

Hidden Mathematicians in Plain Sight:

Addressing the Neglect and Building Hope in African-American Learners



The Lighthouse Almanac

A publication of the Benjamin Banneker Association, Inc.



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About the Benjamin Banneker Association

The Benjamin Banneker Association, Inc. (BBA) is a non-profit organization of individuals and groups concerned about the mathematics education of African-American children. It was founded in 1986 to provide a forum for mathematics educators, mathematicians, and other interested people to discuss the teaching and learning of mathematics for African-American children. BBA is deeply committed to finding solutions to the problems that must be solved for African-American children to reach parity in opportunities to study and achieve in mathematics. Membership is open to all who have a profound interest in the mathematics education of African-American children.

About The Lighthouse

This publication is a resource in which PK-16 educators (inclusive of school administrators and college/university faculty), parents, and other stakeholders can find encouragement and solutions to current and pressing concerns connected to the mathematics education of African-American students. BBA will continue our work as advocates for students through *The Lighthouse* by highlighting both the collective actions and experience of our members as well as other individuals committed to this work.

The theme for our first issue is "*Hidden Mathematicians in Plain Sight: Addressing the Neglect and Building Hope in African-American Learners".* The structure and politics of school communities, ideas about effective mathematics instruction, and the settings in which African-American children receive instruction are extremely diverse. Too often, discussions about equity in our educational systems fail to include or embrace direct conversations about how these issues impact the needs, strengths, and identities of *African-American children as mathematics learners.* In our inaugural edition of *The Lighthouse*, we are given a fresh perspective on mathematics, mathematics / STEM education and advocacy through the varied perspectives and experiences of 5 individuals.

I believe you will find their personal stories as inspiring as I have, and hope that they will encourage you to develop new solutions to some of the challenges we face.

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Brea C. Ratliff Editor, *The Lighthouse* BBA President

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The Accidental Mathematician

Erica J. Graham

Did I always dream of being a professor? No. Getting a Ph.D.? Not a chance. Being a mathematician? Nope.

So, how did I become a mathematician? Accidentally.

And, why did I become a mathematician? Because no one ever told me I couldn't.

Although I didn't dream of being a mathematician, I have always enjoyed studying mathematics. I also enjoyed music and learning foreign languages. There was something about the logical structure of it all that drew me in. Here's where I was fortunate. Throughout my K-12 education I never received a discouraging message about what I could and couldn't do in the future. If I did, none of these messages resonated. I was allowed the freedom to explore my academic interests, as should be the right of any child, without feeling the weight of society's subjective measure of my potential based on the color of my skin.

I am a product of the New York City public school system. So, from first through twelfth grades, I was immersed in the kind of diverse educational environment that could seem fictionalized if it weren't my reality. I had friends of many shades who helped shape who I am and how I view the world. Although the collection of teachers I've had over the years was less diverse, I was never made to question my right to be where I was. So, I never did.

My educational trajectory was pretty straightforward. My high school was a "School for the Humanities," which wouldn't seem like a first choice for someone interested in mathematics. But, it did prepare me for the small liberal arts education I chose afterward. And, I knew I would be a mathematics major even from my first semester at Bryn Mawr College, so that wasn't the accidental part of this story.

There was the inevitable point in my college career when I needed to consider life beyond college and still had no clue where I was headed. Here is where having a stream of likes and an ocean of dislikes was unhelpful. Luckily, the first best decision I've made in my life was to choose a college where I had professors who saw my potential and did what they could to draw it out of me or to encourage me further. Enter senior year, where following an invitation from one of my professors, Dr. Victor Donnay, I elected to do a senior research project based on biological applications of mathematics. At one point, four years earlier, I read briefly about something called "biomathematics," on the still nascent internet. It was some area of mathematics that scientists were using to study diseases like HIV. At that point, biology still resided in my ocean of dislikes, so I quickly forgot about the field. When I started to learn exactly how mathematics could be used to study the flow of chemicals through the body and the transmission of diseases within heterogeneous populations, I began to reconsider. I had stumbled into an entirely new world of possibility. Accidentally.

