Volume 2, Issue 1

The Lighthouse Almanac

A peer-reviewed journal published by the Benjamin Banneker Association, Inc.

Teaching Mathematics Through a Social Justice Approach

The Lighthouse Almanac

The Benjamin Banneker Association, Inc.
Volume 2, Issue 1

Features

Message from the President

Brea Ratliff
BBA President 2017 – 2019

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BBA On the Move

Call for Proposals

The editorial panel of *The Lighthouse Almanac* encourages all readers – especially PK-16 educators, teacher educators, school/district leaders, and mathematicians – to consider writing for the journal. The focus for our next issue will be **Critical Issues in the Mathematics Education of Black Children** and is scheduled to be released in September 2019. We will consider the following submissions related to the topic:

- 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 educators or teacher educators;
- A resource for parents; or
- A tool (e.g. a Cultural Proficiency Rubric / Checklist) for educators, school administrators

Manuscripts will be reviewed and accepted based on their alignment to topic as well as the mission and goals of the Benjamin Banneker Association, Inc. For more information, please contact Brian Lawler at blawler4@kennesaw.edu.

Proposal Submission Deadline: **May 31, 2019**

The Lighthouse Almanac

The Benjamin Banneker Association, Inc. Volume 2, Issue 1

The Benjamin Banneker Association would like to express our sincere appreciation to the following individuals who reviewed the submissions for this issue.

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Purpose and Goals of the Association

The purpose of The Benjamin Banneker Association, Inc. are the advancement, stimulation, extension, improvement, and coordination of the learning and teaching of mathematics for *all* students at *all* levels, with special emphasis on students of African ancestry.

The goals of the Association shall be

(a) to serve as advocate for the educational and professional needs of its members,
(b) to serve as advocate for the educational and developmental needs of students of African ancestry, and
(c) to provide educational solutions and policy alternatives to the educational issues which affect the participation and success of students of African ancestry in mathematics learning.

In executing these goals, The Benjamin Banneker Association shall promote and provide opportunities for networking among individuals, institutions, groups, and agencies operating for the betterment of the educational systems of these United States and Territories and promote and provide opportunities for students of African Ancestry to participate and excel in mathematics learning.

Toward this end The Benjamin Banneker Association shall do the following:

- Serve as a resource for The Benjamin Banneker Association membership,
- Develop programs and activities that encourage and support scholarly and professional activities of The Benjamin Banneker Association membership,
- Develop programs and activities that encourage and support participation and excellence in mathematics learning among students of African Ancestry
- Disseminate educational information to The Benjamin Banneker Association membership,
- Identify fiscal and material resources that support The Association's programs and activities and Collaborate with other interest groups when purposeful in seeking the goals of The Association.

Message from the President

Our culture in America often prioritizes—and even rewards—a constant focus on our individual needs without consideration of the needs of our neighbors and community. Sadly, our fight for self-preservation often leads to selfish action, division, and a deepened fear of people that don't look like us or share our ways of thinking. What's especially disconcerting is to see how our cultural dissensions have impacted schools and learning.

When we look at our personal issues through the broader picture of community, we see children not provided access to rich curriculum, teachers and administrators who lack the resources necessary to adequately serve students, and a revolving door of reform efforts and policies that are meant to improve what is being done, but never quite hits the mark.

BBA President, Brea Ratliff, facilitating a BBA workshop about Benjamin Banneker for Boys and Girls Club staff (San Antonio, TX).

When we zoom in to the local context, we recognize the needs are even more complex. But I still believe there is hope.

If you're like me, you've chosen to volunteer and participate in organizations like the Benjamin Banneker Association because you also believe there are answers to the problems and challenges plaguing our educational system. As an organization, we have directed our efforts toward creating educational spaces rooted in culturally relevant instruction. Attending to the teaching of mathematics through a social justice approach is one of those answers.

One benefit of focusing on social justice as mathematics educators is that its impact is felt both individually and globally. Implementing a social justice approach to teaching and learning necessitates that groups of people work together. It means addressing the inequity, unfair practices, and violence in classrooms and communities with an assurance that change will take place. A social justice approach means we move from making pledges to taking action.

As an organization established to be national advocates for children and young adults, the Benjamin Banneker Association is promoting a social justice approach to mathematics curriculum because we are committed to leveling the playing field and promoting the highest quality learning experiences for students of African ancestry.

I believe we are called to be both proximate and responsive to those in need; with the social justice approach we better understand our own and others' experiences. While it may be uncomfortable, we must continue to encourage our friends and colleagues to participate in conversations around race, equality, and equity in mathematics classroom. As we consider the perspectives and experiences of others, we avail ourselves to the possibility of developing effective solutions. Collectively, we have a voice which can change the narrative and bring forth justice for all people.

Sincerely,

Brea C Ratliff

Brea Ratliff
President, Benjamin Banneker Association, Inc.

About BBA's Position on Social Justice

Kwame Anthony Scott

My name is Kwame Anthony Scott. I am the North Central regional Director for the Benjamin Banneker Association (BBA) as well as the Board Liaison to the Educational Policy Committee. This committee is one of twelve committees of the BBA that are designed to serve as advocate for the educational and professional needs of its members and children of African ancestry.

The Educational Policy Committee was charged with writing a BBA Social Justice Position Statement, to include attention to equity. Social justice is not a new idea within the educational milieu, but BBA needed to give social justice a definition that is pertinent to the work we must do.

