Jan. 2019

GEORGIA PATHWAYS
MAGAZINE

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Underestimated
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Mentors

Code Your Way To
The Stars

Attention Coders!

Chances are that today's High School students will be among the first explorers to land on Mars. Want to see if you have what it takes to code our way to the stars?

Apply to Code Quest, an annual competition where teams of High School students around the world use JAVA, Python, C, C++ and/or VB.net programming to solve 15-20 problems. The international competition will take place on Saturday, April 27, 2019.

Know a high school computer science program that might be interested in attending? Feel free to spread the word! In the meantime, send any questions to code-quest.gr-aero@lmco.com.

Happy New Year! We are pleased to welcome you to another edition of Georgia Pathways™ STEM Magazine.

As we head into 2019, we are seeing tremendous progress nationwide for the visibility of STEM education programs and efforts.

The White House recently announced a new five-year strategic plan for STEM education. The plan examines the federal government's $3B investment in STEM education and emphasizes that value of blending the arts, social science and other areas in providing authentic STEM learning experiences.

The plan, according to a release from the National Science Foundation (NSF), lays out the federal government's role in furthering STEM education by working with state and local stakeholders, the education community and American employers. Its goals include building a STEM-competent citizenry, creating a STEM-ready workforce and removing barriers to STEM careers, especially for women and underrepresented groups, the NSF's release states.

Once again, we see significant steps being taken to strengthen STEM career pathways for all students and to provide the level of investment necessary to truly make an impact. Meanwhile, the University of Georgia has announced a comprehensive research project that seeks to transform STEM education on campus thanks to a $3M grant from the NSF.

According to a release issued by UGA, the Bureau of Labor Statistics projects employment in science and engineering fields to grow by nearly 20 percent in the coming years. At UGA, 22 percent of undergraduate students earned degrees in STEM fields last year, compared to 18 percent just five years earlier.

These advancements and initiatives offer a tremendous boost to STEM education, both nationally and across Georgia.

Georgia Pathways STEM Magazine is intended to play a role in these concerted and collaborative efforts by drawing together STEM educators, parents and students to share best practices, smart ideas and great tips for increasing STEM education efforts.

I hope you will pass this information along as you read through this edition.

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.

From the Executive Director

It's 2019! Welcome to a new year and a new you. New opportunities and new insights. And even the introduction of K-8 computer science standards for the state of Georgia. As we broach a new year we're energized to share the exciting opportunities that are happening within the Department of Education.   If you haven't had an opportunity to review them, please click here to see the new K-8 computer science standards that the GADoE worked diligently to develop with the support and insight of educators, industry leaders, the state board and are aligned to both the K12 CS Framework ensuring that they evolve and grow over the years and the ISTE standards ensuring that there are organizational domains.

These new standards are monumental for the state of Georgia because "computer science drives innovation through the US economy…" And as a state that currently produces 1,747 computer science graduates but has 17,905 open computing jobs according to Code.org it's exciting that

we're investing in new ways to fuel Georgia's economy. Enhancing and expanding the standards ensures a greater reach and a greater percentage of students with exposure to computer science sooner and longer. This initiative continues to place Georgia on a trajectory of growth and success. So exciting things are happening in 2019!

Likewise, we're energized by the number of schools that are not only pursuing STEM or STEAM certification, but the number of schools instituting magnet programs or even the number schools working diligently to enhance their CTAE offerings or STEM certified faculty. The collective efforts that are happening throughout the state all add value and are expanding the educational experiences that are making a difference and making an impact in our state.
So as we approach a new year with new discoveries we look forward to hearing and learning about your efforts over the course of the year. And we hope you'll find new ways to enjoy and share the latest issue Georgia PathwaysTM with your community. And all the best in the new year!

Sincerely,

Errika Moore

Executive Director
Executive Director, TAG Education
Collaborative (TAG-Ed)

Are You Underestimating High School Students,

By Stacey Young Rivers

"Like", this article if you think high school students are one of the most underestimated groups when it comes to working a job. Most people think teens are not ready to work in a corporate environment without a lot of hand-holding. I thought this too until I saw firsthand the skills and talents students possess who enter Turner's Tech Internship Program for High School Students.

As I watched each student's presentation with anticipation and awe, the realization set in that the burden shouldn't lye with students to debunk our assumptions about their abilities, instead WE should provide the opportunities and set the expectations with support and encouragement. Leveraging TAG Education Collaborative, Turner provided the opportunity and our teams set the expectations with guidance and support. Guess what? Every student delivered, had a rewarding experience, and now have a richer outlook on a career in technology as a result.

For several years now, Turner has participated in TAG-Ed's High School Summer Internship Program, and the experience for both managers and students have been nothing less than phenomenal. Our intern managers acclimate students to a diverse culture of world class technologists and integrate them into work teams invested in knowledge-sharing. Students arrive excited about working with us and leave more clearer about their educational and career goals. No one should dismiss the importance of seeing through the lens of a teen, someone who grew up using technology and have intuition not only about how something could work as a consumer, but also what may make it better.

Too?

