

February 2018

GEORGIA PATHWAYS

M A G Z I N E

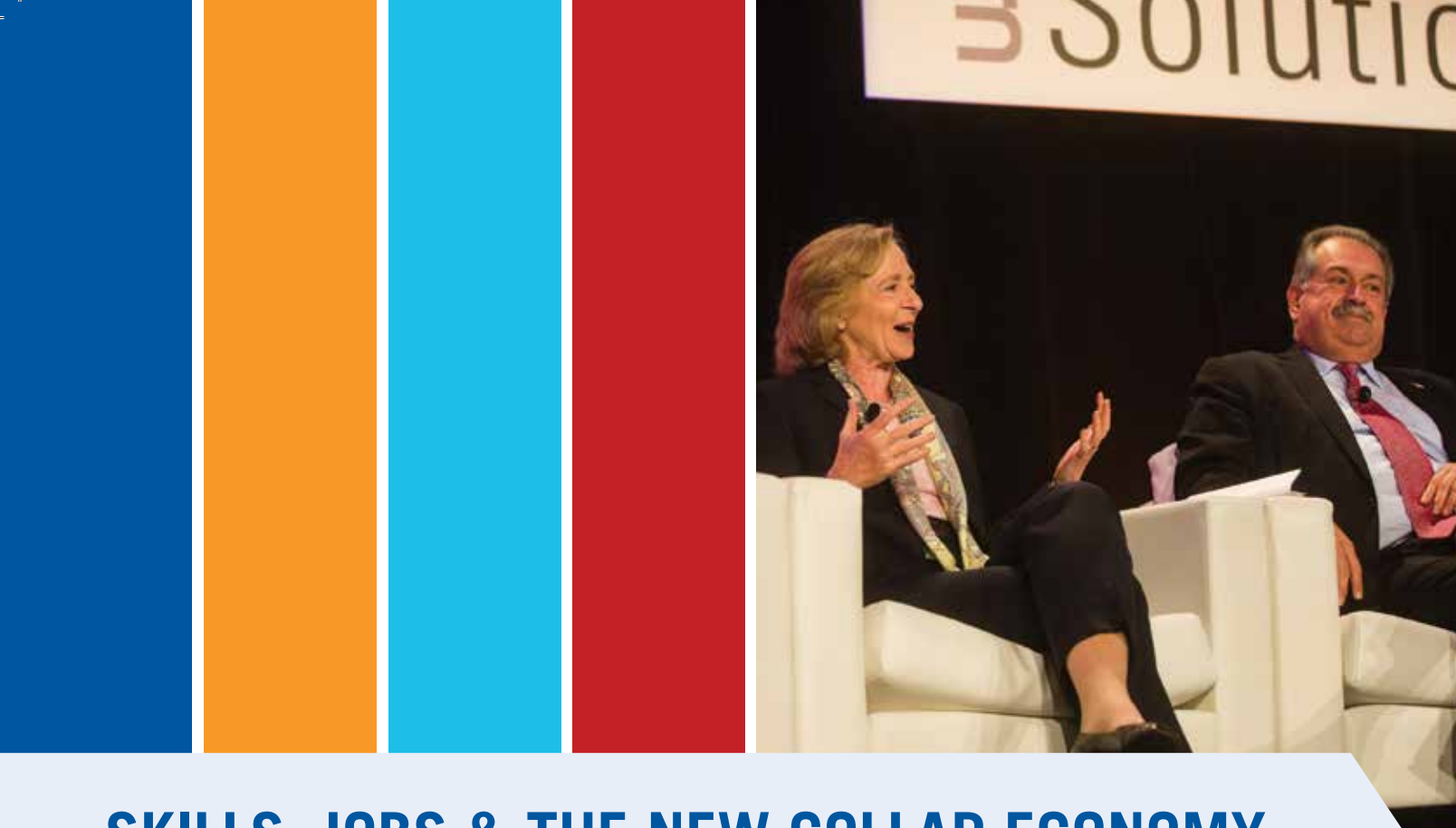
“Watson” in Georgia
from the IBM Foundation

FIRST Robotics
Competition

MOMENTUM

concept
Memory

Georgia STEAM Asset Map



SKILLS, JOBS & THE NEW COLLAR ECONOMY

USNews A WORLD REPORT STEM SOLUTIONS PRESENTS
WORKFORCE
OF TOMORROW

APRIL 4-6, 2018
WASHINGTON, D.C.
WALTER E. WASHINGTON CONVENTION CENTER

U.S. News & World Report STEM Solutions Presents:

Workforce of Tomorrow is the preeminent conference for leaders across multiple industries, from corporate CEOs to university presidents, and influential board chairs to top policymakers. Committed to examining the complexities of developing a workforce skilled in science, technology, engineering and math, these leaders bring their key insights, innovative strategies and industry best practices to develop solutions for advancing this effort. An executive-level event with significant impact, **Workforce of Tomorrow** aims to ensure a strong future for STEM education and employment.

Visit **USNewsSTEMSolutions.com** to register, learn more or sign up for the monthly newsletter. You can **Save \$100** when you register with the code **TAGECVIP**.



This month our nation gives a nod to both budding and leading engineers as we celebrate National Engineers Week.

Engineering is, of course, one of the key elements of STEM education, and it is exciting to see the boost in attention around an educational field and an industry that holds so much promise for the advancement of our businesses, our communities and our students.

Georgia Pathways STEM Magazine also seeks to bring attention to the ways in which we can foster, celebrate and innovate engineering fields and education programs -- and the opportunities that exist for meaningful careers and advancements in this important sector.

Be sure to check out the features from our thought leaders, as well as the stories of students who are finding their way from classroom to career through STEM pathways.

The hope is that by sharing meaningful, interesting and useful content, we help create and fuel an ecosystem that is increasingly accessible to learners



and educators across a spectrum of backgrounds, geography and interests.

By reading and engaging with us through this medium, you become a part of that mission. I hope that you will share this, our second edition, with your networks so that we can continue to raise awareness and encourage students and teachers who are building the momentum around STEM education.

Thanks for your support!

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.

PRESIDENT/CEO
Larry K. Williams

PUBLISHER
Wayne Carley

EXECUTIVE DIRECTOR/EDITOR
Errika Moore

CONTRIBUTORS
Mary Kay Boler, TAG-Ed Staff
Stefanie Slay, TAG-Ed Staff
Dr. Reginald Turner, TAG-Ed Staff

The Technology Association of Georgia (TAG) and
TAG Education Collaborative
75 5th Street, Suite 625 Atlanta, GA 30308

<http://www.tagedonline.org>

This magazine services the STEM education industry needs of the state of Georgia. This magazine is viewed by the consumer with the understanding that the information presented is from various sources from which there can be no warranty or responsibility by the Technology Association of Georgia, the Technology Association of Georgia Education Collaborative and/or their affiliates as to legality, completeness or accuracy.



FIRST Robotics

Mary Kay **Boler**

Momentum

Wayne **Carley**

Teacher Advisor

Tjuan **Dogan, Ph.D.**

Workforce Innovation and Opportunity

Errika **Moore**

Georgia STEAM Asset MAP

Caitlin **Daugherty Kokenes**

Concept Memory

Dr. Judy **Willis**



From the Executive Director



Webster defines an Engineer as someone a person who has scientific training and who designs and builds complicated products,

machines, systems, or structures: a person who specializes in a branch of engineering. Dictionary.com describes an engineer as a person trained and skilled in the design, construction, and use of engines or machines, or in any of various branches of engineering. How would you describe an engineer?