A year and a half after graduating college, I decided to pursue graduate study in mathematics. I targeted my search to programs with research opportunities in mathematical biology. The second-best decision I've made in my life was to attend the University of Utah for graduate school. I could speak at length about the implications of a black woman pursuing a doctoral degree in mathematics in the state of Utah and the implications of being the only black graduate student among dozens in the program, but I won't. What I will say is that the most important aspect of completing my graduate education was the support network I developed through various mentors and fellow graduate students, and being in a graduate program characterized more by collaboration than competition, with faculty who clearly wanted us to succeed. These factors may sound like common sense, but too many mathematics graduate programs lack them.



In an environment where stereotype threat is very real and imposter syndrome runs rampant, it was essential for me to shed (read: ignore) as much unnecessary weight as I could and to pretend as though I was any other graduate student. It wasn't always easy, but I did what I could.

The third best decision I made in my life was participating in the Enhancing Diversity in Graduate Education (EDGE) program in the summer preceding my first year of grad school. In actuality, it just confirms why attending Bryn Mawr was the first best decision I made, but I will get to that. Created by Dr. Sylvia Bozeman (Professor Emerita at Spelman College) and Dr. Rhonda Hughes (Professor Emerita at Bryn Mawr College) in 1998, the EDGE program is focused on increasing the number of women and underrepresented minority students who complete graduate programs in the mathematical sciences. At the suggestion of Rhonda Hughes, I applied to EDGE. As a participant in the summer program, I was introduced to the academic life of a graduate student – a harsh dose of reality – but in a completely supportive environment. EDGE was also the first time in my life I met black women mathematicians who had already done what I was getting ready to spend the next several years of my life doing. There is such a normality to their presence that I sometimes forget what the actual composition of mathematical community is. In the years since that first summer at EDGE, I have amassed a network of friends, colleagues, mentors, and research collaborators without whom I'd be less likely to be where I am today.

So where am I today? I am a mathematics professor at my alma mater, where I hope to be the kind of advocate and mentor that I have been lucky enough to have throughout the course of my mathematical career. I get to work on research problems that delve into the underlying mechanisms of type 2 diabetes development and reproductive hormone (dys)regulation, and I get to learn cool biology (now in my stream of likes) in the process. I also work to generate for my students an appreciation for applied math and math biology that I developed as a college student. I mean, who doesn't want to study the zombie apocalypse using mathematics?

More importantly, I want to help normalize the presence of women and underrepresented minorities in the mathematical world. The overwhelming popularity of the film *Hidden Figures* has, thankfully, catapulted a mainstream discussion of diversity in STEM fields.

Websites like NSF ScienceMakers (<u>www.thehistorymakers.com/makers/sciencemakers</u>) and Mathematically Gifted and Black (<u>mathematicallygiftedandblack.com</u>) are also helping to highlight the accomplishments of black scientists and mathematicians.

I didn't set out to be a mathematical biologist. I consider mine to be a story of mostly happenstance and opportunity; but, I often wonder how different my story would be were it woven with the denser threads of bias, invisibility, and discouragement that are sewn into the fabric of so many young black lives.



Erica Graham is an assistant professor of mathematics at Bryn Mawr College. She received her Ph.D. in Mathematics from the University of Utah and was an NSF Alliance postdoctoral research fellow at North Carolina State University. Her primary research area is mathematical biology, with a particular focus on endocrinology. Recent work includes mathematical modeling of diabetes development, metabolic dysfunction, reproductive hormone regulation, and ovulatory dysfunction. Dr. Graham currently serves as chair of the organizing committee for the 2017 Workshop Celebrating Diversity, hosted at the annual meeting of the Society for Industrial and Applied Mathematics.

Positioning Yourself to Be an Advocate... Even When It Is Unpopular Margaret Walker



The voice of many has the potential to be far stronger than the voice of one, which is a reminder that I do <u>not</u> have to advocate alone. Organizations like the Benjamin Banneker Association (BBA) provide a collective opportunity to advocate for what is right, and to advocate for what is just. Joining BBA and its vision of advocacy was natural for me. BBA provides a conduit through which I can

continue to advocate for all students and educators on issues pertinent to their ongoing success.