People of African ancestry have a unique history. For hundreds of years our beliefs were communal, and our acts were corporate. However, our indigenous practices were distorted after centuries of slavery, Jim Crow segregation, racist terror, and institutional exclusion (Woodson, 1933/2017). Consequently, we need a process to identify, examine, diagnose, discuss, and determine solutions to those political, economic and social conditions that have an adverse effect on our lifestyles as a people. We call the name of this process ***Social Justice.***

The purpose for writing this article was to revisit and summarize BBA's Social Justice Position Paper, and to bring clarity to the readers to why we wrote it. The actual position is online on BBA's website www.bbamath.org. BBA's position paper can provide a resource and an encouragement for our membership to continue to join us in the struggle to move our children off the bottom of the academic achievement ladder.

The challenge for educators is to make the content relevant while keeping students engaged in the classroom activities as they learn the concepts, skills and application of mathematics that is presented in the school's mathematics curriculum. In response, we wrote the position paper to encourage teaching and learning of mathematics while placing the content within the context of the family, community, history and culture of the children of African ancestry.

What follows is a summary of the BBA Educational Policy Committee's purpose for writing the BBA Social Justice Position Paper. This does not cover all of the points, but the purpose, problem and method to illustrate the thought process we used to designing the position paper.

Purpose

Too many teachers are missing or are unaware of opportunities to develop and implement issues of political, economic and social conditions as mathematical application so they can engage students in their lesson's activities. These opportunities could provide the ability to teach mathematics content using context that resonates with and appeal to student interests. Furthermore, these types of application can be used in mathematics instruction to achieve change in positive ways for the students' communities. Consequently, we need a process to identify, examine, diagnose, discuss, and determine solutions to those structural conditions. We call this process Social Justice.

Problem

For equity and access—buzz words in education—as it concerns the schooling process in the United States of America, there is little or no equity to speak of. Schooling, by design, is a process that is intended to propagate and continue the power relations of the larger society and the established structure(s) that maintain those arrangements. Those in power work to legitimize the school system as it stands and describe the failure of the educational system vis-à-vis people of African ancestry. The problem is created and defined by them, and the supposed solutions are provided by them.

Method

To move in the direction of Social Justice as defined by the Benjamin Banneker Association, the educator must be mindful of the historical and persistent economic, social and political context of the educational system in which he or she is engaged. Given the aforementioned circumstances surrounding the education of children of African ancestry, creating and developing a core belief that embraces aspects of social justice should be embedded within classroom lessons. We are providing a support for a social justice approach to the mathematics curriculum. This approach would have the following elements: self-love and respect, issues of social injustice, and awareness raising and social action. Classroom examples of each follow:

Self-love and respect

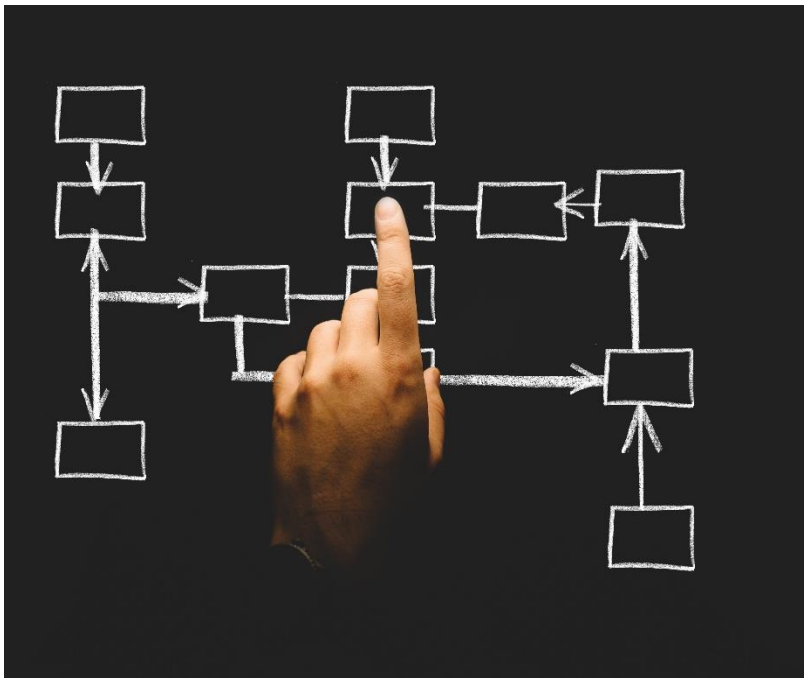
- Introducing students to Hypatia an Egyptian mathematician, inventor, astronomer and philosopher, or to Timbuktu's manuscript so that students learn of the depth of mathematical knowledge that was used in that time.
- Increasing students' knowledge of African culture by using the Great Pyramids of Giza to illustrate the use of pi and other geometric concepts.

Issues of Social Justice

- Where is the equity in Stop and Search policing? If an officer has reasonable grounds to believe that someone has been involved in a crime, they are given the power to stop and search that person by the Police and Criminal Evidence Act of 1984.
- Students would be given a data set of the racial demographics of Stop and Search suspects as opposed to the city population. Students could be challenged to create a visual representation of the data and use it to explain graphically the equity or inequity of Stop and Search practices.
- Students could be encouraged to create further questions, illustrating and extending their findings.

Awareness raising and Social Action

- Can there be economic equality? Students would be presented a chart illustrating the economic differences between Asian, White, Hispanic and African Americans. The chart would include median income, ratio of number of businesses owned to population, number of times the money moves around their neighborhood, and unemployment.
- Students could create ratio tables with race as an independent variable. Next students could graph these relationships on a common Cartesian plane. This would allow students to make predictions and explain the graphs relationship to unemployment.
- To conclude, students research and/or propose solutions to the plight of the African Americans or other racial groups in the data.



Conclusion

When students are taught mathematics through the thoughtful implementation of a social justice approach to a mathematics curriculum, they have learned not only mathematics concepts and skills, but more importantly they recognize the both the legacy of achievement in their ancestry and the responsibility that has been passed on to them. A social justice approach to a mathematics curriculum will enrich the teaching and learning of all students by showing them how the subject is applied critically in solving real life issues.

