutierrez, included the outcome of this effort in the release of her project of social welfare policy.

The impact of this pivotal commitment drew her attention particularly given the potential trajectory and impact to both current and future students within the state of Georgia. In it she draws information from the Department of Education, Code.org, CEISMC and other notable sources that reflect "why" an effort like this is so critical. And she identifies the statistics provided below to create the backdrop for the need:

According to the Georgia Department from Education. The Georgia Computer Science Statistics are:

- 20,104 open computing jobs v/s 1,496 Computer Science graduates.
- 71% of all new jobs in STEM are in computing.

- Computer Science majors earn 40% more than average college graduates.
- Average salary for computing occupation in Georgia: $85,678.00.
- 16% of schools teach Advanced Placement Computer Science.
- 1,658 students took the Advanced Placement Computer Science test in 2015; 19% were female.

But no one understands the relevancy of this opportunity for the state of Georgia better than Georgia native, entrepreneur and business leader Rodney Sampson, Executive Chairman & CEO of Opportunity Hub who shared that "The passing of HR 1036 is a pivotal and historic step forward for the state of Georgia, particularly as we continue to attract large scale technology companies to the region and launch high growth startups that create net new jobs from the ground up.

By urging the state to fund an innovative, interactive and relevant integrated branding, advertising and marketing campaign for parents, schools, industry, influencers and communities to be aware of the careers and entrepreneurial opportunities of today and the future and the skills required to acquire them, we increase our funnel of interested stakeholders. Until this is done, companies will continue to hire talent

from abroad for jobs that could be filled by local citizens.

TAG Education Collaborative knows that this type of coordinated awareness can help change trajectories and paradigms for thousands of students in the state. And with change comes increased economic mobility and more consistent and sustainable employment for the 60 percent of our students who currently are not targeted for accelerated STEM career pathways.

As some of the data and graphic's in Gutierrez's report reflects, the current need or demand for technology talent in Georgia far outpaces the production of that talent. So organizations like TAG-Ed have already fully committed to leading the actual fulfillment of this statewide marketing initiative. To help make a difference in the lives of students and to help close the gap in Georgia's workforce needs."

Over time it will be a powerful testimony for the state of Georgia as the details of this commitment begins to unfold. Hopefully it will encourage and empower educators, counselors, parents and community leaders throughout the state to gain the access and information they need to support the students in their respective communities.

Georgia's future looks bright as we continue to take strides in the right direction.

Special Contributor Alba C. Gutierrez is the Educational Outreach Manager for School and Community Engagement team in the Center for Education Integrating Science, Math and Computing (CEISMC) at the Georgia Institute of Technology.

https://www.ceismc.gatech.edu

Georgia Institute of Technology - http://www.gatech.edu

Alba Gutierrez


Wings

# of Passion

by Wayne Carley and Azam Shaghaghi

Mélanie Astles is five times aerobatics French champion and finished several times in the top ten World and European championships. Now, as a pilot in the Red Bull Air Race (RBAR) Challenger Cup, she writes a page in history of aviation by being the first woman to ever compete in the RBAR.

Mélanie's story is one of passion, perseverance and overcoming the odds. Nobody believed that she could fulfill her childhood dream to become a pilot when she quit school at 18 to enter active life. When she took a job in a petrol station in Roquebrune Cap Martin, in the South of France, where she lived, the dream seemed far away.

But thanks to her relentless work, she became manager of several petrol stations. She was then able to save money to pay for flying lessons, which she started at age 21. In her very first year in aerobatics competition, she snatched victory at the French Cup in the "Espoir" category.

With a steady and constant progression, she worked her way up the categories, winning national championships and her place in the prestigious Aerobatics French Team. In 2014, she was seventh overall at the Aerobatics World Championships, "Advanced "level and first at the female ranking. In 2015, she ranked world fifth best female pilot in the highest category "Unlimited", and was a member of the French team which won the world title.

The following is candid interview with Mélanie about her flying career and STEM applications.

- How old were you when you started flying?