To be an advocate, I believe you must have a seat at the table. You must be present in the places where the decisions impacting students and educators are made. To do less is to be full of good intentions, yet without any real sustenance, and you become as a "sounding brass and tinkling cymbal" (1 Corinthians 13:1, King James Version).

I acknowledge that the path of advocacy is challenging, because this is where "the rubber meets the road", and you are compelled to challenge the status quo. In the field of education, the status quo has not aided or abetted all people, nor do I believe was it designed to fully support children and educators of color. While there are success stories, the vast numbers of unsuccessful students remain unacceptable on all levels.

Where do I stand? What am I willing to do to change the status quo?

I believe in addressing the elephant in the room. We must have honest conversations, and then we must act. We require more, we want more, and therefore we must demand more. I define unsuccessful students as those who leave a grade level - or even school - without the required tools to move on successfully to the next phase of their educational journey. These students are unable to maintain and function at or above their current grade level, and I often wonder, "Why is this still the case, and what am I willing to...no, what are we willing to do about it?"

Stop and ask yourself these questions: "Where do I stand?" and "Do my actions show this is where I stand on educational issues that impact students and educators – particularly those of color – at all levels?" That tends to be the part we get stuck on. Fortunately working collaboratively has provided a method to go beyond mere words, and to begin to put some of those words into action. BBA is now on the move. We are not only talking about, but acting towards focusing on equity, access and social justice as we create and cultivate change in our communities. Where do you stand in this movement?



Margaret Walker has been in education for 33 years. She currently is the mathematics coach at the great Catalina Elementary School in Orlando, Florida. She taught high school mathematics for 23 years and served as a Mathematics coach, specialist and department chair for Orange County Public schools. Margaret is active in education at the local, state and national levels and is the immediate Past-President of the Benjamin Banneker Association and the Florida Council of Teachers of Mathematics.

Margaret believes that all children can learn, maybe not all in the same way or at the same rate. She received her Associates of Arts and Bachelor of Arts Degree in Mathematics and Secondary Education from the University of South Florida, her Master's Degree in Inter-Disciplinary Studies in Curriculum and Instruction and her Specialist Degree in Educational Leadership and Administration and Supervision from National Louis University.

Girls (STEM) Institute (GSI): Changing the World by Challenging, Empowering and Transforming Girls and Young Women

Crystal Morton

As a former mathematics student, college mathematics major, high school mathematics teacher and current mathematics educator, I have experienced and observed mathematics instruction completely devoid of any real meaning. It is very difficult for me to pull up any memories of engaging with mathematics during the myriad of courses and classes that addressed my lived experiences as a black and female mathematics learner raised in the rural south. In my experiences as a high school teacher and mathematics educator, I have talked with several Black females - some who love math, some who like it, some who just tolerate it and some who hate it - that share their lack of connection with school mathematics, the negative experiences they have in classrooms as well as not seeing how their mathematical knowledge can be used as a catalyst for social change.

It is these types of stories coupled with my lived experiences and the underrepresentation of Black females in STEM related careers that led me to create an informal learning space to provide holistic and transformative learning experiences for females of color. The success and effectiveness of this learning space hinges on the collaboration between the learner, their caregivers, university administration, faculty, staff, and students, local businesses, and community members. This learning space is known as Girls STEM Institute (GSI).



GSI operates as a fourweek summer program with monthly year-round follow programming. Young ladies of color are provided an opportunity to develop an understanding of mathematics and other STEM concepts in a meaningful and culturally grounded context. Within GSI's rich, rigorous, relevant, and supportive context, young ladies have the freedom to grow interpersonally and intellectually.

Through GSI, young ladies are provided access to powerful and transformative STEM learning experiences that challenge them to think deeply and critically. These experiences also empower them to use STEM as a tool for personal and social change. GSI also reinforces the importance of higher education, aims to help young ladies develop more positive perceptions of STEM, and increase the flow of underrepresented groups to upper level mathematics courses as well as other STEM related degrees and careers.