I'm asking because February is the host month for National Engineers Week. It was founded by the National Society of Professional Engineer (NSPE) in 1951 and they've stated that "is dedicated to ensuring a diverse and well-educated future engineering workforce by increasing understanding of and interest in engineering and technology careers. Today, EWeek is a formal coalition of more than 70 engineering, education, and cultural societies, and more than 50 corporations and government agencies. Dedicated to raising public awareness of engineers' positive contributions to quality of life, EWeek promotes recognition among parents, teachers, and students of the importance of a technical education and a high level of math, science, and technology literacy, and motivates youth, to pursue engineering careers in order to provide a diverse and vigorous engineering workforce."

And as we continue to focus on empowering the Georgia community with new and

innovative ways to create "pathways" for growth, development and leadership in students and the future workforce of Georgia and the world, we too want to "raise public awareness and create positive contributions to everyone's quality of life."

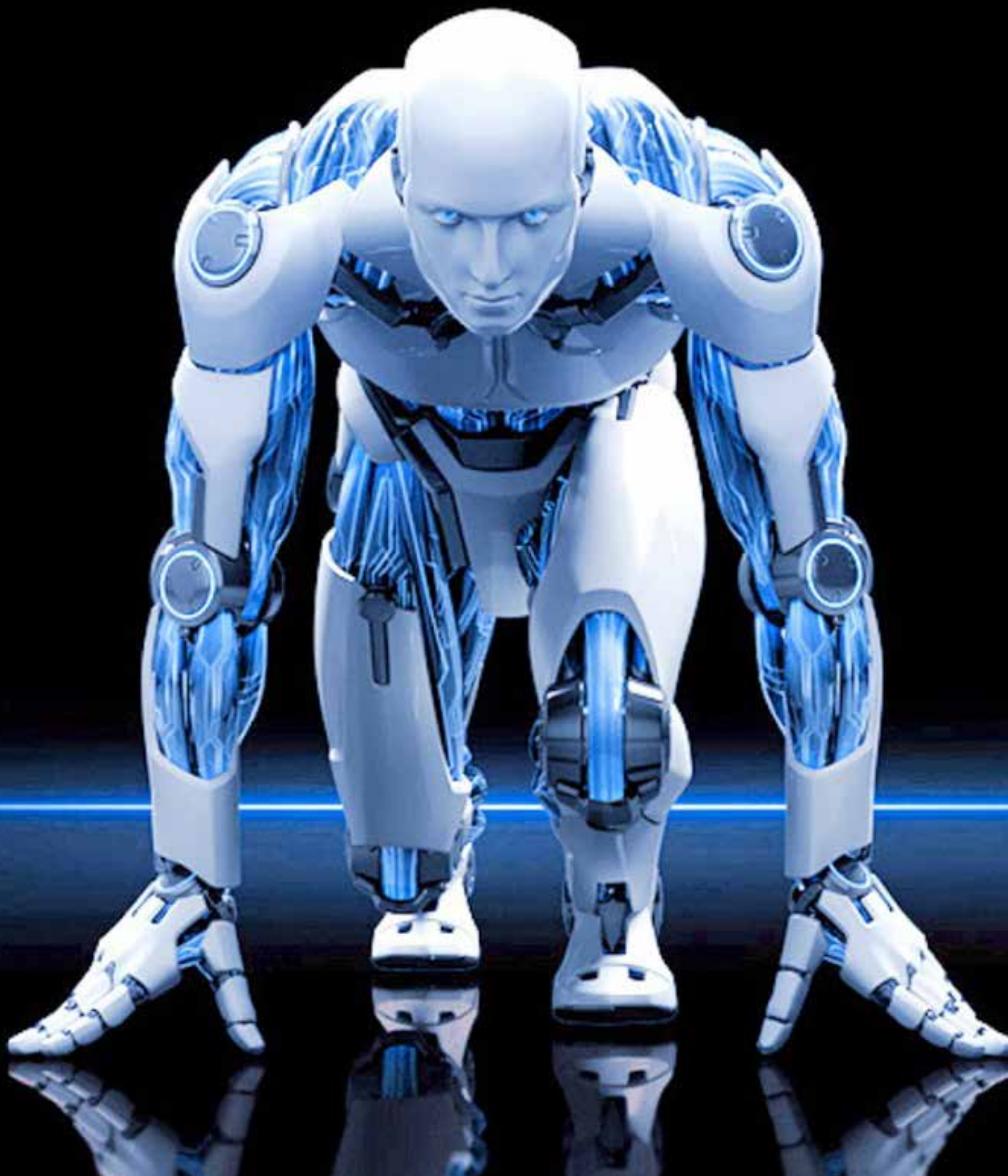
This journey and evolution of what we know...and what we share...is one where we're excited to partner with you and create a collective impact to the state of Georgia. In this issue you'll read tremendous articles from corporate partners such as IBM, community partners such as the Georgia Partnership for Excellence in Education and Conyers Middle School all merging into one medium, Georgia Pathways, to entice, encourage and empower you as educators, community leaders and students with "what's new" in STEM. It's an amazing and innovative world that we live in. And I appreciate everyone willing to share their world with us. In the words of a famous engineer and astronaut, Mae C. Jemison, "I want to make sure the future that we're creating is one that is for people around the world, and also one that includes the full range of our talents and our skills for solving the world's problems."

Please enjoy the February issue of Georgia Pathways STEM Magazine.

A handwritten signature in black ink that reads "Erika Moore".

Executive Director
TAG Education Collaborative

FIRS



FIRST Robotics Competition



by Mary Kay Boler

The **FIRST** Robotics Competition (FRC) is an international non-profit K-12 organization founded to inspire young people's interest and participation in science and technology. Frequently described as an event that is part science fair, part sporting event, and part rock concert, FRC is referred to as a "Sport for the Mind."

Each year, teams of high school students design and build robots weighing up to 120 pounds that then compete in a preselected game requiring the robots to complete tasks, such as slinging discs into goals. Over 515,000 students participate in FRC internationally, including 75 teams from across Georgia.

FRC is more than just a single competition. The game details are revealed at the beginning of January each year, and the teams are given only six weeks to construct a competitive robot that can operate autonomously, as well as when guided by wireless controls to accomplish the game's tasks.

Each team is given a standard set of parts, but they are also allowed a budget, and encouraged to buy or make specialized parts as long as they conform to the FIRST rules. Students and mentors work together to design and manufacture most parts for their robot. The process helps students not only become skilled craftspeople, but introduces them to college-level engineering concepts and practices.

“By competing in FIRST robotics, student develop technical and problem solving skills through a meaningful, competitive challenge. From basics like using hand tools and precision cutting to advanced skills like 3D modeling and CNC machining, students can grow from novice to student-experts in the course of four years on an FRC team,” said Andrew Nichols, Head Coach of #1648 G3 Robotics, out of Grady High School in Atlanta.

Each year, games are inspired by themes like steampunk or medieval times that not only provide unique engineering challenges, but also inspire students to get creative with costumes and team decorations. This year’s game, POWER UP, finds teams trapped in an 8-bit, 1980’s era video game. Each three-team alliance has numerous ways to help defeat the boss, including loading ‘power blocks’ (canvas covered milk crates) on to a giant scale to out-

weigh /out power their rival alliance, and programming their robots to climb up an oversized tower. The alliance with the highest score at the end of the match, which includes autonomous and teleoperated periods, wins the game.

So many ways to win results in some radically different robots. A team can choose to create a multi-functional robot that has the potential to excel at all aspects of the game or one that specializes in a particular function that may give them a competitive edge as an alliance member. The scope of possibilities and the short time frame are designed to push students’ intellectual, technical and teamwork skills to new heights, or as Nichols simply states, students get hands-on practice “learning to collaborate to find solutions to difficult problems with unclear solutions.”