My love for planes dates from my very early childhood as far as I can remember. As young as 7 or 8, I wanted to become a fighter plane pilot. However, it is only after I quit school on impulse at 18 to start earning money, that I finally had the opportunity to take my first flying lesson only at 21.

- How important is understanding aerodynamics as a racing pilot?

On the circuit, we are subjected to aerodynamic forces. Our task is to understand them in order to counteract them. For example if I take a turn, I put my ailerons to the left, therefore creating a differential drag, this will have to be counteracted.

Another example: the stall, when we pass a certain angle of attack, there will be no more wing lift. To go fast, we need to stay close to this limit, showing how important it is to understand it.

- Were there any special education requirements to enter this career?

My own path is not the typical one. I lacked the maths and science background demanded of pilots.

So I studied privately to obtain the academic diploma necessary to reach the level. At the same time, I was working in gas stations, and saved money from my salary to pay for enough lessons to obtain my Private Pilot License, with the minimum number of hours. I studied to enter the prestigious ENAC School (Ecole Nationale de l'Aviation Civile), where I finally obtained my Professional License.

Parallel to studying I developed my passion for aerobatics, and I very quickly won titles, national, European and world. I reached the Unlimited

level in Aerobatics (the highest) in 2015, which opened the door to applying to compete in the RBAR.

- Air racing has been male dominated. Do you have any comments on gender acceptance and competition?

Even today, it is still not easy for women to succeed in air racing. You need a strong and determined personality to fit in. Aviation in France is a strongly male dominated activity and only 7% of women hold a pilot's license. It would be wrong not to say that discrimination is latent in male dominated sports, like in any type of activity or trade. Things can sometimes be difficult, but women have to keep a positive attitude at all times, and just concentrate on their objective. If we complain, it will be shrugged off as being a "woman thing".

Of course, as women, our sports career is sometimes shorter if we decide to start a family; pregnancy and having children is quite often the reason why some of us quit the sport. So female pilots probably will face sexism, but you just have to believe in yourself and focus on your project. At the Red Bull Air Race, I am treated not as a woman pilot but just as a pilot. Everybody is equal in the cockpit in competition.

- Tell us about the physical effects and demands of your sport.

Physically, of course, we need to be able to pull up to 10 G's, and you can only achieve that by serious constant physical training. Unlike fighter plane pilots, we do not wear G-suits, the difference being that they have to bear g-forces over a long period of time. In aerobatics we also have to sustain high g's, but on short successive laps of time. So of course, physical breath control exercises are essential. We also do a straining maneuver, when you tense everything up, hold your breath in short bursts and pull against it.

You make your head feel a little buzzy, and it forces the blood back into your brain, and clears your vision.

To build up my physical endurance, I train six days a week; I run for an hour and bike for two hours, twice a week.

Then I punch and run intervals for an hour or two, once a week. I do body-building two or three times a week. At RBAR, my main challenge has been to learn to fly at low attitude, and master the speed. In aerobatics, we are judged on the quality of the figures, at RBAR, we fly low against the clock.

- Since engineering is really about decision making and problem solving, how frequently before and during an event do you find yourself using the engineering method of decision making?

Before each flight or event, it is important to raise the problems, the possible errors, what we call the threats. The mnemonic way for me is P.A.I.M.E.

P. for Pilot, - am I in good shape, did I have a good sleep etc.-->. find a solution, e.g. be even more attentive.

A. for Avion (Plane) – in good order, checked

I. for Infrastructure – e.g. last weekend Porto track- in case of threat what decision to avoid crowd = land on water.

M. for Meteo – e.g. threat = clouds above the bridge to enter the track at Porto last week - decision = annul flight or plunge deeper through the clouds.

E. for Environment. E.g. Porto = water ; Spielberg = mountains – decision taken according to the elements around.

We need to scan all the possible threats in all aspects. And for each threat, find a solution to counteract it upstream, not waiting for the threat to become reality.

I guess this is the similarity with engineering, before building a bridge, a railway… an engineer must be going through a similar process of thinking.