What I gained insight about is that most interns are eager to:

- Learn something new
- Contribute to the operation
- Gain an understanding of possible careers
- Develop a new community of mentors and friends

Too often managers may feel high school students lack the necessary experience to execute tasks required for the role. Managers must grasp that it is their responsibility to create the expectations for learning and performance. Teachers understand this perspective completely because they live it every day; likewise, managers should have this same approach with their own employees. Furthermore, what is different about learning in the workplace for students is they get to immediately apply their skills in an area of interest. By extension, managers can help build employees' coaching and mentoring skills through partnering them with an intern. This tactic can make the experience beneficial to staff and students while delivering business value.

Companies who have an interest in hiring students through TAG-Ed's program should ensure:

- Managers and staff have the ability to coach and mentor, creating an environment conducive for learning.

- Roles for high school students mimic "real" roles in the organization and provide a level of responsibility and accountability.

- Students join an intact work team (including virtual teams) to learn about teamwork, collaboration, and developing relationships.

- There are opportunities for students to contribute, even if through feedback about a product or process to engage and encourage.

- The program ends with student presentations about what they learned.

The investment is minimal, but the impact is far-reaching. I am excited Turner is partnering again this year with TAG-Ed to work with high school students during the summer. If you have an interest, I would love to share more about what we are doing to develop the next generation of leaders. You can learn more about Turner's focus on tech skills here.

Stacey Young Rivers is the Director of Tech Skills Analysis + Development in Turner's Global Technology & Operations Division.

Turner, a WarnerMedia company, is a global entertainment, sports and news company that creates premium content and delivers exceptional experiences to fans whenever and wherever they consume content.

These efforts are fueled by data-driven insights and industry-leading technology. Turner owns and operates some of the most valuable brands in the world, including Adult Swim, Bleacher Report, Boomerang, Cartoon Network, CNN, ELEAGUE, Great Big Story, HLN, iStreamPlanet, TBS, Turner Classic Movies (TCM), TNT, truTV and Turner Sports.

Join us for a TAG-Ed Workshop to develop your high school internship program. Register now to gain access to insightful information and a seat for lunch.

TAG Education Collaborative and Turner Workshop:
Develop Your High School Internship Program
Wednesday February 27, 2019
Registration: https://goo.gl/forms/PgIzhgYb36UoJkRy2

My STEM Story:
Perseverance of a Scholar

By Zuriel Johnson

The following is an interview with Georgia student Zuriel Johnson, and has not edited or altered in any way out of respect for Mr. Johnson's personal journey, convictions and opinions.

Where did your interest in math and science begin?

My interest in math and science started when I was accepted into the Advanced Learners Program at Georgia Cyber Academy, powered by K12, in the third grade. At 8 years old, I thought about going into math and science but I also believed it was too challenging and I wanted something that I could do quickly. As the years went by, my view transformed.

When I was accepted into SMASH Academy, my view of math and science broadened. I had a chance to experience the different ways scientists use math and science to shape our society and improve it as well. I wanted to become someone that changed the world with my ideas. The way that I saw it was utilizing science and math.

How did it become a passion?

The field of STEM became a passion when I saw the many opportunities available and the resources God provided me. In my Advanced Program classes at Georgia Cyber Academy, I

was introduced to the different ways I could use science in real life. During my time at SMASH, I had an opportunity to see it with my own eyes. I met different people who worked in the STEM field and learned how they utilized their training to help people in my own community.

What excites you about math and science?

I am passionate about solving problems and overcoming the challenges and obstacles to understand them. Knowing that I have been put in this world for a reason and using the knowledge that God has given me is thrilling. It took a while to realize it, but math and science is all around us. Science and math is in our electronics, cars, and even the money we use. I also get excited when I can find out the way they work in our world.

$$\lim_{x \to \infty} \frac{\pi(x)}{x / \ln(x)} = 1$$

$$\sum_{k=0}^{n} \binom{n}{k} = 2^n$$

$$\oint_C \frac{f'(z)}{f(z)} dz = 2\pi i (N - P)$$

Who or what was your greatest influence and why?

Honestly right now, many people have influenced me. However, I would say that the benefits of technology influence me directly and indirectly. It influences me directly because I am always around technology. I use it continually throughout my daily life. For example, I use it in my academics and when I DJ or make beats.

It also influences me indirectly by seeing the various ways scientists use new technology to enhance other people's lives. They create new cars or new phones with enhanced features that makes the lives of others easier (even though they can be expensive).

Any special challenges along the way thus far?

I believe the main challenge for me is balancing my academic life with my social life. I am participating in various things and am busy doing something every day. Trying to balance being a scholar, soccer player, soccer referee, SMASH scholar, friend, and older brother can be a lot to handle.

However, participating in these things have helped me to become better at time management and a better person in general. Although I have thought about giving up numerous times, God

has helped me to endure through the hard times, and as a result I am grateful for those times.

Why did you choose virtual education over public school?

I chose Georgia Cyber Academy over public school because of the adaptability and opportunities for a quality advanced education. With a flexible schedule, I am capable of doing many things that I believe if I attended a brick-and-mortar school would be limited.