Outside of the competitions, FRC teams also function as small organizations, and are required to manage their own fundraising, business planning, marketing and educational outreach programs. Non-engineering mentors are business professionals who help guide students in this aspect of the competition, which often engages students who would otherwise have limited interest in robotics. In fact, of the all awards given at the FIRST FRC events, many are not focused on the



East Cobb Robotics FRC Team 4910 were the captains of the winning alliance at the Peachtree District Columbus Qualifier- 2017

competition, but rather on the team's community impact, and overall quality of business operations.

"While the call for an increasingly STEM educated workforce is clear, especially here in Georgia, there is parallel need for non-technical workers who deftly understand the unique demands of tech companies and can integrate seamlessly into cross-functional teams," said Karen Judd, GeorgiaFIRST's public relations advisor. "FRC does just that.

As high-school students, future communications, business, and financial experts, are innately learning how work side-by-side with their technical counterparts to execute defined goals. It's an innovative design program that graduates students of all disciplines that are ready to better serve tech companies."

With only a single paid employee, GeorgiaFIRST Robotics, the state-wide arm of FIRST, is a true volunteer lead organization. From event volunteers to team mentors, over 4,000 volunteers donate 1,000,000+ hours to FIRST programming in Georgia each year. "Volunteers are the very heart of our organization. Event after event, our dedicated teams, at state and local levels, provide a top-notch STEM-focused experience for every student no matter which of our many events they attend," said GeorgiaFIRST Executive Director Connie Haynes.



The need for volunteers is always strong, especially at FRC events. In the six-week period from March 2 to April 7 alone, the organization will host FRC events every weekend, including district qualifying events in Gainesville, Dalton, Albany, Columbus, and Duluth, as well as a the championship in Athens.

Haynes states that the organization has both technical and non-technical opportunities available at events across Georgia. Some roles are specific to FRC, such as game referees and robot inspectors, and the organization is happy to train volunteers who take an interest in these technical positions. Many other roles are more general and include A/V and electrical assistance, set-up/breakdown volunteers, administrative and logistics coordinators, photographers and many more.

All FIRST events are free and open to the public. Each event also features special tours for field trips, educators, and the community at large. “Whether you are interested in volunteering, starting a local robotics team, or just cheering on amazing robots and their teams, we encourage everyone to come spend a few hours at one of our

competitions, and see some of Georgia’s smartest students in action,” Haynes said.

Visit-

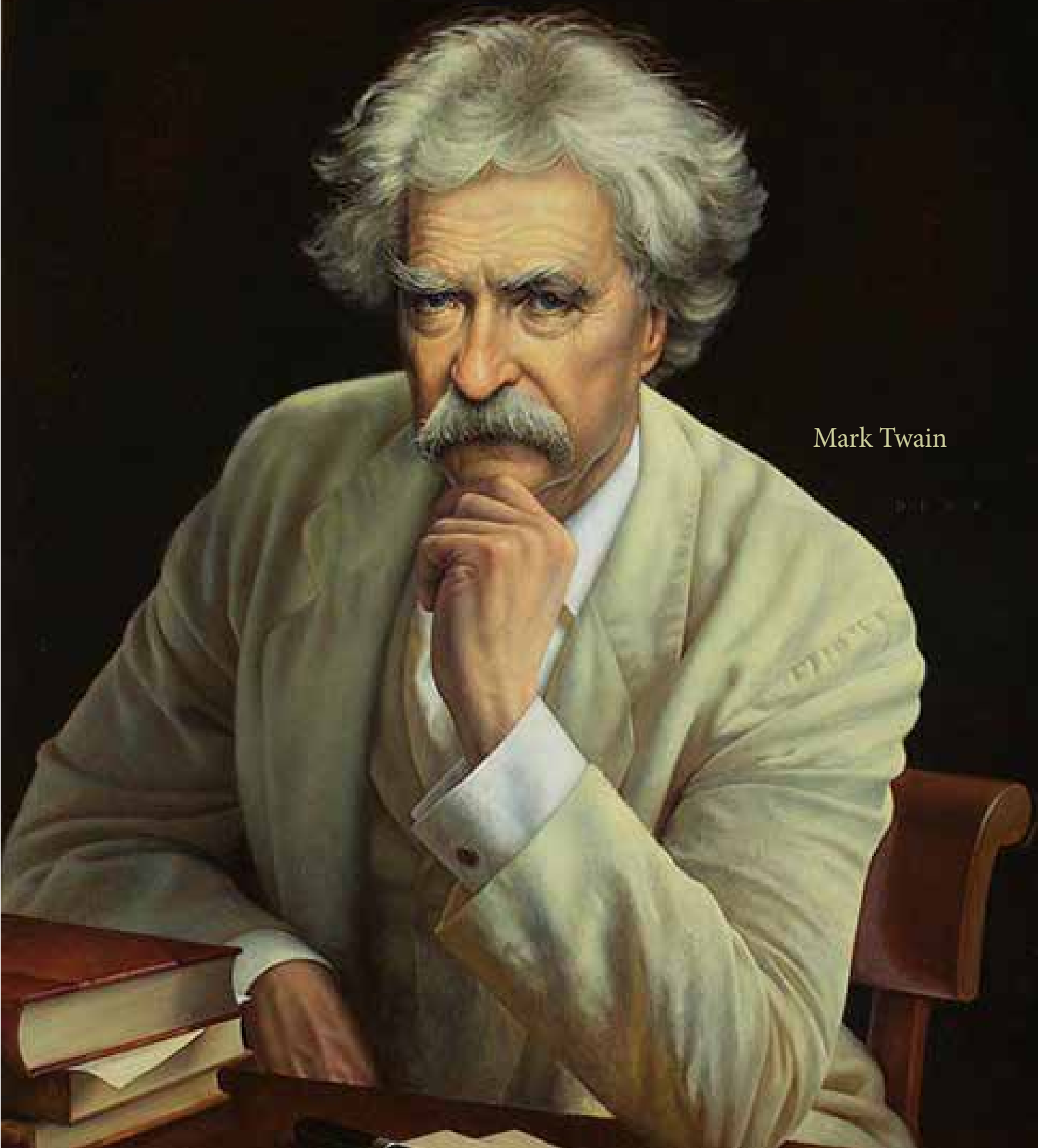
www.gafirst.org

- to learn more about GeorgiaFIRST and FRC events. For more information about volunteering, please contact volunteer coordinator Elizabeth Shannon at eshannon@gafirst.org.

Mary-Kay Boler is the Senior Director of Development for the TAG Education Collaborative. She also is a member of the Georgia FIRST Leadership Council and a mentor for FRC Team 6842, Polaris Robotics.



*“Two of the most important days of your life are the day you were born.....and the day you find out **why**.”*



Mark Twain

MOMENTUM

Dr. Reginald Windom

Psychological momentum is a powerful force in school, life, sports, and business. Recently many of us were glued to our screens watching psychological momentum play out on the courts of the NCAA Basketball Tournaments.

For reasons unknown, the selection process of the NCAA Tournament pits often unexpected competitors against one another, regardless of past performance, resulting in unknown teams sometimes upsetting larger, more talented rivals through sheer will to win.

As school continues to challenge your short and long term goals, attitude from day to day, self esteem, abilities, mood and behavior it's important to be reminded that all of these influences are actually controllable.

As we watched with bated breath the NCAA Tournament brackets, the display of psychological momentum and fortitude we witnessed during March Madness can be a powerful lesson for school, business and life.

momentum;

noun

mo·men·tum \mō-men-tm,

- the strength or force that allows something to continue or to grow stronger or faster as time passes/



1 Understand that it's all in your head.

Psychological momentum is defined as a state of mind in which an individual or team feels things are going unstopably their way. It's a concept well known in the world of sports.