- Science by definition is the systematic accumulation of knowledge. Tell us about the knowledge you've had to gain to be an air racer.

When I entered the RBAR in 2016, I had experience in aerobatics competitions, where we are judged on the quality of the figures performed. But I lacked the racing knowledge, I had everything to learn. Luckily at RBAR, we are surrounded by very competent pilots; in particular Paul Bonhomme (three times RBAR world champion, captain of 747 on British Airways).

He has shared with us his knowledge as an engineer, airline pilot, air race pilot, his maturity, and made us aware of the importance of security. He taught me step building, step by step first, and now putting all this together I am able to produce nice results.

- What do you enjoy most about flying and racing?

I love the feeling of escape. It's like there are two different worlds; one on the ground and one in the sky. Having the power to live in both gives you freedom. When in the sky, negative thoughts and problems disappear and I become completely focused on flying. I also love the action part of it: I'm very much into speed, precision and adrenaline rush, be it in training or competition. At RBAR my main challenge has been to learn to fly at low altitude and I love it. And of course, I love the positive reaction of the public, it really lifts me.

- Do you have any comments for young women that may be interested in a flying career?

I get a lot of feedback from young girls writing to me or meeting me at the races. I am happy if I motivate them by my experience. I will just say to them, if you have determination, "Go for it", if it is your dream, and never ever give up.

Failure can and probably will happen, but success will follow if you believe in your project strongly enough. Be proud to be a woman, and stay feminine.

You don't envisage a flying career, but rather you have a need to live a passion. And you owe it to yourself to do everything possible to fulfill that passion. And then, as someone said once, "If you do what you love, you'll never work a day in your life".

- Is there anything else you would like to add for our readers in 67 countries?

My unusual career path has not been easy. But it has helped in building my determination and my strong mental state, while conveying a feminine image. My passion for sport is strong and I always want to go further. I aim at improving all the time as a Challenger pilot to reach one day the Master Class. I invite you to look at my Internet site melanieastles.com , where you will learn more about my life, my sport, my association, and sponsorship opportunities, an innovating communication solution, to take part in this special adventure.


BMW
AIRMEL

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 stands for.

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)

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 skills and STEM careers.

STEM & SEL: *Inseparable Partners*

by **Betsy Hill**
President of BrainWare Learning Company

A recent article in The Washington Post reported on two internal studies at Google. The studies involved masses of human resource data and extensive analysis to identify the skills and characteristics most important for success at Google. In one study, Project Oxygen, STEM skills were eighth on the list, behind seven other skills, which the article calls "soft skills." These "soft skills" included "possessing insights into others" and "having empathy," skills commonly considered the province of Social and Emotional Learning (SEL).

The important "soft skills" at Google also included critical thinking and problem-solving. These findings were surprising to the author because of the common belief that only technical STEM skills matter in getting a job with and succeeding at a technology company, while Google was finding that soft skills were actually more important.

Likewise, in a second study, Project Aristotle, Google found that the most successful teams exhibited well-developed "soft skills," many of which reflect the kind of social and emotional competence that is the goal of SEL, such as empathy, equality and emotional intelligence.

It may seem ironic that it was the application of "STEM Skills" (lots of data analysis) that led to these findings underscoring the importance of soft skills. However, Google's findings simply reinforce what the champions of "21st Century Skills" have been saying for years, based on reports from the Conference Board, the National Association of Colleges and Employers, and many others. Employers need employees with problem-solving and critical thinking skills, with creativity and flexibility (adaptability), and who can communicate. And social and emotional competence are essential in the workplace.

Nonetheless, the article prompted some heated debate. How can you say STEM skills aren't important for employees in highly technical jobs? After all, an employee needs computer programming skills do to computer programming. Is empathy really more important than calculation or coding skills?

Some people also objected to the author's implication that education in the humanities does a better job of developing these soft or social competence skills than STEM training. There were proponents on both sides of the question of whether humanities or math and science do a better job of readying students for STEM careers, at least insofar as "soft skills" are concerned.