When we need to travel, I am able get my work done ahead of time or while I am away. I can take my school anywhere! I can also spend valuable time with my family. Georgia Cyber Academy also gives my family and I a more flexible schedule so we can do both academic work and serve others around us. I am the oldest of five children and all of us are enrolled in Georgia Cyber Academy. I also have a job as a certified Georgia soccer referee and have the flexibility of working around my demanding course load.

What is the GCA's Advanced Learner Program?

Georgia Cyber Academy's Advanced Learners Program is a supplemental enrichment program designed to meet the needs of advanced learners through accelerated course planning, topic enrichment, Learning Coach support, curriculum compacting, and other activities that incorporate academics, multiple intelligences, and social interaction.

To get into the ALP program, students must qualify. Because GCA's qualifications variate every year, students must qualify yearly. I was accepted into GCA in third grade and have qualified every year since to remain in the program. It becomes challenging at times because of the workload, but I persevere through it and in the end, I notice how much I have improved because of it.

Why Morehouse college?

SMASH Morehouse is a STEM extensive college prep program for underrepresented high school students of color. Out of all the SMASH sites, SMASH Morehouse is specifically made for young men of color.

When I was accepted into the program, I had the privilege to live on the Morehouse campus for 5 weeks this summer

(which I will do for 3 years). During those 5 weeks, scholars take stem classes every day, and once a week, we network with STEM professionals. During those weeks, I met and created relationships with the other 50+ scholars in the program as well. During the school year, we meet every month for Saturday Academy.

On those days, we go through different classes like College Success which prepares us to become successful in college. We apply for scholarships, learn how we should manage our money, and are given tips on how to become successful in our academics in college. SMASH has given me many opportunities and has helped me become more confident going into college.

Where are you headed after high school?

My goal is to attend either Morehouse College or Georgia Institute of Technology. I am not exactly sure what I want to major in, but I am moving towards majoring in either architecture, architecture engineering, or civil engineering.

Although I am still deciding, God has given me the desire to major in something that I enjoy and use my abilities to help others around the world. If I go into architecture or civil engineering, I want to be able to build convenient and affordable homes for people in need of a home. I could create different utilities that help people that lack water around the world as well.

Career goals?

Presently I am pursuing a possible career in architecture or civil engineering. Although my goals may change overtime, my short-term goal is to maintain a high GPA so that I can obtain various scholarships and have opportunities for internships in the STEM field.

I also aim to be a leader in my classroom at Georgia Cyber Academy by taking initiative to help other students who may be struggling in science and

math. My long-term goal is to excel in the STEM field and graduate with the highest degree. Furthermore, I desire to utilize my skills in a way that benefits others. I am also aiming to use my life and career to be an example to others who also want to go into the STEM field, primarily minorities.

What do you hope the "takeaways" are for readers? What do you want them to remember?
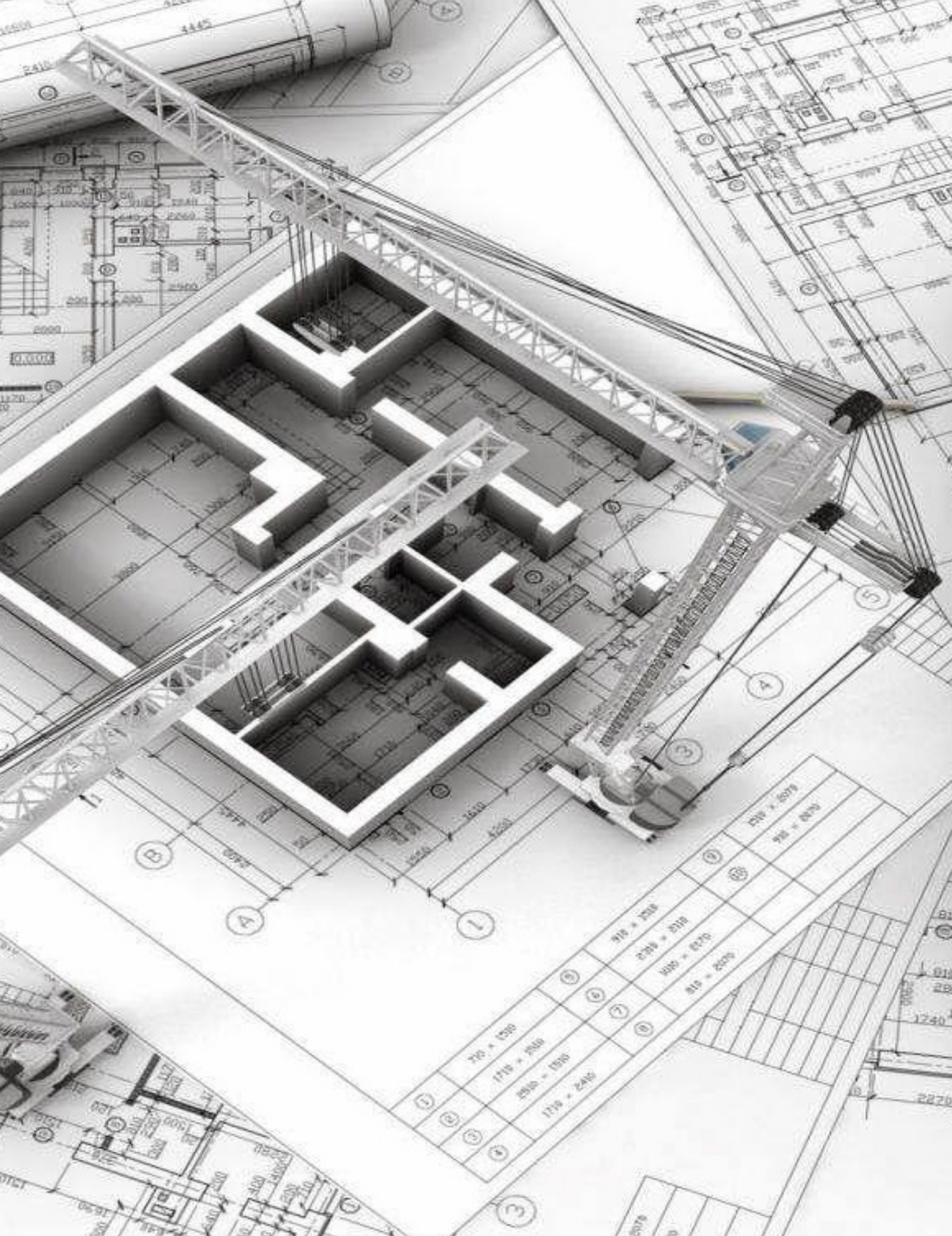
The takeaways I hope the reader will remember is that perseverance and faithfulness can take you very far. It took me very far and has opened many possibilities. Opportunities like Georgia Cyber Academy and SMASH has helped me tremendously. SMASH Academy's motto is "SMASH Transforms Lives" and they have certainly transformed my life. Georgia Cyber Academy has done the same. I am very grateful for that.