According to the American Psychological Association's Review of General Psychology, 93% of basketball coaches believe their performance is "crucially determined by momentum." The impact is so strong, studies have shown that coaches frequently change their

overall behavior and adopt a more aggressive strategy after a single successful play early in the game.

When it comes to school, a similar psychology plays out. Observers are often amazed at a students ability to excel in a subject after a short series or even single successful grade result, boosting confidence, attitude and hope.

This momentum isn't necessarily due to specific successes, but rather how we perceive the actions we take afterward. It maybe a simple C+ rather than that regular D that builds a sense of momentum that keeps us moving forward.

2 Your emotions don't control your behavior; rather, your behavior controls your emotions.

It's a head game. This idea is ingrained in anyone who has played team sports. Why do sports teams often dress formally before a game? They do it because the sense of professionalism and discipline that goes along with dressing up actually influences behavior on court or playing field. This attitude is not only important and powerful, but should begin in grade school.

Do private schools wear uniforms just to remove individually in the classroom or does it go further, establishing a level of professional appearance that may influence scholastic performance. Is it a coincidence that graduation rates and testing results are repeatedly higher in private schools nationwide compared to public schools?

Once you adopt the "as-if" principle, your internal psychology shifts. Challenges and obstacles begin to be viewed as opportunities, rather than reasons for despair. We can celebrate successes, no matter how small, and eventually a feeling of positive momentum takes hold.

3 Build momentum in every class.

Naturally, coming to these realizations and, more importantly, putting them into action takes a lot of time and effort. What emerged from this introspective process are five key principles that can be applied to any subject.

-Act like you're already succeeding. Conduct yourself in a manner that exudes confidence. Come into class composed, well rested, and energized.

-Focus on the positive. Don't dwell on problems. Instead, look at them as opportunities for greatness. Be realistic, but try to frame things positively at all times.

-Celebrate victories. It doesn't matter how small they are. Make sure your teacher and parents know about wins and recognize their contributions every time.

-Show excitement. Show optimism in everything you do, regardless of the grade you get or class you're in.

-Don't give up. If you find yourself short on success and start to see pessimism on the rise, don't despair. It takes determination to build momentum. Just keep pushing and you'll get there.

Remember.....it's all in your head.



"Keep pressing..."

Teacher Advisor With **Watson**

from the IBM Foundation

A new, free philanthropic tool - by teachers, for teachers

By Tjuan Dogan, Ph.D.



As a Corporate Citizenship Manager at IBM who regularly engages with the education community here in Georgia, I often hear from teachers about the many responsibilities that compete for their time and attention over the course of a given week: figuring out how best to teach or reteach a particular concept; staying on top of relevant content knowledge for an upcoming instructional unit; grading student work; examining results from a recent mid-unit assessment; meeting with and calling parents...

As any teacher—new and veteran alike—will tell you, time is truly of the essence in their profession. And there simply isn't enough of it. The majority of elementary school teachers have the added challenge of developing expertise in multiple subject areas, which means more prep time required to plan lessons, and more challenges when trying to master the rigorous content demands of 21st century ELA and math standards.

As noted in a recent op-ed by AFT president Randi Weingarten and the IBM Foundation's president emeritus, Stan Litow, "Under pressure to improve student achievement, many elementary school teachers are suddenly asked to instruct unfamiliar grade levels or master specialized areas like math without adequate support. This lack of support affects our nation's youth directly."

The implications of all this are significant for the overall stability and success of the teaching profession. According to the National Center for Education Studies, between 20 and 30 percent of

new teachers will leave the profession altogether within 5 years. So the question is, what can we do to better support teachers as they seek to navigate the daily demands of the job, while also trying to improve their instructional practice? Specifically, how can companies like IBM leverage their people, technology, and partnerships to help out?

One answer is finding new ways to leverage innovative technology specifically built with the needs of teachers in mind. Through our philanthropic Teacher Advisor With Watson tool, we at the IBM Foundation are doing all we can to help teachers more efficiently plan and deliver quality instructional resources aligned to 21st century standards, thereby enabling them to better meet the needs of every student in the classroom.

We're proud to be able to offer it for free, now and always, and to continue to improve the advanced computing technology on behalf of our teacher users over the long-term.

A little background: A few years ago, the IBM Foundation convened a group of education leaders in New York City, to explore how IBM's artificial intelligence technology that can understand, reason, and learn in partnership with subject-matter experts could best be put to use in the education space. Ultimately this led to a decision to focus on supporting the over 1 million elementary math teachers in the U.S., who are typically pressed for time and in need of thoughtfully developed supporting tools to help them adapt to 21st century standards and meet the needs of all students.



Teacher Advisor With Watson

Discover free instructional resources with the power of IBM Watson™

Sign up at teacheradvisor.org



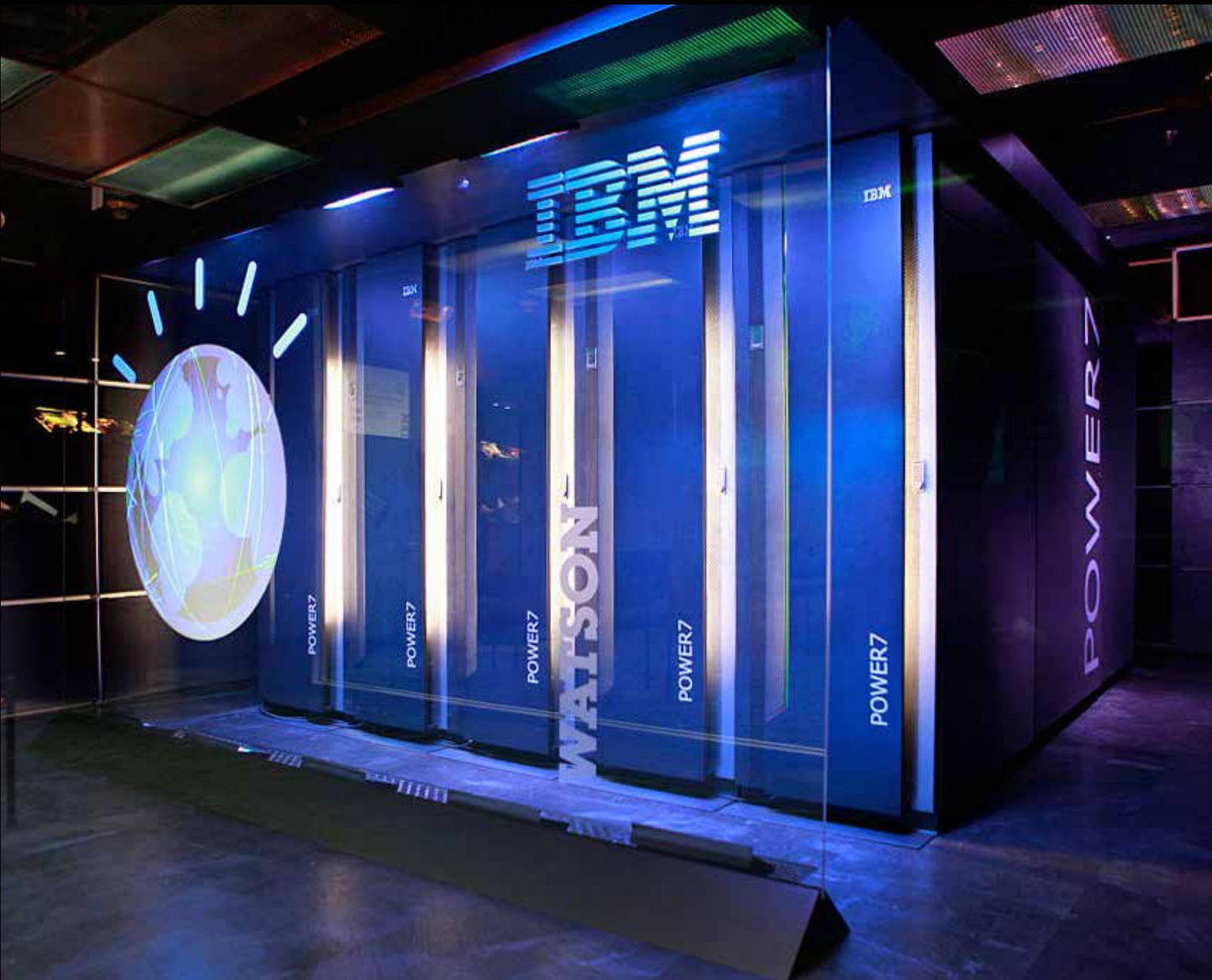
Intentionally choosing a partnerships-based model to ensure that the tool was conceived and built with the requisite domain expertise and understanding, the IBM Foundation teamed up with respected educational nonprofits such as UnboundEd, and engaged directly with teachers to get their feedback, advice, and suggestions during development.