The obvious answer to the debate would be to compromise and say that both STEM and soft skills are important. But that would require us to overlook the fundamental problem of trying to parse skills into two mutually exclusive categories. The problem, we believe, is fundamentally intractable because all of our skills and behaviors are embodied in our brains and each of us, STEM student or poet (or STEM student and poet – I know many who are both), has one brain that we use for everything we do. Maybe a better answer lies in finding the commonality among these skills.

Maybe, there are similar things going on in our brains. So let us dig a bit at the roots of this dilemma and see what we find to support the idea of shared cognitive processes between STEM and soft skills.

STEM Skills?

STEM stands of course for Science, Technology, Engineering and Math. Science is not a single skill; nor are any of the others. We have to look more deeply to discern skills and when we do, it is difficult to find agreement.

In Forbes Magazine, Anna Powers identifies three "skills" for success in STEM in 2018: Social Media, Data Analysis and Artificial Intelligence. Competencies in these areas may be in demand currently, but only Data Analysis corresponds to skills that typically appear on lists of STEM skills. If Social Media and Artificial Intelligence were actually skills in the same way as Data Analysis, we should be able to imagine how we would start to develop those skills in kindergarten (not instruct, but help students develop the skills). We do start teaching students about data at very early ages (how many boys are in the class and how many girls?). And Data Analysis or Analytical Skills certainly appear on many lists of STEM Skills, as do statistics and math calculations, inherent parts of analyzing data. Another set of skills that is frequently associated with STEM fields is Visual-Spatial Skills.

There is evidence that visual-spatial skills are correlated with success in engineering and other fields in science and technology. In fact, while I haven't been able to find a citation to support it, I have been told that underdeveloped visual-spatial skills are responsible for many students dropping out of engineering programs in their first year.

However, as useful as visual-spatial skills are in "technical occupations," such skills would also seem to be important in "nontechnical occupations," like Artist or Interior Design. The distinction between technical (architecture) and non-technical (art) occupations becomes problematic when one considers the similarities between an architect's process of scaling from a drawing/rendering and a sculptor scaling from a small model to a large statue.

Looking further for guidance as to what we should consider to be STEM skills, we encounter lists that include problem-solving, critical thinking, flexibility, creativity, intellectual curiosity and communication. But aren't these the same skills that Google studies characterized as "soft skills?" Yes, and that once again reinforces the difficulty of separating these skills into discrete buckets. Could it be that these skills that are both "STEM Skills" and "soft skills?"

Soft Skills?

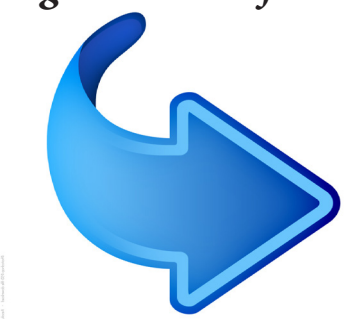
For the last few decades, the term "21st Century Skills" has been used to refer to what are otherwise called soft skills and typically refer to problem-solving, critical thinking, creativity, communication and collaboration. As we noted above, these skills are also considered essential STEM Skills.

Soft skills are also frequently characterized as emotional intelligence, typically encompassing skills such as initiative and self-direction, self-management and self-control, relationship management, leadership, the ability to coach, empathize and understand different points of view. Here again, the Google research, as well as ample data from other research from organizations such as NACE, makes it clear that success at Google, and, indeed, most other employers these days, requires good "soft skills."

The need for good "soft skills" is one of the driving factors behind the fact that Social and Emotional Learning (SEL) is an active topic of discussion in schools these days. The interest in SEL is likely being driven by a variety of factors, including federal policy (the Every Student Succeeds Act) which adds social, emotional and behavioral factors to academic measures. Another factor is the growing evidence of the positive impact on student learning of anti-bullying, trauma-informed care, and other similar initiatives.