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Dr. Kwame Anthony Scott earned a BS and MA in Mathematics to deepen his understanding in mathematics, a MA and EdD in Administrative Leadership to work with and encourage people to move under one vision and mission, and a MS in Inner City Studies to enlarge his understanding in the history and culture of people of African ancestry. He has directed a city-wide program called the Chicago Mathematics, Science and Technology Academies (CMSTA). He was responsible for small schools within ten Chicago high schools and their respective feeder schools. Dr. Scott has worked as a consultant with Americas Choice, Pearson and my company Djehuti Maathematics, LTD. He is also an adjunct professor at National Louis University where he has taught methods courses for preservice mathematics teachers and supervised student teachers. He also teaches at Harold Washing College and is a member of several national mathematics organizations. Contact Dr. Scott with any questions or concerns at ascott@bbamath.org.

Promoting Self-Love and Knowledge in Mathematics for African-American Students

Kyndall Brown

In 2017, the Benjamin Banneker Association (BBA) released their position statement entitled "Implementing a Social Justice Curriculum: Practices to Support the Participation and Success of African-American Students in Mathematics." The position statement is a call to rethink instructional practices in mathematics for African-American students. To support the implementation of a social justice curriculum, BBA (2017) recommends a variety of curriculum elements including Self-love and Knowledge.

> The mathematics curriculum is inclusive of lessons which use historical and contemporary context to highlight the contributions of Africans and those of African ancestry. As a result, a sense of dignity in their culture, heritage, ethnicity/race, is cultivated in the classroom. Negative stereotypes about students' identities and abilities to create and apply mathematics are deconstructed as a result. (p. 4)

In order to attend to the curricular element of Self-love and Knowledge, teachers of African-American students need access to instructional resources that include the contributions of people of African descent to the field of mathematics. Unfortunately, few textbooks that are used in K–12 schools have any information of this nature. It then becomes the responsibility of the teachers of African-American students to find this information for themselves and incorporate it into their mathematics lessons.

There are a number of ways that teachers can increase their student's knowledge of the contribution of people of African descent to the field of mathematics. One way is for teachers to allow students to explore African mathematical artifacts, number systems, and games. For example, the oldest mathematical artifact in the world is the Ishango Bone, a counting instrument that was "discovered" in the 1950's by a Belgian archeologist in the African country of the Congo (Zaslavsky, 1973). The instrument has groups of markings that imply an understanding of addition, doubling, base 20, and prime numbers. Students can study images of the bone to identify the many number patterns. Such an activity can lead into a discussion of prime numbers and factorization. *An outline for a classroom activity is provided in Figure 1.*

Another option would be to study the number system of the Yoruba people of Nigeria (Zaslavsky, 1973). This base-20 number system relies on addition, subtraction, and multiplication to compose numbers up to one million. Studying the Yoruba number system reinforces place value and order of operations.

There are a variety of methods of multiplying that were used in Africa. The Egyptian method of multiplication by doubling, and the lattice method are two of them (Van Sertima, 1983). Students can be taught these methods of multiplication, determine why they work, and compare them to the standard algorithm currently used in schools. African games like ACHI and Mancala can be used to teach logic, critical thinking, and problem solving.

Another way to attend to Self-love and Knowledge is to research the contributions of people of African descent to the field of mathematics. For example, African-American students can study the wealth of mathematical knowledge of the ancient Egyptians. Artifacts "discovered" in Egypt reveal the ancient Egyptians had their own number system, measurement system, and methods of performing mathematical operations. The ancient Egyptians also had a very unique way of solving equations of the first and second degree known as the method of false position (Gillings, 1972).

The Ishango Bone Lesson

Goals of the Lesson

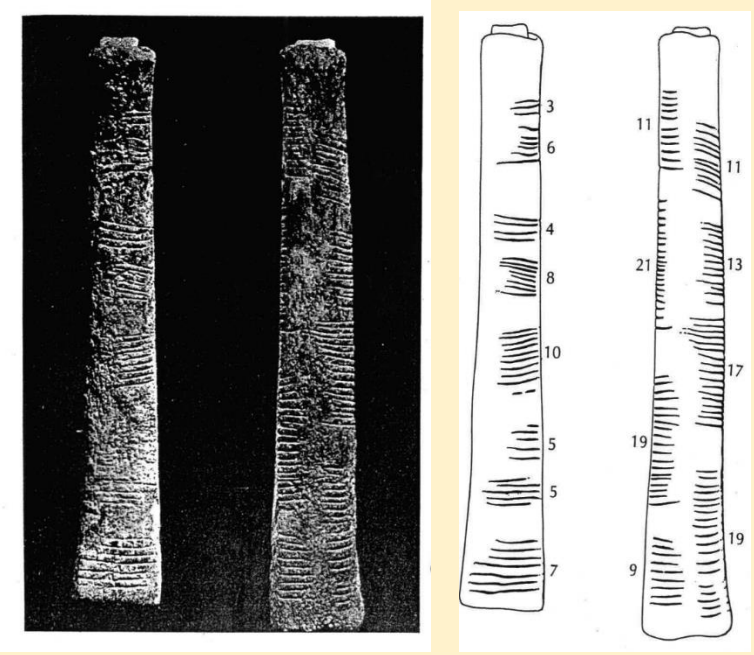
Students explore number patterns with the Ishango Bone. These patterns include: doubling, addition and subtraction, prime numbers, and sums of number columns.

Introduction

Students read or watch a video about the history of the Ishango Bone. (https://video.search.yahoo.com/search/video?fr=aaplw&p=Ishango+Bone+Video#id=2&vid=8f6ebc3b797b11f8ff621e2435128b82&action=click)

Students examine a map of the continent of Africa and locate the country of the Congo, where the Ishango Bone was discovered.