What we ended up with—and continue to build upon—is a robust, vetted, and standards-aligned Open Educational Resources hub that offers dynamic resource recommendations to support both current planning needs, and practical professional development. Across K-5, Teacher Advisor offers more than 1,200 lesson plans, 4,000 student-facing activities, 300 tasks, and over 100 instructional strategy videos and pedagogy documents. Our content partners include EngageNY, AFT’s Share My Lesson, Student

Achievement Partners, Achieve, Illustrative Mathematics and three state departments of instruction or education.

Importantly, teachers are presented with a variety of recommended resources for any given search query. For example, a search for “addition and subtraction word problems” will return Watson recommendations across all four of our resource categories: Lessons, Activities, Strategies, and Standards info. The idea here is to both meet “real-time” teacher needs, and also present potentially useful supporting materials, from a variety of sources, all in one place.

In terms of how teachers are engaging with Teacher Advisor on the ground, we’ve heard that in addition to serving as a “one-stop shop” for free quality OER resources, the tool is particularly well-suited for enabling differentiation, re-teaching, and remediation; and for



helping teachers boost their content knowledge and instructional expertise. Teachers, instructional coaches, district leaders, and others have expressed their appreciation for what Teacher Advisor is helping to enable in the K-5 math instruction space.

What it comes down to is that solutions such as Teacher Advisor that use innovative technology in response to teacher needs—at absolutely no cost to districts or teachers—need to be adopted and scaled if we collectively want to reduce the burdens facing teachers across the U.S. I'm excited and proud to share Teacher Advisor with the education community here in Georgia. I look forward to engaging directly with many of you in 2018; and I encourage you to sign-up and use Teacher Advisor as you plan your projects for Georgia STEM Day on May 4, 2018.

Check out teacheradvisor.org for more information and to sign-up for a free account!

Dr. Tjuan Dogan manages Corporate Citizenship with the IBM Foundation and informs investments and partnerships for the company's strategic focus on education. She holds a Ph.D. in education and is passionate about increasing educational opportunities and building stable communities for all students.



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.

As an example, according to the Department of Labor, there is a huge shortage in the U.S. of -

Teachers

Did you know teaching was a STEM career?

With this in mind, briefly connect any career you choose to the definitions above.

That's how it's done.



Workforce Innovation and *Opportunity*

by Errika Moore

The Workforce Innovation and Opportunity Act defines a Career Pathway as a combination of rigorous and high-quality education, training, and other services that:

- align with the skill needs of industries in the economy of the State or regional economy involved
- prepares an individual to be successful in any of a full range of secondary or postsecondary education options, including apprenticeships registered under the National Apprenticeship Act of August 16, 1937
- includes counseling to support an individual in achieving the individual's education and career goals
- includes, as appropriate, education offered concurrently with and in the same context as workforce preparation activities and training for a specific occupation or occupational cluster
- organizes education, training, and other services to meet the particular

needs of an individual in a manner that accelerates the educational and career advancement of the individual to the extent practicable

- enables an individual to attain a secondary school diploma or its recognized equivalent, and at least 1 recognized postsecondary credential and,
- helps an individual enter or advance within a specific occupation or occupational cluster.

A school in Georgia that embodies and fulfills the philosophy of creating career pathways is Conyers Middle School (CMS). The Center for Technology and Engineering (CTE) headquartered at CMS has developed a comprehensive and unique approach to educational pathways for students by offering advanced abilities and outcomes in science, technology, arts, engineering, and mathematics. The expanded learning options offered by CTE for students from 5th Grade through college degree programs includes as its lead specialty the Aerospace Engineering and Technology Specialty Choice Option (www.cmsaerospace.com).

The Center for Technology and Engineering grew from a Rockdale County Public Schools (RCPS) initiative in 2014 and a resulting strategy that created a rigorous system of teaching and learning that empowers students to define and achieve their educational success through an equitable and efficient system of specialty and choice programs that promote and enrich learning pathways and experiences in Technology and Engineering.

The program is a by-product of a conversation between Assistant Principal Anterro Graham and Lt. Colonel Stephen Williams. Mr. Graham is a former Air Force pilot, mechanical engineer and computer engineer with companies like IBM & GE and Lt. Colonel Williams is a retired Air Force Fighter Pilot, Instructor Pilot and retired Captain for Northwest Airlines.

So when the Rockdale County school was asked to collaborate with its community and come up with a specialty of study, the community responded by selecting Aerospace Education. Principal Allison Barbour interviewed several candidates and given the talent and vitality of Mr. Graham's credentials found him to be the perfect selection to help navigate the success of the program.



Through a concerted effort, it was decided to leverage the Civil Air Patrol STEM guidelines and materials as the course curriculum. Students are exposed to project-based learning that is both student centered and student directed covering a wide range of subjects. Students learn to use the Design Process to plan projects, determine materials requirements, participate and lead teams, collect and analyze data from experiments and to question whether they met their objectives.

In this environment, the process for teaching and learning offers opportunities to make sense of the world as the





students themselves take charge of their learning by solving problems while gaining skills in communication, collaboration, critical-thinking, and creativity. Students collaborate with Engineering students to design gliders and aircraft and then test their theories by building aircraft models to test their designs, among other program collaborations. Students are also exposed to Aerospace Engineering and Flight Simulation using two state of the art FAA approved Redbird TD2 Flight Simulators, a 24 Seat Flight Simulation Lab and a New 24 Seat Drone Simulation Lab.



But what's even more impressive are the "classroom to career" pathways created by CMS. Through collaborative partnerships with Middle Georgia State University (MGSU) and Delta Airlines, students are introduced into the CMS AE program and follow it through into careers. MGSU offers a program called 2 PLUS 2.

In this program students who apply can begin studies in their junior year in high school paid for by public education funds. They earn not only a high school diploma, but also a 2-year Associate Degree at the same time upon graduation! They can earn certifications in Aerospace Engineering, an FAA Pilot Certification, an FAA Aircraft Mechanic's Certification and an Air Traffic Control Certification or possibly a Bachelors' Degree in Aviation Science and Management.

Additional college degree career pathway options may be followed including Engineering/Robotics, Video Production, Video Gaming, and Software Development through CTE Partners in industry. As a way of supporting CMS' efforts, but also exposing students to the field of aerospace engineering or aviation, in 2016, the first six of their Aerospace Students attended a Delta Airlines sponsored all-expense paid week long summer Aviation Camp at the National Flight Academy in

Pensacola, Florida. For 2017, Delta also sponsored an all-expense paid week long summer Aviation Camp at the National Flight Academy for 20 CMS Aerospace Engineering Students. And for 2018, Delta will again sponsor an all-expense paid week long summer Aviation Camp at the National Flight Academy for 20 CMS Aerospace Engineering Students and possibly an additional 20 alternates as well.