The types of skills included in SEL programs vary widely and there is no common understanding or consensus on which skills should be the focus of school-based or out-of-school programs. As a recent Wallace Foundation report says, "Researchers, educators and policy-makers alike are beset by dilemmas about what exactly is included in this broad domain."

To address the dilemma, the Wallace report introduces a useful framework for categorizing social and emotional skills, organizing them which can be useful in understanding the relationship between STEM and soft skills. ***The five categories in the framework are:***



1. Cognitive Regulation. In essence, these are the skills now commonly referred to as executive functions. They include attention control, inhibitory control, working memory and cognitive flexibility.

2. Emotional Processes. These skills involve self-awareness of emotions, emotional regulation, and empathy.

3. Social/Interpersonal Skills. These include understanding social cues, conflict resolution, and pro-social skills.

4. Character. Character is generally seen as a complex and multi-faceted concept and can range from respect to justice, and from dealing with personal challenges to tolerance.

5. Mindset. The concept of mindset deals with an individual's beliefs about their own ability to develop intelligence and talents.

It is this first category of skills, Cognitive Regulation, where the common threads emerge. There is now broad consensus regarding three core executive functions: working memory, inhibitory control and cognitive flexibility.

These skills are critical processes in the brain that are applied to a variety of situations to yield emotional intelligence. But they are also critical to academic performance, to problem-solving, critical thinking, and even creativity.

From the point of view of SEL, emotional regulation involves inhibitory control. Conflict resolution is enabled by cognitive flexibility. Understanding others' points of view and holding them in one's mind as one compares and contrasts them requires working memory.

From the STEM perspective, these same skills are recruited in our brains when we solve problems, or think critically, or think creatively. In math, for example, working memory is what enables us to hold multiple aspects of a problem in mind and to track where we are in solving a multi-step process. Inhibitory control is what enables us not to leap to the first possible solution in an engineering challenge but to question our assumptions and consider alternatives.

There is now a strong body of evidence that executive functions are highly predictive of school success, including both academic and social-emotional facets, and for reading and math and other STEM subjects.

So, if we now return to the question of whether these skills are both STEM skills and soft skills, the similarity is compelling, especially considering their common cognitive grounding in executive functions. The skills are the same, from the brain's point of view, whether they are applied to STEM or something else.

We should acknowledge that the degree to which emotion is involved and the presence or absence of social relationships will certainly alter important aspects of the task of applying executive functions – neuroscientists speak of hot cognition (executive functions in an emotional state) and cold cognition (executive functions operating in a non-emotional, "rational" state). At the same time, the areas of the brain activated to perform core executive functions are the same.

It can be tempting to separate "rational" STEM skills from "emotional" self-management and interpersonal skills. But even then, the distinction starts to crumble. Whatever we believe about the relative importance of technical and non-technical or soft skills, we must recognize that STEM disciplines are inherently social in nature.

Science advances by testing hypotheses and communicating the results so that others can build on our findings. Few scientific papers today have a single author. Most research requires the efforts of a team. Technology is driven by human needs and wants. Engineering involves solving a problem with the end-user in mind. And math. Well, if math is a language, then communication about STEM matters makes fluency in the language of math indispensable, and communication happens between people.

All of this discussion leads to consideration of the possibility that strengthening executive functions can enhance both STEM capacities and social and emotional competence. Rather than saying that success in STEM fields require two independent types of skills, perhaps there is value at looking at the common cognitive process involved and helping students develop those.

Developing STEM and SEL

As an April 4 blog from Mindprint Learning points out, executive functions, whatever the context (computer coding or interpersonal relationships), "really are not skills that can be explicitly

taught like a lesson in physics or statistics." They are skills that can be trained through awareness, nurturing over time and/or through cognitive training, and preferably a combination of all of those.

STEM and SEL are not in competition. They are not even separate but equal. They don't sit side by side. They are built on a common set of cognitive processes. And those processes can be and must developed and nurtured in students for them to be successful in the STEM careers that await them. As Earl Hunt and Tara Madhyastha wrote in an article in the Journal of Neuroscience, "The modern workplace runs very largely on the cognitive abilities of its workforce." That is true, whether we consider them STEM skills, Social and Emotional Learning.