Ever since I was young, my parents have prayed continuously for me and have trusted God to provide the best education for me. I believe that they have made the right decision by choosing Georgia Cyber Academy and that the possibilities for my future as a STEM professional are endless.

With the ear of thousands of students and teachers world-wide, what are your words of advice or encouragement?

My words of encouragement are to persevere through your challenges. Never give up, no matter what other people say. Moreover, do not quit because things are hard. Make connections with people and always have a support system. Getting to where I am now has (and still is) a challenge. Fortunately, I've had a good support system which includes God, my family, and friends. This has kept me moving forward. Additionally, you can be skillful in sports and still be skillful in academics. You can use the same determination that you put into sports, for your academics as well.

Life is about balance. I have not done this perfectly, but from my mistakes, I am learning how to balance my academics, athletics and social life. I am able to have a healthy social life, but if it's all about a social life, then my focus will just be about popularity. My last words of advice are to stay true to yourself. God has made us all distinguished and unique, so you do not have to try to be like anyone else. If you would take the time to notice your own attributes, you will not have time to worry or be envious of others.

Bright Spots in Post-Secondary Success: College Advising Corps

by Jessica Robinson

"Without my college adviser, I don't think I'd be going to college. I was really unmotivated before. Ms. Reese has inspired me."

The College Advising Corps (CAC) works to increase the number of low-income, first-generation college, and underrepresented students who enter and complete higher education. CAC programs accomplish this by placing well-trained recent college graduates in high schools to work as full-time college advisers. In 2019 there are two university partners in Georgia: the University of Georgia's Institute of Higher Education, which is celebrating ten years of college advising service, and Georgia State University, which launched its CAC program in 2017.

CAC adviser responsibilities are based on key performance indicators of increased college enrollment. This week, our advisers are busy planning FAFSA workshops for families, coordinating campus visits, registering students for the SAT, and myriad other actions related to supporting students as they navigate the path to college. Advisers also regularly track and analyze data to measure impact and strategically plan initiatives in the following areas:

- Campus visits
- College fairs/college representative visits
- SAT/ACT registration
- College workshops
- College application submission
- FAFSA completion
- Scholarship dollars awarded
- Parent engagement

Two unique aspects of the College Advising Corps are our focus on one-on-one meetings and our near-peer advising model. As the director of the UGA College Advising Corps, I've seen first-hand the impact of these components on students' post secondary aspirations. Last semester, UGA College

Advising Corps advisers met with 91 percent of seniors at our partner high schools, holding 8,237 one-on-one meetings with students. Each of those meetings was a unique opportunity to engage in honest conversation about the student's aspirations and challenges to pursuing higher education. As near peer role models, advisers are close in age and background to the students they serve. Seeing themselves in their advisers, students gain confidence in their own ability to obtain a post secondary degree.

CAC college advisers not only offer students information, but also inspiration and motivation. It's a powerful combination that has proven successful in promoting a college-going culture in high schools and increasing post-secondary enrollment.

One of the exciting aspects regarding this program are that the advisors come from varying backgrounds to support students from their respective community. Below is the profile of a current advisor who shares her perspective and her motivation for becoming an advisor:

College Adviser: Jasmine Moorman
Education: South Carolina State University, BS Industrial Engineering
School Site: D.M. Therrell High School, Atlanta Public Schools

Why did you decide to serve as a college adviser with UGA's Georgia College Advising Corps?