Exploration



Students receive copies of a picture and drawing of the Ishango Bone (pictured right). Students work in pairs or groups to identify patterns in the numbers on the columns of the Ishango Bone. After sufficient time to explore, students share the patterns they discovered. These patterns will be recorded on the board, overhead projector, or chart paper.

Possible patterns that students will identify are:

- Doubling patterns. One of the columns has the numbers 3, 6, 4, 8, 10, 5, 5, 7. They may observe that 3+3=6, 4+4=8, and 10=5+5.
- Addition and subtraction patterns. One of the columns has the numbers 11, 21, 19, 9. These numbers can be represented as 11=10+1, 21=20+1, 19=20–1, and 9=10–1. Also, 11+10=21 and 19–10=9.
- Prime numbers. The third column has the numbers 11, 13, 17, 19. These numbers are the prime numbers between 10 and 20.
- Sum of the Columns. The sum of the numbers in the first column 3+6+4+8+10+5+5+7=48. The sum of the numbers in the second column 11+21+19+9=60. The sum of the numbers in the third column 11+13+17+19= 60.

Analyze

Students respond to the following questions verbally or in writing.

- What do you think the Ishango Bone might have been used for? Why do you believe that?
- How might the creators of the Ishango Bone have used doubling?
- What base number system might the creators of the Ishango Bone used? How do you know?
- Why might the creators of the Ishango Bone have a column of prime numbers? Why are prime numbers important?
- How are the sums of the columns on the Ishango Bone related? What might those sums represent?

The BBA position statement on social justice is not just for teachers. There is most definitely a role for teacher preparation programs, district personnel, and professional development providers in helping mathematics teachers make their curriculum and instruction more culturally responsive and relevant.

Thomas Fuller. Taken from https://bit.ly/2Pm6x5H

Teachers can have their students study African-American mathematicians like Benjamin Banneker, or his less well-known contemporary Thomas Fuller. The first African-Americans to receive PhD's in mathematics, Elbert Francis Cox and Euphemia Lofton Haynes, could be the topics of great research projects. The popularity of the recent movie and book "Hidden Figures" has opened up a new chapter in the history of African-American women in mathematics (Shetterly, 2016).

The BBA position statement on social justice is not just for teachers. There is most definitely a role for teacher preparation programs, district personnel, and professional development providers in helping mathematics teachers make their curriculum and instruction more culturally responsive and relevant. In order to assist teachers in incorporating these ideas into their instruction, teacher preparation programs must do a better job of exposing pre-service teachers to resources such as those referred to in this commentary. The contributions of people of African descent can be incorporated into mathematics methods courses, and teachers can be required to create lessons that include this information.

Dr. Elbert Francis Cox. Taken from https://bit.ly/2BVc4Nj

Dr. Euphemia Lofton Haynes. Taken from https://bit.ly/2QJNjMo

District personnel, such as mathematics coaches and administrators, can support teachers in the lesson planning process, and provide feedback on culturally relevant mathematics lessons. Professional development providers can offer programs that are specifically designed to expose teachers to the African mathematical legacy. This support requires that teacher educators, district personnel, and professional developers be well versed on African mathematical history themselves.

Studying the mathematics of different African cultures and researching the lives of African-American mathematicians are two ways to promote Self-Love and Knowledge and make the BBA position statement come alive.

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Kyndall Brown has over 30 years of experience in mathematics education. Kyndall holds a bachelor's degree in mathematics, master's degrees in computer-based education and mathematics education, and a PhD in Education. He was a secondary mathematics teacher for 13 years and has been a professional development provider for schools and districts in Los Angeles County for over 20 years. He is currently the Executive Director of the California Mathematics Project. He presents at local, state, and national conferences and writes articles on mathematics education. His research focuses on the impact of culture and identity on the ways that African-American males learn mathematics. Contact Dr. Brown at kyndallb@math.ucla.edu

Reclaiming Their Time: Removing the Barriers to Ensure Equity in Our Children's Education

Natalie Holliman, Veda Pendleton, Kelli Mack, Kendra Nwosu

For years I labored with the idea of reforming the existing institutions of society, a little change here, a little change there. Now I feel quite differently, I think you've got to have a reconstruction of the entire society, a revolution of values.

– Dr. Martin Luther King, Jr. (Halberstam, 1967, p. 47)

Education exists in our society as it has for many years, one-dimensionally, where the teacher is the giver of knowledge and students bring their empty slates to be filled. One may suggest that by making a little change here and a little change there, small steps can work to reform the existing organization of education within our society. These little changes may look different in various contexts, and could include changing the curriculum, instituting mathematical practices, or changing funding formulas to better support the educational system. Within this article we call for a reconstruction of the educational system through advocacy and a revolution of educational values, both related to removing barriers that have been stacked against culturally diverse children in America.

Such a revolution should begin with the correction of written history. American history was written by the conquerors; whoever won by force had the opportunity to record history. McIntosh (1998) considers this version of history to contribute to an invisible, weightless knapsack of special provisions, passports, codebooks, tools, and blank checks; a knapsack that has been utilized by oppressors and outlines privilege in America. This privilege magnifies "power" that many possess primarily as a result of their racial identity, but also as a result of socioeconomic class, gender, and age, just to name a few.

The omission of mathematicians of color from our history suggests to children of color that they have no seat at the table of the sciences. If culturally diverse students can't see themselves in history as mathematicians, if it's not possible to see what their ancestors have done to advance mathematics, and if they have no idea of the contributions their culture has made to the field, how are they going to see where they are going or follow the path of those who came before them given the examples are minimal or non-existent? Within this reconstruction of education, we suggest a call to action centered on the idea of lifting up the contributions of African Americans and others of culturally diverse backgrounds in mathematics, illuminate the resilience and brilliance children bring with them to a mathematics classroom, and use these artifacts to represent precious commodities of excellence—in order to take back students' time, empower them in mathematics, and advance their learning in mathematics.