CMS is proving that when you “begin with the end in mind” you help students navigate from “point A to point B.” You give students a glimpse into the future through exposure and access to both curriculum and the teachers. Principal Barbour ensures that all CTE teachers have an industry background and are “Subject Matter Experts” in their respective fields as well as being Highly Qualified and Certified Teachers. By doing so, the CTE can give the students the opportunity to see what’s possible.



The CMS footprint has already impacted 280 students and is setting the standard for delivering strong educational experiences that lead to viable careers.



Connecting Resources and Communities with the **Georgia STEAM Asset Map**

By Caitlin Daugherty Kokenes



The Georgia STEAM Asset Map -

www.gasteammap.org

- is an online map – created by the Georgia Partnership for Excellence in Education in partnership with Neighborhood Nexus – that documents investment into STEAM education in the state of Georgia. STEAM is an acronym for the subjects of science, technology, engineering, arts, and math, though we use the term with the intention of also including STEM-focused opportunities as well.

Beyond just representing certain subjects, STEAM education has taken on a greater meaning. It is an educational movement that focuses on project-based learning and integrating across disciplines so that the curriculum students interact with throughout the day focuses on real-world applications and the interconnected nature

of these subjects. The acronym STEM has been used for at least twenty years, but now education in these subjects is more important than ever. In the U.S., STEM jobs are expected to grow at a much faster pace than other careers in the next five years, and several reports have shown a talent gap in Georgia between the number of post-secondary degree graduates and the number of jobs in certain STEM fields that remain unfilled. Educating students in STEM fields is a major need to develop the highly talented work-

force that Georgia's growing economy demands.

Our goal for creating the Georgia STEAM Asset Map was to show where investments exist to support STEAM education in the state, in order to give a visual reference for potential investors from the business and philanthropic communities. After meeting with groups of advocates, teachers, and administrators in the state's STEAM community, however, the STEAM Asset Map quickly evolved into much more than just a tool for investors—now it is a website that can provide useful information for many different groups of people, including advocates and parents.

The map has visually documented all the Georgia Department of Education STEM and STEAM certified elementary, middle, and high schools—and these are the colored dots a user initially sees upon visiting the website. There is much more to explore. In fact, for all public schools in Georgia, the map features information about the population of the school including demographics and student achievement data related to STEM and STEAM subjects. Users can also view characteristics of the neighborhood investments are in as well.

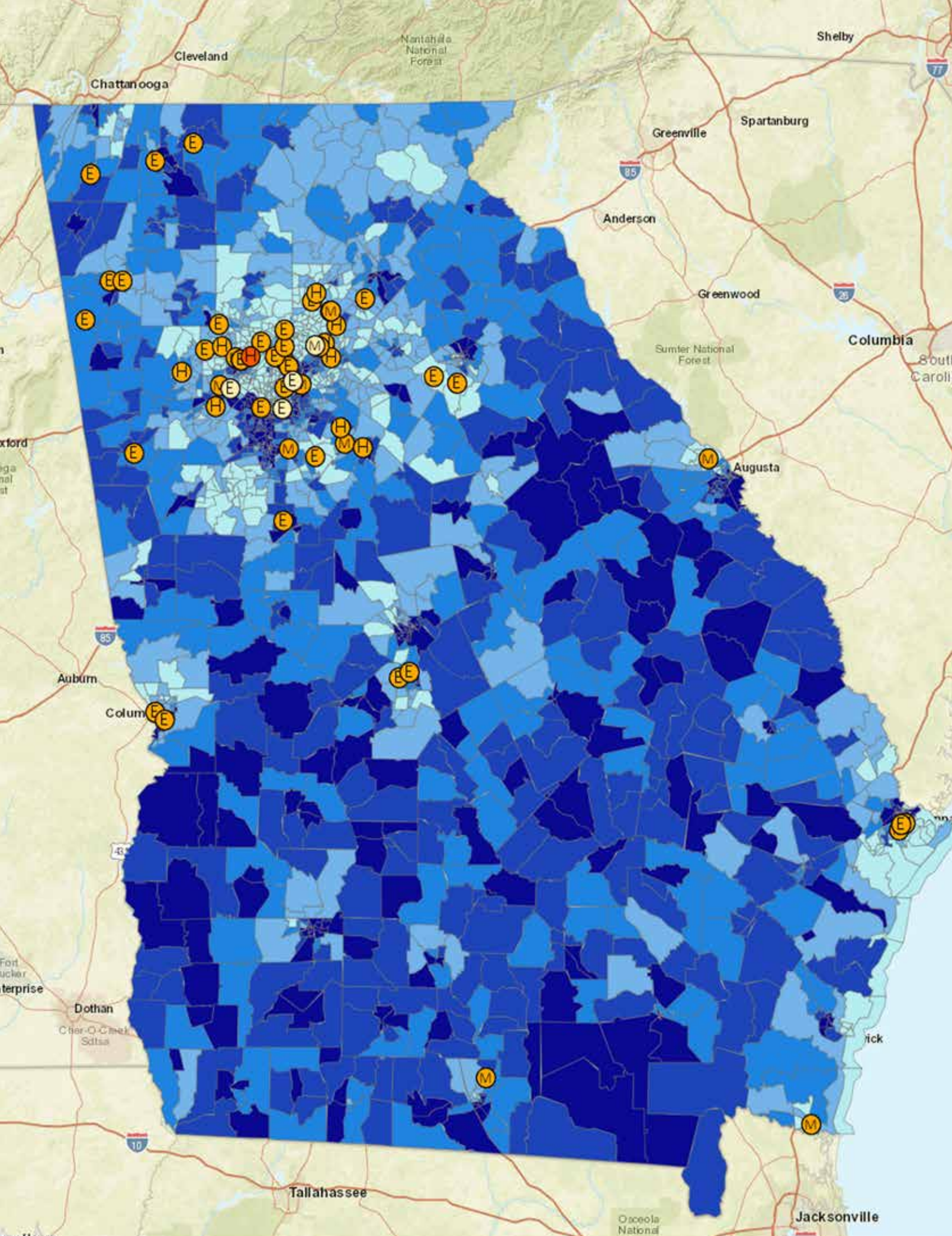
Beyond data on schools, the map features data on investments made to

support STEAM education across the state. These investments are divided by the type of entity to which they were made, and include school districts, museums, colleges, and other groups. The map also includes an index of economic conditions that overlays across the state and aligns to census-tract level data; this feature can be toggled to display the index or the percentage of the population below the poverty line.

One of the layers of the map that has proved most interesting and exciting for parents is the “Out-of-School Opportunities” which includes over 600 out-of-school time opportunities for students that have been reported to include STEM/STEAM related programming.

These programs were largely self-reported or reported through the help of partners like the Georgia Statewide After School Network, the Georgia Division of Family and Children's Services, TAG-Ed, and the Georgia STEAM Alliance Network.

Included in the map are when these opportunities take place and where they are located. We urge parents to inquire with individual programs about their offerings, however, as the map does not include any measure of quality of opportunity. Programs featured take place before, during, or after school or in the summer.



The combination of these indicators paints a powerful picture of where investments are needed to support STEM/STEAM education or to grow an interest in these fields that promise to best prepare students for the workforce of tomorrow. The map is being updated with new information on a rolling basis, with updates of all major information sections occurring annually. By March 2018, the map will show AdvancEd STEM certified schools in addition to those certified by STEM Georgia.

With the STEAM Asset Map, the Georgia Partnership is providing a way for parents to connect their students with educational options that particularly appeal to their needs and interests. The STEAM Asset Map also provides businesses with a way to locate schools to connect with, thereby connecting employers and schools to help foster a conversation on how to better prepare students for the needs of the modern workforce.