I serve as a college adviser with the Georgia College Advising Corps because it gives me the opportunity to be a positive role model to all students who are eager to learn more about the college admissions process and securing financial aid. The work of this program within the metropolitan area of Atlanta continues to empower many young individuals to be successful, and I am honored to be part of an organization that focuses on that goal.

As a college adviser, how do you open doors of opportunity for underrepresented students to pursue careers in STEM fields?
The first step of advising students who are interested in STEM fields is believing in them and their capabilities. Giving them the encouragement they need plays a huge factor and it is my job to guide them through this process and share my own personal experience of receiving a bachelors degree in industrial engineering. Secondly, I create a list of majors that they can possibly pursue based on their interests and hold them accountable for doing their own research. It is very important to show students the different paths they can take within STEM and how they can customize their interests.

Last but not least, I create a list of schools that are good fit for them academically, professionally, socially and financially and inform them about possible summer bridge opportunities at various academic institutions.

How has your own college experience informed your work as a college adviser?

During an internship with the National Nuclear Security Administration Minority Serving Institution Program, I volunteered with the University of Tennessee's pre-college program for middle and high school students. It inspired me to get involved in various organizations that showed me the value of encouragement and how it can enormously impact the lives of others. My college experience has molded me to open the eyes of students and let them know their dreams are attainable.

To learn more about the Georgia College Advising Corps at UGA's Institute of Higher Education, please visit their website or contact their program director at jessica.robinson@uga.edu.

Jessica Robinson is the director of the Georgia College Advising Corps. Jessica has over a decade of experience in the field of education, including work as an education consultant, high school teacher, and youth services librarian.

She earned a Bachelor in Arts in Comparative Literature from the University of North Carolina at Chapel Hill, a Master of Arts in Teaching from the University of North Carolina at Wilmington, and a Master of Library and Information Sciences from the University of North Carolina at Greensboro.

Air Traffic Controllers

A STEM Career

Every minute, every hour, every day, there are men and women working to ensure the safety and efficiency of our national airspace system.

This elite group of more than 14,000 FAA air traffic control specialists provide a vital public service to guide pilots, their planes and 2.2 million daily passengers from taxi to takeoff, through the air and back safely on the ground.

Because of the serious nature of this work and zero margin for error, the training regimen and proficiencies needed to become an air traffic control specialist, are demanding. Initial selection does not guarantee placement into federal civilian service. Entry-level applicants must complete required training courses at the FAA Academy in Oklahoma City* and gain on-the-job experience before becoming certified professional controllers.

Air traffic controllers' primary concern is safety, but they also must direct aircraft efficiently to minimize delays. They manage the flow of aircraft into and out of the airport airspace, guide pilots during takeoff and landing, and monitor aircraft as they travel through the skies. Air traffic controllers use radar, computers, or visual references to monitor and direct the movement of the aircraft in the skies and ground traffic at airports.

Controllers usually manage multiple aircraft at the same time and must make quick decisions to ensure the safety of aircraft. For example, a controller might direct one aircraft on its landing approach while providing another aircraft with weather information.

The following are examples of types of air traffic controllers:

Tower controllers direct the movement of vehicles, including aircraft, on runways and taxiways. They check flight plans, give pilots clearance for takeoff or landing, and direct the movement of aircraft and other traffic on the runways and in other parts of the airport. Most work from control towers, observing the traffic they control. Tower controllers manage traffic from the airport to a radius of 3 to 30 miles out.

Approach and departure controllers ensure that aircraft traveling within an airport's airspace maintain minimum separation for safety. They give clearances to enter controlled airspace and hand off control of aircraft to en route controllers. Approach and departure controllers use radar equipment to monitor flight paths and work in buildings known as Terminal Radar Approach Control Centers (TRACONs). They also inform pilots about weather conditions and other critical notices. Terminal approach controllers assist the aircraft until it reaches the edge of the facility's airspace, usually about 20 to 50 miles from the airport and up to about 17,000 feet in the air.

En route controllers monitor aircraft once they leave an airport's airspace. They work at air route traffic control centers located throughout the country, which typically are not located at airports. Each center is assigned an airspace based on the geography and air traffic in the area in which it is located. As an airplane approaches and flies through a center's airspace, en route controllers guide the airplane along its route. They may adjust the flight path of aircraft to avoid collisions and for safety in general. Route controllers direct the aircraft for the bulk of the flight before handing to terminal approach controllers.

Some air traffic controllers work at the Air Traffic Control Systems Command Center, where they monitor traffic within the entire national airspace.

When they identify a bottleneck, they provide instructions to other controllers, helping to prevent traffic jams. Their objective is to keep traffic levels manageable for the airports and for en route controllers.

Air traffic controllers typically do the following:

- Monitor and direct the movement of aircraft on the ground and in the air
- *Control all ground traffic at airport runways and taxiways*
- Issue landing and takeoff instructions to pilots
- *Transfer control of departing flights to other traffic control centers and accept control of arriving flights*
- Inform pilots about weather, runway closures, and other critical information
- *Alert airport response staff in the event of an aircraft emergency*

Education for Air Traffic Controllers

Candidates who want to become air traffic controllers typically need an Associate's or a Bachelor's degree from an AT-CTI program. Other candidates must have 3 years of progressively responsible work experience, have completed 4 years of college, or have a combination of both.