A phrase re-popularized by U.S. Representative (Democrat of California) Maxine Waters, "reclaiming my time" was a stone-faced invocation of the United States House of Representatives floor procedural rules (Emba, 2017). Likely you have been there: while engaging in important dialogue and questioning with promising outcomes toward a solution, the opposition side-steps and draws attention away from the argument. *Reclaiming my time* is an interruption that suggests—you are wasting my time and using it on unrelated-irrelevant dialogue. In the instance of Representative Waters, "reclaiming my time" shut down the rambling of the opposition as well as redirected the conversation to address Representative Waters' question. Her use of this floor-interrupting phrase rang out as a rejection of the avoidance, a premise that became an awakening for all who have been spoken over, ignored, or have had their time wasted by others (Emba, 2017). Waters' dismissal of the opposition's attempted misdirection allowed her to find value in long-established rules and to use them to her advantage. Ultimately, "reclaiming my time" was seen as a powerful negation of a system usually used to keep Representative Waters and those like her in their places. Rather than continuing to cede the floor to others, "reclaiming my time" signaled the moment for Waters—and an implication to all—to use collective knowledge and established societal tools to take back our power.

The omission of mathematicians of color from our history suggests to children of color that they have no seat at the table of the sciences.

Introduction

The purpose of this article is to reclaim our students' time by instituting daily mathematics instructional practices such as micro-affirmations and culturally responsive pedagogy so that each and every student, especially students of color, can achieve at high levels in the classroom and experience life-long success. The authors will explore examples from personal experiences conceptualized as a bulletin board, lesson plans demonstrating culturally responsive teaching, and micro-affirmations. Each of these topics support the notion that educators must re-evaluate how instructional time is used in the classroom; does it support or negate the academic achievement of students of color? Building on the work of educators Geneva Gay, Gloria Ladson-Billings, Mike Rose, Danny B. Martin, Pedro Noguera and others, this paper examines challenges as well as possible solutions to help children of color gain access, solidify opportunities, and experience mathematical success in the classroom and beyond.

Like Representative Maxine Waters, educators hear the same rhetoric of misdirection. These messages are unrelated to pushing students forward in learning, creating a detour from the proposed goal of student academic achievement. This rhetoric does the opposite of building up students as confident scholars in the classroom. Either intentionally or unintentionally, most of the tearing down is related to African American children and their academics, especially in mathematics. As educators we must reclaim our students' time by removing barriers while changing the narratives related to African American children and their achievement.

Experienced educators know valuable learning opportunities are created when meaningful instruction utilizes pedagogy relevant to each and every student's culture. Instruction with these qualities allows for each and every student to be engaged in learning, and is further supported by micro-affirmations, supportive messages that build confident, competent learners. Provided exposure to mathematics curricula through meaningful instruction, students are granted access to the types of learning places and spaces in which they realize that education in mathematics is attainable. Education in mathematics is a powerful tool; it has the potential to be a change catalyst needed for future generations, to remove barriers that have been stacked against students and educators, giving them an opportunity to reclaim their time. This paper will examine three avenues in which mathematics educators of African American children can work to remove barriers in efforts to reclaim their time and to allow them opportunities toward seeing themselves and others in their culture as mathematicians. First, mathematics educators can diminish the achievement gap rhetoric by advocating for a differentiated approach to learning utilizing the literature aimed at advanced and gifted learners of mathematics. Second, mathematics educators can attend to the invisible messages of empowerment or disempowerment that are transmitted in our daily interactions with children. And third, mathematics


Photo Credit: US Department of Education on Foter.com/CC BY

educators can implement the practices of culturally relevant pedagogy, a teaching strategy that emphasizes relationships and content in context, resulting in heightened student engagement.

Achievement Gap Rhetoric

Education itself has a role in explaining our past and determining the future (Rose, 1995). According to The Trends in International Mathematics and Science Student (TIMSS), the achievement of students in the United States falls short of those in other countries (Mullis, Martin, Foy, & Arora, 2012). In his Educate to Innovate announcement (U.S. Office of the Press, 2010), President Barack Obama stated, "Everybody in this room understands that our nation's success depends on strengthening America's role as the world's engine of discovery and innovation…. And that leadership tomorrow depends on how we educate our students today—especially in science, technology, engineering and math" (para. 5). Rhetoric regarding America's classroom disparities in mathematics is often centered on racial gaps; many mathematics-focused educational reforms have contributed to fostering the implied notion that African American children are viewed as intellectually inferior and mathematically illiterate (Martin, 2009). The time has come for educators to reclaim our students' time and demand that all stakeholders put an end to rhetoric that suggest a message of inferiority for any student or groups of students in the mathematical sciences.

The notion of an "achievement gap" is an example of this inferiority rhetoric. An achievement gap is typically identified as the difference between achievement test scores of minority students compared to their White and Asian peers (NEA, 2018). Ladson-Billings (2013) asserts:

> The notion of the achievement gap seems to cast blame on individual students, parents, schools and teachers without looking at the structural inequalities that have been at work since the establishment of the nation. Achievement gap language suggests that each individual is responsible for his or her own educational circumstance and Black and brown students need to "catch up" to their White counterparts without acknowledging the ways that catching up is made near impossible by the many structural barriers the society has imposed on them. (p. 106)

As a community, mathematics educators, professionals, and enthusiasts must reclaim our time, refute the achievement gap rhetoric, and move forward to overcome these structural barriers to prepare each and every student for future learning endeavors.