Finally, we hope that the map drives investment into areas that need it the most. It is easy to see that the rural parts of our state could use investment into this high-value type of education that promises to best prepare students to be a part of the workforce of tomorrow.

This project was made possible by a grant from the Goizueta Foundation, as a part of the larger education policy framework project—EdQuest Georgia, and both are initiatives of the Georgia Partnership for Excellence in Education. Please see -

www.gpee.org/steammap

- for more information on sources of information included in the map and for more information on using the STEAM Asset Map. To hear more in person about the map and its many uses, visit my “TED Talk” session at the CEISMC STEAM Leaders conference on March 22nd or stop in to my presentation on the map at the STEM Interdisciplinary Teaching and Learning conference on March 23rd in Savannah.

Caitlin Daugherty Kokenes is a Project Associate for the Georgia Partnership for Excellence in Education. She worked previously for the Southern Regional Education Board and she obtained a Master of Science in Public Policy from Georgia Tech. Caitlin also serves as co-coordinator of the Georgia Education Policy Fellowship Program through the Institute for Educational Leadership.

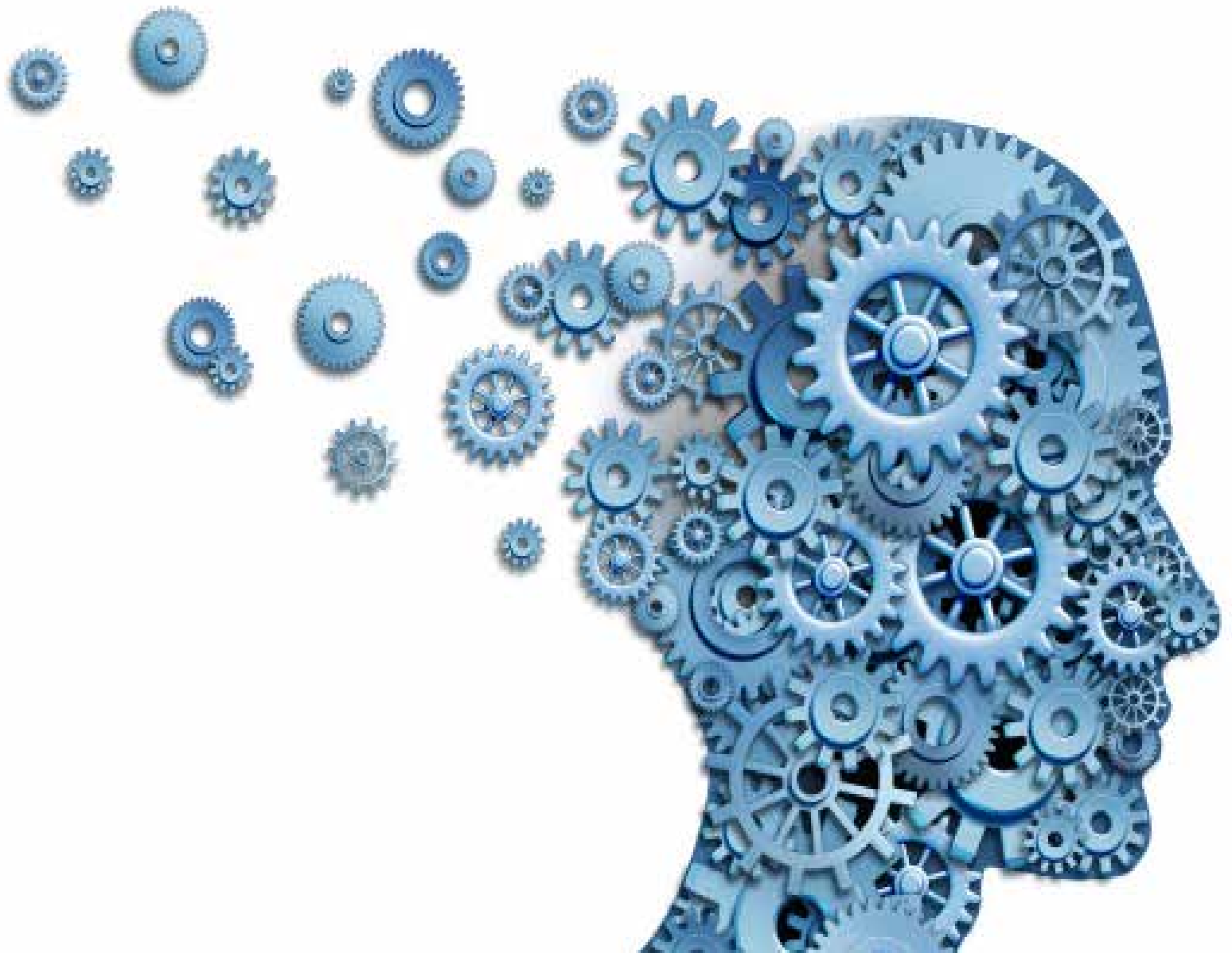


Memory

as **Understanding** is **Student-Constructed...**

...Concept Memory is **Brain-Constructed**

Dr. Judy Willis



Under your guidance and through the opportunities you provide for students to use and transfer learning, their neural circuits expand the range of interconnections. As understanding builds, students' brains construct concept knowledge networks they will be able to apply to solve problems, adapt to new information, and collaborate successfully beyond the classroom and school itself.

Your support will be needed along the way. Just as learning how to walk, speak, and read does not emerge fully proficient, the construction of understanding and concept networks is not a smooth pathway to perfection. Going from the unknown to the known involves detours through uncertainty and mistakes.

Help students understand that setbacks provide opportunities for them to revise their brains' erroneous circuits and working through periods of confusion strengthens the accurate networks their brains ultimately construct.

Help students build their flexibility as a powerful support system for their emerging cognitive, emotional, and social mindsets and their tolerance for the growing pains they'll experience along the path to adulthood.

First Response – Limited Perspective

Take a look at following examples and see if you can find a mistake in either.



There are mistakes in both! Perhaps you did see them, but most people do not see either the second "the" or the incorrect color of the 4 of hearts until they are pointed out. These are examples of in-attentional blindness.

Although the errors are clearly evident once they are pointed out, they are not initially perceived. In-attentional blindness regarding these examples is well within normal limits. However, the focus on single correct responses and specific “right” ways to solve problems has narrowed the perspectives of a generation of students.

When the brain repeatedly uses mental processing geared to rapid efficiency and single responses, it grows increasingly “successful” at this response to information and experiences. Students build the cognitive habits of accepting the first retrieved response as correct and the only accurate response.

adequate preparation for the rapidly expanding information pool in the globalized, technological world awaiting them when they leave school.

With accelerating quantities of information today’s students face higher education and career challenges of interpreting, reasoning, communicating, and transfer of knowledge to novel applications. The repetition of facts is no longer adequate for being “smart”.

After years of passivity and limited responsibility for evaluating ideas, considering multiple options, or supporting their opinions, students must build the skills of constructing under

The repetition of facts is no longer adequate for being “smart”

Learning experiences need to go beyond single answers and applications to push students to resist their first response as correct or as the only correct response. Brains that have become habituated to unthinkingly following direct instructions and memorizing single right answers may be restricted beyond in-attentional blindness.

Students without more expanded experiences interpreting data and developing solutions will not have

standing, formulating ideas and clearly supporting their opinions or solutions with reasons.



BUILDING Cognitive Flexibility

Cognitive flexibility is one of the executive functions developing in the prefrontal cortex, especially during the school years. It is the capacity to be open and receptive to considering all aspects of an experience, sources of information, a variety of interpretations, or approaches to problems. With well-developed cognitive flexibility students will have greater capacities to consider alternative points of view, predict a variety of outcomes, and assess changing data or new information from multiple perspectives.