The FAA sets guidelines for schools that offer the AT-CTI program. AT-CTI schools offer 2- or 4-year degrees that are designed to prepare students for a career in air traffic control. The curriculum is not standardized, but courses focus on subjects that are fundamental to aviation. Topics include aviation weather, airspace, clearances, reading charts, federal regulations, and related topics.

The STEM of ATC

Vital Qualities for Air Traffic Controllers

Communication skills. Air traffic controllers must be able to give clear, concise instructions, listen carefully to pilots' requests, and respond by speaking clearly in English.

This skill set falls under language arts or STEAM, and is critical to nearly every career field.

Concentration skills. Controllers must be able to concentrate in a room where multiple conversations occur at once. For example, in a large airport tower, several controllers may be speaking with several pilots at the same time.

Decision making skills (Engineering Method). Controllers must make quick decisions. For example, when a pilot requests a change of altitude to avoid poor weather, the controller must respond quickly so that the plane can operate safely.

Problem-solving skills (Engineering Method). Controllers must be able to understand complex situations, such as the impact of changing weather patterns on a plane's flight path. Controllers must be able to review important information and provide pilots with appropriate solutions.

Math skills. Controllers must be able to do arithmetic accurately and quickly. They often need to compute speeds, times, and distances, and they recommend heading and altitude changes.

Organizational skills. Controllers must be able to coordinate the actions of multiple flights. Controllers need to be able to prioritize tasks, because they may be required to guide several pilots at the same time.

Salaries -

The median annual wage for air traffic controllers is $122,410. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $66,390, and the highest 10 percent earned more than $172,680.

Editors note: Please notice that the FAA programs listed below only require an associates degree. This puts this career field in range for most financially, geographically, in time requirements and best of all, is a desparately needed field that is *hiring rapidly for the foreseeable future.*

Approved Technical Operations
Collegiate Training Initiative (TO-CTI) Schools

Middle Ga. State University
• 71 Airport Road, Eastman, GA 31023

Broward College Associate of Applied Science:
• Electronics Engineering Technology Coconut Creek, FL

College of Southern Nevada Associate of Applied Science:
• Electronics Engineering Technology Las Vegas, NV

Delgado Community College Associate of Science:
• Electrical -Electronics Engineering Technology New Orleans, LA

For a complete list, visit:
https://www.faa.gov/jobs/students/schools/media/tech-ops-cti-schools.pdf

Writing Promotes:
Memory In   Wisdom Out

By Judy Willis, M.D.

The process of writing can provide a template the brain can use to detect and extend patterns. When students have opportunities to write about the concepts underlying the math and science facts and procedures, they guide their brain's increased pattern building. As patterns expand, this further increases the brain's ability to find the patterns in new, subsequent topics. A cycle whereby intelligence builds more intelligence that can be assisted by the representation of writing.

These students will have the ability to use these conceptual networks, such as what fractions really represent, to recognize patterns running throughout their courses in mathematics and science, as a series of ideas they can use to interpret their world.

Writing in narrative, expository, and mental mapping formats can promote promotes mental manipulation and active processing of learned information through the executive functions in the prefrontal cortex. Mental manipulation is not what happens when students passively repeat procedures over and over on worksheets.

Practice really does make permanent – as long as the practice involves reflection, communication, and activation of newly formed memory networks to promote their transformation into well-connected, myelinated, durable memory circuits.

When the brain reconstructs mathematical or scientific facts and procedures into writing, that communicates how these are related or connected to other things they know, students personalize the facts into understanding. The process of writing offers the time for this mental reflection and repeated network activation.

When writing is an act of developing mental relationships that joins isolated facts into conceptual knowledge bundles, students have the understanding to recognize when formulas and procedures are needed and, when necessary

to reconstruct those tools to solve new problems.

These students are not dependent on working memory to hold on to isolated networks of rote memorized formulas, that may have become faulty from lack of application) while solving new problems.

They can devote more of the brain's limited working memory to processing the new information. During the school years, especially from ages 8 – 18 there is the most rapid phase of maturation taking place in the prefrontal cortex.

This is a critical time in a child's learning as the brain is shaping the individual's development of executive functions. These include judgment, critical analysis, induction, deduction, delay of immediate gratification for long-term goals achievement, recognition of relationships (symbolism, conceptualization), prioritizing, risk assessment, organization, creative problem solving, and the ability to identify one's emotional state, exert emotional self-control, and reflect about emotional response choices. When information is taught with opportunities for students to process learning using the executive functions,

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.

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

they strengthen these control networks as they are undergoing their most rapid maturation. Writing about science and mathematics promotes executive function processing as students evaluate and respond to new information and, through the reflection inherent in the guided writing process, develop new insights.