This preparation should not just center on being skilled for jobs of the future, there exists a moral component in mathematics education of identity building and socialization (Martin, 2013). As a component that prepares students for excellence in future pursuits or plans, identity building and socialization must be our initial aim. We can achieve this by showcasing the brilliance that Black children possess. Martin insists that educational communities and society in general change the rhetoric related to Black children away from comparing their achievement to that of their White and Asian peers. Ultimately, there is more value in learning environments when educators celebrate Black children's resilience, agency, and tenacity, illuminating their brilliance as ordinary, not extraordinary.

Building Students Up with Expression

The underlying messages students receive in schools set the tone for how they receive instruction. Examining these micro-messages, a term prevalent in the business industry, is applicable in the field of education. They are described as "small, subtle, and often unconscious messages we send and receive" when interacting with others (National Alliance of Partnerships in Equity, 2014). Micro-messages become apparent as we examine our daily interactions, conversations, and instructional delivery. Delivered in five forms, facial expression, tone of voice, hand gestures, choice of words, and eye contact, these messages can exude either a

negative or positive connotation and shape every relationship. Broken into two categories, micro-inequities (negative) and micro-affirmations (positive), micro-messages inform students of one's expectations and how the teacher values them as human beings. Micro-messages play a significant role for educators to either damage student relationships or to forge better ones (Young, 2007). Young explains, "Micro-messages reveal what we really feel and carry powerful clues as to what exists between the lines" (p. 19). In education, these messages have a way of revealing to students what is under the mask, exposing teacher's hidden assumptions and implicit biases that speak to underachievement related to race, gender, class, nationality, and appearance (Young, 2007).

Students have an innate desire to be motivated and feel empowered in the classroom so as to be successful. Teachers have the power to create a positive classroom culture by utilizing uplifting micro-messages or positive affirmations that build students up and encourage them to take risks, remind them of their value, and to focus on advancing themselves academically. Utilizing powerful words and phrases that exudes positivity can even push students beyond their own expectations. Some affirmations that teachers could implement include but are not limited to the following:

- I lack nothing and I don't give up,
- No weapon formed against me shall prosper,
- I have hope and an awesome future,
- I will be successful and accomplish great things,
- I have everything it takes to succeed, and
- No one will sabotage my education and success.

The use of affirmations will ultimately create a classroom culture where teachers and students expect and exhibit success. Teacher expectations are a good predictor of their educational achievement (Good, 1987). In mathematics education, most teachers have the autonomy to include resources of choice into their daily instructional practice. It is important to showcase the cultural backgrounds of your students with these resources by including artifacts related to achievement of diverse peoples. These artifacts could be classroom displays, videos selected to introduce a lesson, a book to explain a concept, or the pictures on a homework worksheet. These artifacts may be considered a minor shift, but there is evidence of their value—the inclusion of students' culture in the classroom sends a message of high expectations. One example of establishing high expectations for all students through such reference is the use of *Hidden Figures*, a modern movie with a historic narrative featuring Black women employed by NASA, specifically the untold story of three Black mathematicians who helped win the Space Race. This movie represents a culturally relevant starting point for discussion of the limitless career possibilities for Black students.

Macro-messages refer to what people do not say, giving precedence to the idea of omission. When the omission has a negative impact, this macro-inequity sends an even larger message, becoming more damaging than that of a more explicit micro-message (Pendleton, personal conversation, 2018). Such a macro-inequity was demonstrated by Sojourner Truth when she declared, "Ain't I a Woman?" Through this courageous speech, she worked to fight against the sexist imagery that supported the disenfranchisement of women. Truth was compelled to speak out while many insisted that she be silenced; she reclaimed her time, leading to a prominent turn in American history. Truth (1851) cried out:

> That man over there says that women need to be helped into carriages, and lifted over ditches, and to have the best place everywhere. Nobody ever helps me into carriages, or over mud-puddles, or gives me any best place! And ain't I a woman? Look at me! Look at my arm! I have ploughed and planted, and gathered into barns, and no man could head me! And ain't I a woman? I could work as much and eat as much as a man—when I could get it—and bear the lash as well! And ain't I a woman? I have borne thirteen children, and seen most all sold off to slavery, and when I cried out with my mother's grief, none but Jesus heard me! And ain't I a woman?

By using her own life to reveal the contradiction between the ideological myths of womanhood and the reality of Black women's experiences, Truth's oratory provided a powerful rebuttal that contradicted the macro-messages regarding gender and race, that women were categorically weaker than men, and that excluded Black women from the gender rhetoric all together. No one person explicitly informed Sojourner Truth that she was not a woman, but it was implied through micro- and macro- messages. Truth was smart enough to read between the lines, as are our students who decipher the messages sent intentionally or unintentionally. Students are able to decipher when educators have explicit or implicit biases against them. As a barrier, micro- and macro- inequities have the potential to distort self-confidence and extinguish the efficacy of students. Martin Luther King, Jr. (1965) once stated, "the time is always right to do what is right" (para. 12). Reclaim their time; be cognizant and proactive in removing the barriers of macro- and micro-inequities in the classrooms within your reach.

That's Just Good Teaching

Current approaches in mathematics education have shortcomings. Topics that are vibrant in the minds of experts become lifeless by the time they reach students in the classroom. "As the world changes, and industries evolve, teaching methods must be modified to be effective in current environments" (Cleaver, 2018, n.p.). An excellent mathematics program requires that each and every student has access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support of resources (National Council of Teachers of Mathematics [NCTM], 2014, p. 5). While students need access and opportunity, they also need to experience meaningful participation, a differentiated curriculum, and positive outcomes. Reclaiming our students time will occur when the content that is taught is connected to what the students already know and pushes them to the next tier of their learning.