Girls STEM Institute is unique in that it focuses on the whole person through the integration of STEM learning with overall wellness and well-being. Family and community engagement are major components of GSI. We recognize that it is not enough to support the learning of the students, but families and communities must be engaged for critical systemic and long-term change to occur.

Some goals of GSI include:

- Engage girls and young women in transformative, culturally grounded, inquirybased STEM curricula through hands-on and minds-on experiences;
- Instill girls and young women with the interest and confidence to pursue math or other STEM careers and engage in STEM related extracurricular activities while providing opportunities to interact with STEM professionals;
- Empower girls and young women to understand how STEM related concepts can be used to address inequities in their personal lives and community;
- Increase girls' and young women's mathematics skills (i.e. problem solving, number sense, geometry and measurement, and statistics);
- Provide college and career readiness experiences;
- Promote the intellectual, social, physical, emotional and financial wellness of participants;
- Build authentic relationships/partnerships with parents and community stakeholders;





Powerful mathematics takes into account students' experiences, education, and community context (Skovsmose & Valero, 2008). This means that students must "receive a mathematics education that is inclusive and prepares them for tomorrow; they should receive an education that enables them to learn powerful mathematics and to be citizens in a society where their knowledge—especially their mathematical knowledge—can help determine their future and future of their world" (Malloy, 2008, p. 24). Girls STEM Institute is answering this charge.

Please contact Dr. Crystal Morton at <u>cmortongsi@gmail.com</u> if you would like to learn more about Girls STEM Institute and/or would like to find out how you can support this effort.

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Dr. Crystal Morton is an Associate Professor of mathematics education at Indiana University Purdue University at Indianapolis (IUPUI). She teaches undergraduate and graduate courses in Elementary and Secondary Mathematics Methods, General Secondary Methods, and Assessment in Schools. Her research is driven by a passion to understand why African American students, particularly females, are disproportionately underachieving in mathematics. She has designed and implemented two summer programs focusing on the mathematics and science development of African American students. For the past four years, she has designed and implemented a program

to engage African American females in mathematics to increase their confidence and interest in STEM related careers. This former high school mathematics teacher has received multiple awards for her service, research, and teaching. Dr. Morton holds a BA in Mathematics, an M.A.T in Secondary Mathematics Education and a Ph.D. in Education from the University of North Carolina at Chapel Hill.

To Be Young, Gifted and Black

Candice Price

I am an assistant professor in the mathematics department at the University of San Diego, and I think of myself as a ripple maker. I am someone that helps to create change to what can sometimes seem like a calm and normal surrounding: small ripples that turn into large waves.

The latest ripple I have been involved in making is a website that launched in February 2017, Mathematically Gifted and Black (<u>www.mathematicallygiftedandblack.com</u>). I, along with colleagues Erica Graham of Bryn Mawr College, Raegan Higgins of Texas Tech University, and Shelby Wilson of Morehouse College came together to create Mathematically Gifted and Black (MGB). We reached out to 24 Black Mathematicians who are well known in the mathematics community for their contributions to research, education, industry, government, academia, and outreach. We selected an additional 4 mathematicians that we labelled as rising stars-- those who are contributing to multiple facets of the mathematical community early in their career. We were inspired in part by a website celebrating Hispanic Heritage Month by honoring Latin@ mathematicians and the release of the Academy Award nominated film, *Hidden Figures*, which focused on three black female mathematicians and their experiences at NASA. The website came to life quicker than expected and has been tweeted, posted to Facebook, and mentioned in the NY Times.

I am someone that helps to create change to what can sometimes seem like a calm and normal surrounding: small ripples that turn into large waves.

The response to MGB has been overwhelming positive. I believe strongly this is due to the power of the personal story and its ability to help others better understand people and shed stereotypes. The mathematicians we spotlighted could tell their story in their own words, to discuss their proudest moments, in mathematics and in life, and include personal stories of struggle along with inspirational anecdotes. All were allowed to be themselves, unapologetically.