As students grow and learn, they continue to expand their experiential data base. The more experiences they have, the more likely they are to have a fit when they compare new experiences with previous ones. In this context, the neural correlates of intelligence might be considered a measure of students' ability to make accurate connections to
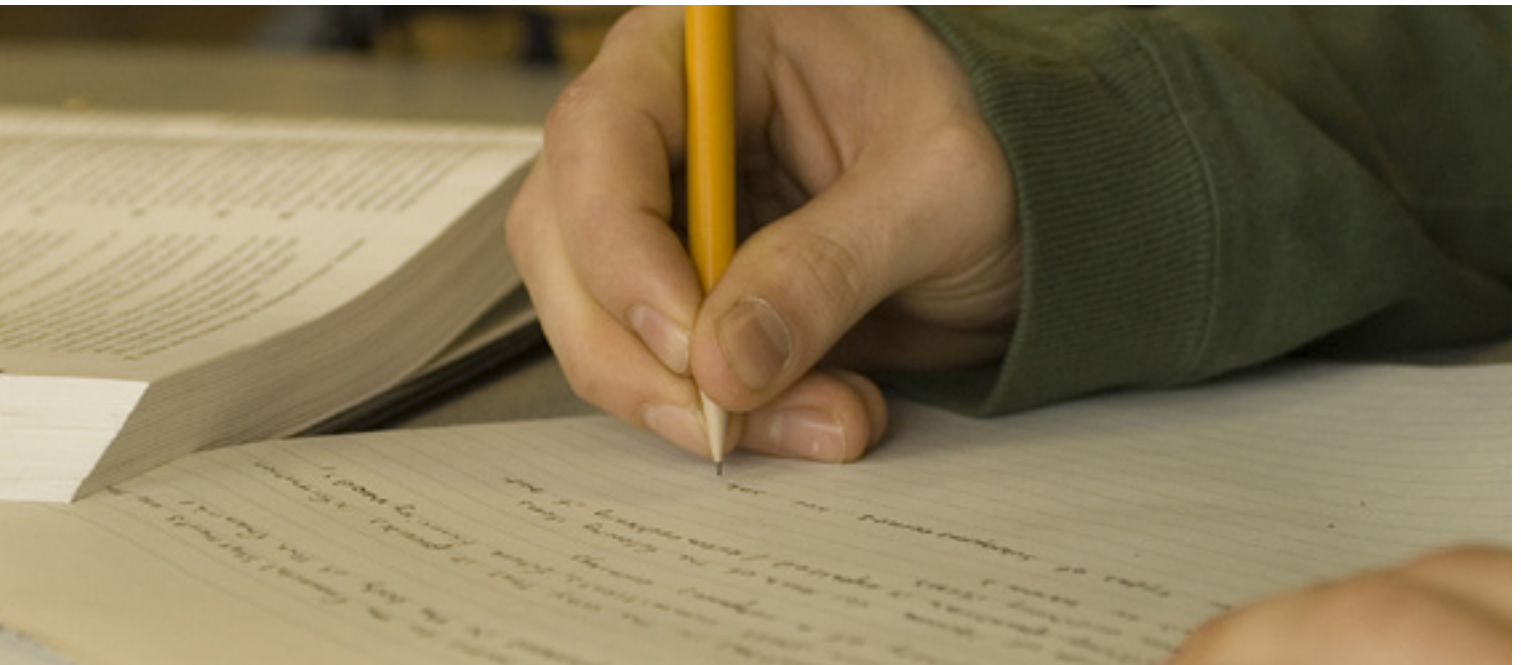
Written communication can be included in assessments that go beyond plugging data into formulas when students are asked to explain their thinking, why they selected a procedure, or what previous knowledge they used to solve problems. This reflective writing engages executive functions such as metacognition, thought organization, deductive or inductive thinking, and consolidation of knowledge, as well as activating the memory networks to promote the durability provided by neuroplasticity.

existing patterns in their cortical networks of stored information - to acquire new learning and apply what they know to make accurate predictions and solve new problems.

Let's be sure the STEM philoso-
phy that "A literate nation not only
reads. It computes, investigates and
innovates" and recognizes writing as
critical for that literacy.

*Let's make sure students can
write on!*

Understanding the need for Interdisciplinary mentoring
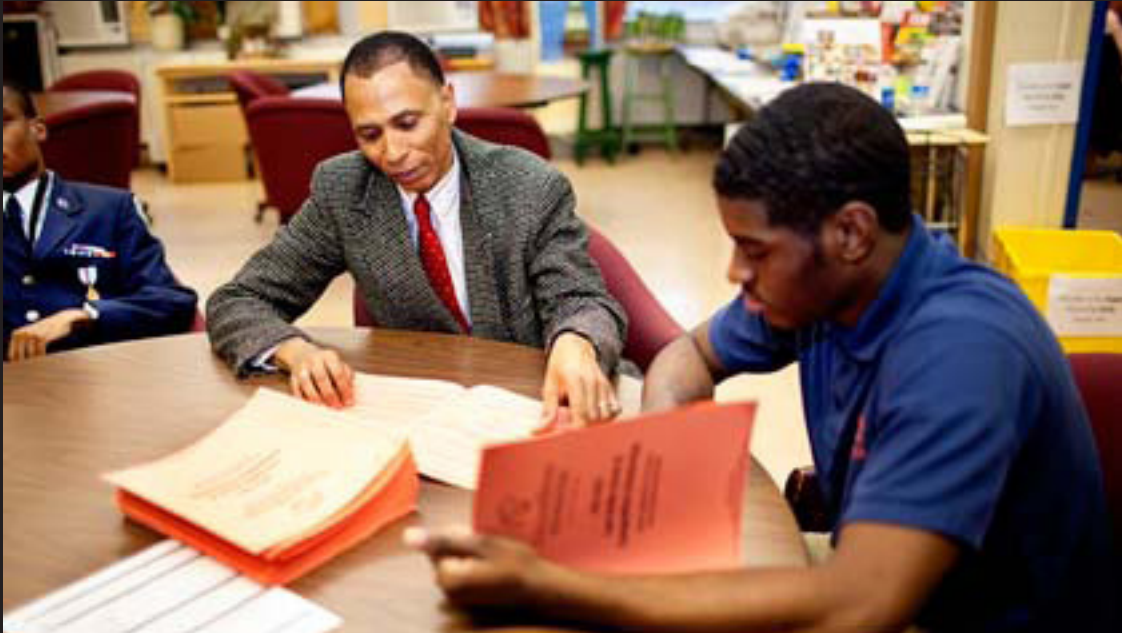
Ofelia Olivero, Ph.D, ATS