Mathematics educators know that all children show up to class on various mathematics proficiency levels. Student needs today vary more than in the past due to innovations of technology, developments of learning theory, and the access to new age medias (Cash, 2011). While adhering to mandated standards, it's our responsibility as mathematics educators to ensure all students needs are being met and to create pathways for them to achieve success. NCTM (2000) recognizes the need to accommodate various levels of learning by focusing on their readiness and confidence to allow for each student to learn mathematics. This process of accommodation has been characterized to include differentiation of instruction, tiered activities, and conceptual teaching, all which have strong referents to gifted education.

When identifying gifted learners, it's important to acknowledge that they are present in all communities, including those that are culturally, linguistically, and economically diverse (Heacox & Cash, 2014). Unfortunately, culturally diverse students are less likely to be identified as gifted or selected to participate in advanced placement courses due to internal gatekeepers of such programs. The aforementioned accommodations, modes of instruction thought to be for the gifted students—who are often from among an elite class—have a place in the instruction for all mathematics students.

Effective educators use their knowledge of students to provide specific ways for each individual to grasp the learning as deeply as possible in a differentiated classroom (Tomlinson, 1999). *Figure 1* presents Tomlinson's model for the differentiation of instruction. In response to learners' needs, differentiation strategies are determined based upon the student's readiness, interests, and learning profile. Differentiation of instruction occurs in the content, process, or product of a lesson segment. The practice of differentiating a lesson for students of color provides macro-affirmations that suggest students are ready and capable of advancing from where they stand now as a culturally-rich knower of mathematics. This tailoring of the curriculum would make a child feel pretty special, wouldn't it?

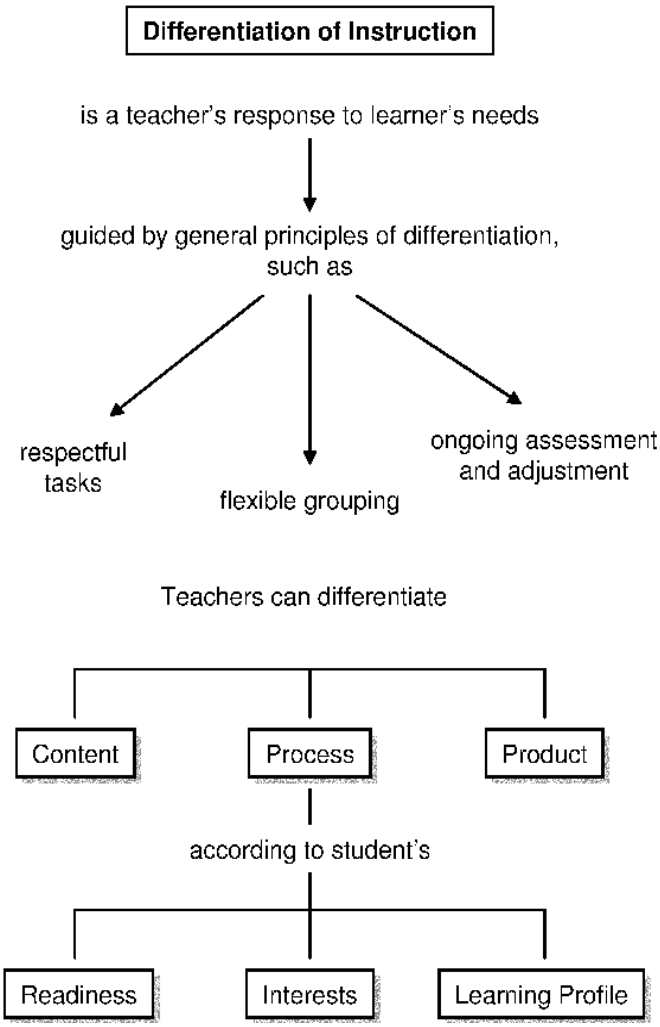

Figure 1: A concept map for differentiating instruction (Tomlinson, 1999, p. 15)

Differentiation requires the mathematics teacher to emphasize conceptual understanding and embed more rigor into the curriculum, employing strategies to motivate and engage learners, building students self-regulation attributes and learning autonomy while making certain that students are not just learning, but thinking (Cash, 2011). Differentiation strategies include adjusting your questioning techniques and allowing student's choice in their task selection. Small & Lin (2010) suggest "two core strategies for differentiating mathematics instruction" (p. 7), open questions and parallel tasks. Open questions allow students an array of entry points to the task and usually constitute several opportunities for a correct answer. This type of question could be represented as the following:

> *Open Question (6–7th grade) example:* 5 is a factor of two different numbers. Prove another truth related to both of these numbers.

The use of open questions creates the opportunity students of all cultural backgrounds to obtain access to a task and encourages them to persevere in solving.

Parallel tasks (Small & Lin, 2010) are designed to reach each student at their developmental level. By presenting students with more than one task, they are granted choice in their selection of problem solving while getting to the same big idea originated by the teacher. All the tasks presented are based on the same content, curriculum, and standards but the rigor of the questions vary in complicity. *Figure 2* provides an example that differentiates students thinking and allows choice in their task selection but offers opportunities of deep rich thinking in the process.