Candice Price grew up in Sacramento, California. She received at BS in mathematics from California State University Chico, an MA from San Francisco State University, and her PhD from the University of Iowa. She is currently an Assistant Professor at the University of San Diego. She enjoys playing and watching rugby, watching documentaries and reading. Her service mission is to create and contribute to programs that broaden the participation of underrepresented groups by focusing on strong mentoring and research networks.

Lessons from the Journey

Mr. Trevor Muhammad

I want to thank Benjamin Banneker Association, Inc. President, Brea Ratliff, for inviting me to contribute to this inaugural edition of The Lighthouse. The theme, "Addressing the Neglect and Building Hope in African-American Learners," is exactly my life story. I established a program in my community that addresses some of the neglect and hope issues Blacks encounter. By sharing my journey from high school student to program owner and director, I hope to inspire others to pursue careers in science, technology, engineering, and mathematics (STEM).

EARLY YEARS

My STEM journey started in 10th grade when I decided to go to college to become an engineer. Honestly, I had no idea what engineers did, but society said those who are good with math should become engineers. I was mostly an A/B student in mathematics, and took advanced English, geometry, algebra, trigonometry, precalculus, chemistry, and physics.



THE SACRIFICE

I'm not a genius, so I really had to study a lot. Those advanced courses were quite challenging, especially the physics. I fell asleep many nights with my head on the kitchen table, woke up after midnight or so, and then finished more homework. I passed up many opportunities to see the latest movies or to go to the mall with friends because I had school the next day. Fun was for weekends. Furthermore, I worked during my senior year and had to balance work and school. It was easy for me to say "no" to friends when saying "yes" meant I wouldn't be able to study for a chemistry test. That sacrifice paid off and allowed me to graduate as one of the top 10 of 294 seniors.

THE STRUGGLE WAS REAL

After graduation, I started college at Auburn University at Montgomery (AUM) as a pre-engineering major. After one engineering course my freshman year, I decided I needed more mathematics. The same year, I changed my major to pure mathematics and dropped out of engineering, but for a good reason -- I loved the mathematics and the problem-solving. I had no idea that engineers solved problems, too.

While at AUM, I continued my high school study habits of falling asleep with a nap and waking to finish assignments. I was so committed to doing well that my mathematics professors knew my name because I visited their offices for extra help with homework or with test problems I had gotten wrong. That persistence and commitment to excellence worked because I graduated with honors with a degree in pure mathematics.

Why would I visit my professor if I had scored 92 percent on a test? Simple answer: I wanted to know why I missed the 8 percent. Sure, wanting to make perfect scores in mathematics might sound "nerdy" or "geeky." However, those types of comments typically come from poor students, from jealous people, and from those who are not committed to academic excellence. I got my share of "hate" for trying to be a top student.

Sometimes I was the only one having a discussion with the mathematics professor during class because the other 15 classmates had no clue about the lesson. I had done my homework. Eventually, I quickly learned to not share my academic progress with classmates and with others unless there was a real need. My typical response to "How did you do on that last hard test?" was similar regardless to whether I made 100% or 85%. "I did okay. That test was tough."

THE NEED

I discovered while I was a sophomore in college that Black students' mathematics test scores were the lowest of all races and that our community needed more mathematics teachers badly. I was already a mathematics tutor at AUM, so I chose to finish at AUM and to enroll in graduate school at Alabama State University (ASU). While at ASU, I earned a master's degree in mathematics education and teacher certification. I wanted to share my mathematics skills with those who needed help most. For five years, I taught mathematics at predominantly Black schools in Selma and in Dallas County in Alabama.

While teaching high school, I engaged in many activities to benefit our students. I created a mathematics club and held intramural practice mathematics competitions, so our students could get be prepared for the larger area-wide tournaments against other schools. I saw Black students do well and excel in mathematics just like other ethnic groups. In 2000, our graduation exam scores were at the top in the Dallas County school system. Our students did well when we consistently raised the standards for excellence and helped them to meet those high standards. It took support from parents, teachers, tutors, and community leaders who all had high expectations for the students.

Here's a point worth noting: During my 20 years of teaching, I've seen too many college students change their majors from something they wanted to do as a career because the coursework required a precalculus or a trigonometry course. One or two math courses have stopped too many aspiring nurses, architects, scientists, medical doctors, engineers, and computer programmers.