Mentors have been critical in the lives of many politicians, athletes, actors, scientists, writers, doctors, musicians, to name just few. Today, mentoring is regarded as a practice that develops new leaders, enhances career development, promotes diversity, improves technical knowledge, and helps manage organizational knowledge. Mentoring is the tool employed by many successful companies to increase productivity and to generate a solid and interconnected workforce.

Science has evolved in a direction of crosstalk and is becoming more multidisciplinary. Scientific dilemmas are now approached with multi-focal teams that conduct science in an interdisciplinary fashion. The new concept of mentoring should therefore gravitate around this concept: The interdisciplinary aspect of science. So this is an eye opener that seeks to generate awareness and to awaken scientist to think about Interdisciplinary Mentoring.

Interdisciplinary work and collaborations are the most predominant styles in modern research settings today. Contemporary scientific research is multidisciplinary and based on a large amount of cross-talk, hence, mentoring should follow that trend. Interdisciplinary mentoring is the mentoring of the future.

It is the tool of scientists and administrators to produce synergy in groups, and to generate multi-focal ideas and complex solutions to complex challenges and the most novel approach to mentoring today. Transitioning to team science should be perceived as a culture change that requires intensive commitment.

Organizations need to identify their transformational leaders and foster multidisciplinary team development with their help.

It is usual to attribute to mentors qualities that are part of their nature, of their personality and not learned or acquired by training. This is probably largely true. There are some individuals for whom communicating, listening, and caring are normal qualities of their lives; however, for others, those qualities have to be acquired, learned and practiced often to make them a permanent part of their personalities.

...normal mentor qualities......acquired qualities...

Being a classical mentor is a good step to become an Interdisciplinary -mentor (I-mentor); however, being a classical mentor may constitute an obstacle to learning new possibilities, views, and aspects of mentoring that uniquely identify the I-mentor. Since the core of the book is guided to this aspect of mentoring I will explore this in detail here. I have divided the journey of training I-mentors into a series of steps.

Step 1: Introspection. Each individual has fears, unanswered questions, dilemmas, pending issues, dark thoughts, and more to deal with. It is desirable that these are explored to some extent before starting the training process, or as part of the first step in training.

Step 2: Development of flexibility. A deep analysis of one's psyche may help to bring different prospective to each I-mentor in training. These challenges, explored after profound introspection, may bring substrate to elaborate more and more on personality issues. Once that is covered, individuals may need to elaborate on their beliefs and dogmas, and start challenging them.

In that way, openness and flexibility of thinking will be initiated and cultivated.

Step 3: Active listening. The I-mentor by this point acquired two superb qualities, inner connection and mind flexibility. The acquisition of the ability to challenge their own ideas without fear will make the I-mentor ready to establish communication with others. Now is when active listening is essential.

Active listening is a dynamic way to understand, comprehend and be part of a dialogue, even when the information received contradicts the mentor's own beliefs or does not align directly with their knowledge.

Step 4: Communication. Understanding other disciplines, methods, traditions, terminology and underlying assumptions is a facilitator of communication. Communication is often one of the most difficult aspects of relationships; communication in cross-disciplinary teams is even more complex.

The role of the I-mentor is of critical importance here, since the outcome of the team depends directly on the ability of members to communicate, relate to each other, transfer ideas, new concepts, teach, and train.

Personal assumptions need to be suppressed, and team members need to understand the assumptions of other disciplines, so that the views of all members can be used to achieve the team's objectives.

Step 5: consensus building. Probably the most challenging aspect of the I-mentor role is requiring individuals to be able to combine, accept, and blend opinions coming from diverse backgrounds and different schools of thought. Consensus building should start with a few I-mentors first, perhaps those with an obvious scientific connection The I-mentor should be a figure who operates in different spaces and times, and who accommodates the needs of individuals to focus all interests.

The concept of I-mentor and I-mentoring goes further than the individual. The generation of networks of I-Mentors with extremely good capacities and abilities could serve as a transferable tool from team to team. If such a possibility is exercised the reality of I-Mentoring and the establishment of real collaborative teams is just one step away.

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