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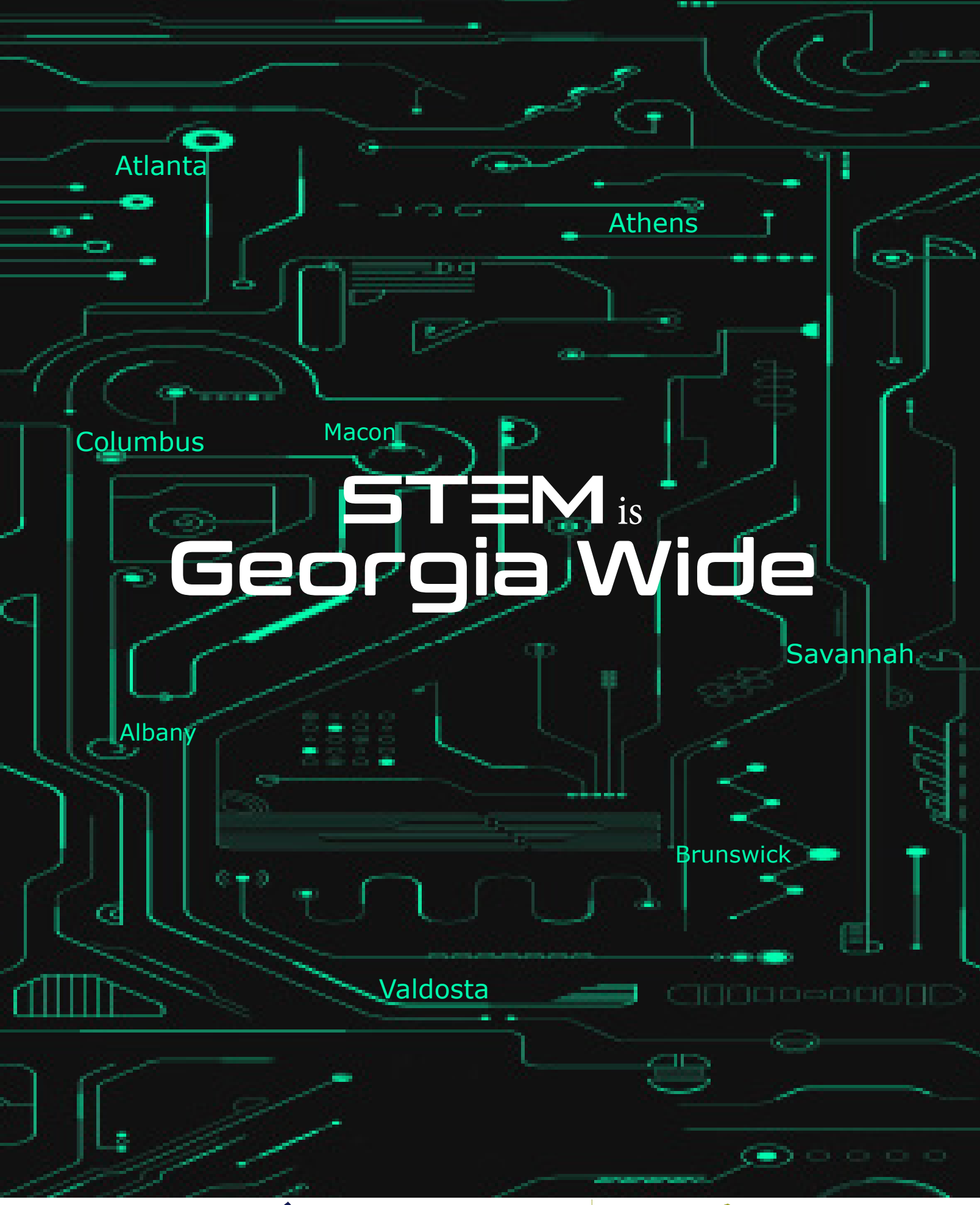

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