Cognitive flexibility could increase the likelihood of being open to multiple interpretations, even when asked to respond with only one – such as finding the two errors in the sample diagrams.

Students can be paired with classmate(s) who have the same opinion on comfortable, interest-related topics that do not require formal evidence. They share reasons for their opinions and select one or two that they feel are most convincing. Groups then expand to four to bring together student pairs with their different opinions and reasons to discuss with each other.

Topics, depending on student age, could include might include opinions

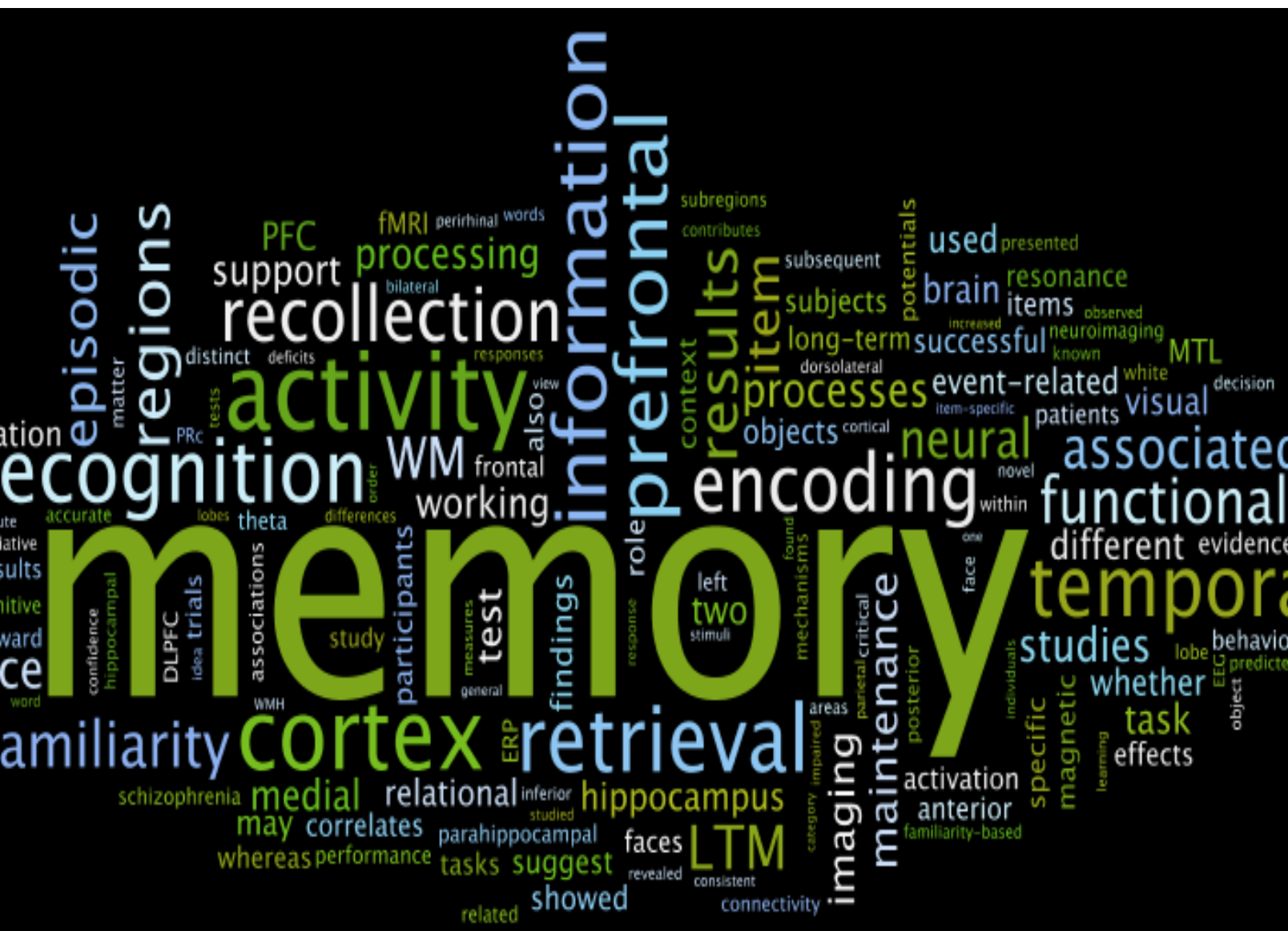
about the best: bedtime story, breed of dog for a house pet, time to do homework, or Internet search engine.

Active listening would be appropriate to include if students are not experienced in supportive and productive ways to exchange different opinions. (Active listening involves listening silently without interrupting, and then repeating back what one thinks the speaker said and inviting corrections of any misinterpretations.) As students build their opinion sharing flexibility, they can extend the discussions by each listener selecting one of the speaker's support reasons that seemed most convincing or reasonable.

Cognitive flexibility can be expanded in regard to media in a number of ways. In literature, students can reflect on reasons that an “evil” character in a story might not be fully to blame or deserves sympathy. Students can develop several different interpretations of art, music, a historical event, or an author's choice of literary devices. Even cartoons can provide opportunities for students to build cognitive flexibility when they are asked to think of several possibilities for, “Why do you think this cartoonist selected cows to be the talking animals with all the

Beyond having students develop multiple interpretations, they can be challenged to find more than one solution to a problem. The goal would be for them to build the habit of not stopping at the first “answer” that comes to mind. The problems could include historical disputes, ways to divide odd amounts of supplies equitably, several different endings for a story, improvements in rules for playing or scoring a sport, multiple ways to solve a math

Teachable moments will become evident when you have cognitive flexibility in mind. When a student, novel character, politician, economist, critic, or analyst acknowledges a change of mind or opinion in response to considering alternative points of view or assessing new information, that can be an opportunity to acknowledge that person's flexibility, open-mindedness, fairness, or even courage.



Added Bonus

Basketball legend, Michael Jordan said,

- “I’ve missed more than 9,000 shots in my career.
- I’ve lost almost 300 games.
- 26 times, I’ve been trusted to take the game winning shot and missed.

I’ve failed over and over and over again in my life. And that is why I succeed.”
As students develop cognitive flexibility watch for additional expansions in their habits of mind.

Making mistakes will be recognized as an opportunity to increase understanding and not an indication of failure. You’ll see them build increased perseverance figuring out problems, improved skills of collaboration, and greater responsiveness to corrective feedback and making revisions.

Best of all, consider the impact your efforts will have on your students’ tolerance, ethics, and citizenship far beyond your classroom.

Dr. Judy Willis is an authority on brain research regarding learning and the brain. With the unique background as both a neurologist and classroom teacher, she writes extensively for professional educational journals and has written six books about applying the mind, brain, and education research to classroom teaching strategies, including an ASCD top seller, *Research-Based Strategies to Ignite Student Learning*.

After graduating Phi Beta Kappa as the first woman graduate from Williams College, Willis attended UCLA School of Medicine where she was awarded her medical degree. She remained at UCLA and completed a medical residency and neurology residency, including chief residency. She practiced neurology for 15 years before returning to university to obtain her teaching credential and master’s of education from the University of California, Santa Barbara. She then taught in elementary and middle school for 10 years.

Dr. Willis gives neuroeducation presentations, and conducts professional development workshops nationally and internationally about educational strategies correlated with neuroscience research.

Abstract

Critical thinking exercise:

Q: Which direction is the bus driving and ***why?***



Atlanta

Athens

Columbus

Macon

STEM is Georgia Wide

Savannah

Albany

Brunswick

Valdosta