A NEW LEVEL

After hearing several students say, "I never understood math until you explained it to me that way," I started to believe them. I took concepts like solving problems involving percentages, fractions, geometry proofs, and AP Calculus and explained them in a way that students could learn them easily. I gave students hope that they could make it through the mathematics course they were currently enrolled in, and even do well in the next mathematics course. I made them believe in themselves as learners.

Furthermore, once I learned that Blacks had used mathematics and engineering to build both the White House in Washington, D.C. and the Pyramids in Africa (Asia before it was renamed by explorers), I knew that mathematics was in my and my students' genetic DNA. We are supposed to excel at mathematics, science, and engineering. I expect my students to take over NASA, these big private corporations and to dominate the engineering and the scientific research departments.

COMMUNITY OUTREACH

In 2002, I took my mathematics skills to a new level and started an academic tutoring business, Enjoy Learning Center. I used \$1,600 of my personal funds and started tutoring students one-on-one in their homes. God blessed the business and within one year, I had enough clients and could afford to rent a 450-square foot office. Our headquarters is now in an 1,800-square foot facility and employs eight tutors. The tutorial program helps several students weekly with a variety of subjects such as reading, writing, mathematics, chemistry, AP Calculus, and ACT prep. We have helped several hundred students improve academically over the last 16 years.

BUSINESS LESSONS

I learned a while back that people will pay for excellence. All who pay for services want to get the most for the dollars they spend -- you, me, and everyone. Average products and services mean someone with superior products and services will replace us.

OTHER LESSONS

If you dedicate yourself to mastery of a particular discipline (STEM I hope), then money will follow easily. I've enjoyed teaching and tutoring math for over 25 years. I'm committed to continually mastering the art of teaching it to students, so I can better serve them. This commitment to continually improving myself and to being better than I was last week, last month, and last year keep me improving in my profession. God put that desire for excellence and community service into my spirit, and God nourishes that force within me.

EXCELLENCE FOR EVERYONE

Only a few people will ever become mega-successful like the top entertainers, athletes, and CEOs of major corporations. There can only be a few like LeBron James, Mark Zuckerberg (Facebook), Oprah Winfrey (media mogul), Bill Gates (Microsoft), or the \$100 million-dollar lottery winner. That mega-success is what the masses of people desire.

However, excellence is something that's available to everyone. We all can achieve excellence each day of our lives, yet only a few people ever seek to become excellent.

Seek to become excellent in some discipline of learning that you enjoy.



Mr. Trevor Muhammad was born in New York and moved to Alabama at age 10 with his parents. He received a B.S. (with honors) in pure mathematics (Auburn Univ. at Montgomery, where he was Most Outstanding Senior in Math), and an M.Ed. in secondary mathematics education (Alabama State Univ.). Trevor is currently an Alabama State Department of Education Class A (master's level) certified teacher.

Mr. Muhammad has taught grade school for five years but has taught developmental math for the previous 15 years as a fulltime faculty member in the Department of Advancement Studies at ASU.

He owns and directs a one-on-one tutoring program. He and his staff of eight tutors teach a variety of subjects.

Trevor has been married to his wife Angela for 20 years. They have four home-schooled children. In his spare time, Mr. Muhammad writes and develops Java computer programs.

Read more about his tutorial program at <u>www.EnjoyLearningCenter.com</u>. Follow his computer coding lessons YouTube channel at TheTechMaster4u.

Want to learn more about the Benjamin Banneker Association?

Visit www.bbamath.org and follow us on Facebook (https://www.facebook.com/bbamath/)



If you are interested in contributing to the next edition of *The Lighthouse Almanac*, please contact Brea Ratliff at <u>bratliff@bbamath.org</u>.

We will accept:

- A personal story / original essay;
- An abstract describing your current research or related projects you are developing;
- Commentary of a current event or issue;
- An activity or lesson for PK-16 teachers or teacher educators;
- A resource for parents; or
- A tool (e.g. A Cultural Proficiency Rubric / Checklist) for educators, school administrators