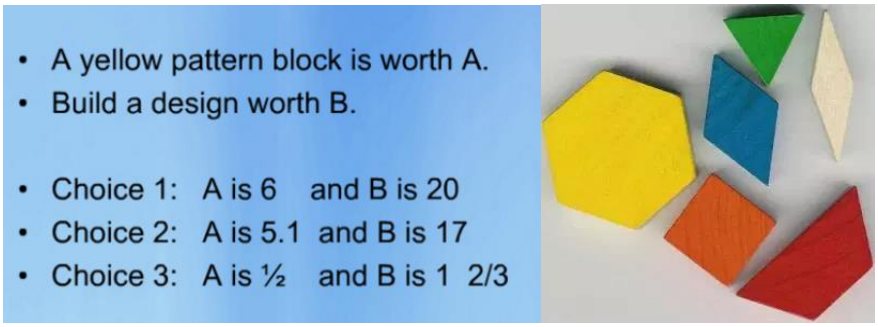

Figure 2. Parallel task presented by Marion Small (2010)

Teachers in differentiated classrooms seek to become partners with their students in their learning. "These teachers are students of their students" (Tomlinson, 1999, p. 2). Tomlinson elaborates, teachers who differentiate "are diagnosticians, prescribing the best possible instruction for their learners" (p. 2). Some argue that this idea of differentiation has a designation for only a select group of students, gifted students. We perceive that argument as a way to limit the quality of teaching for culturally diverse students when we observe the majority of students in gifted programs are affluent White students. We argue that differentiation of instruction is just good teaching and advocate for its use in all mathematics classrooms, especially those populated by culturally diverse students.

Reclaiming our students' time suggests we use our tools to advocate for change in the system to ensure students of color are engaged in practices that yield high achievement given their use and efficiency. Noguera (NYU Steinhardt, 2012) suggests theoretically schools would want to ensure all students, regardless of cultural differences, have similar opportunities toward education. But according to him, within schools there has been deliberate practice to assign the "best teachers to teach the identified high achieving students and the least effective teachers, usually with less experience, to teach the identified highest need students" (Noguera, 2018, n.p.) categorized by standardized testing and data reports that suggests gaps in learning of culturally diverse students. Schools do this to serve dual political purposes, to appease both the elite parents of children with high achieving students and the teachers with seniority. The achievement gap rhetoric allows for this practice of inequitable opportunities, it creates a perceived limitation to the potential mathematical learning of students of color negating the possibility for stellar work of those children and their teachers.

Metaphor of Culturally Relevant Pedagogy

Reclaiming our students' time suggest we must showcase their brilliance. Knowing students' resilience, there exists limitless potential to excel when provided the opportunity of instruction drawing upon culturally relevant pedagogy (CRP). First coined by Ladson-Billings (1992, 1994) and later expanded by Gay (2002), CRP challenges educators to use the cultural backgrounds of students as the foundation for all learning. Instruction must be relevant and relatable in order for the learning transfer to take place. Noguera (2018) asserts that there can be no excellence or deeper learning without instruction that meets students at their points of need. In his work, he found that when teachers actively seek ways to connect the content being taught to the home lives of the students, everyone learns and achieves at high levels. This instruction has to be intentional and culturally relevant to the lived experiences of the learners. "Even the best mathematician, if they are unfamiliar with their students, would have a hard time teaching mathematics effectively" (Carr, 2010, p. X).

Holliman and Mack (2017) presented the major constructs of CRP in the form of a bulletin board (Figure 3), a metaphor to conceptualize this method and practice of teaching. The bulletin board demonstrates that culturally relevant teaching is vital, essential, and necessary for the success of each and every student (Pendleton, 2018), but especially for those who are culturally diverse. In this conceptualization the backdrop

or butcher paper, border, and die-cuts represent the work of mathematics educators to research students' culture so they can examine what students bring to mathematics classroom, uphold curriculum rigor to its highest standard, and use the most effective instructional strategies to engage students in the process of learning, respectfully. In sum, the backdrop represents the relationship established when educators act as researchers to make connections with student lives and their ways of being in the world.

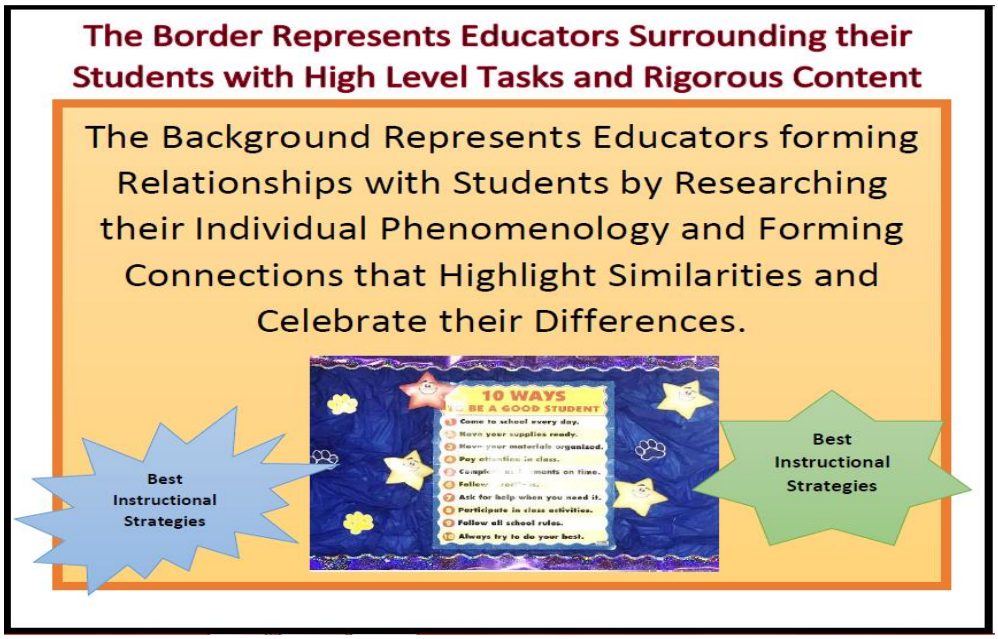

Figure 3. Conceptualization of Culturally Relevant Pedagogy (Holliman & Mack, 2017).

According to Holliman & Mack (2017), relationships created are the most important aspects of a teacher's practice. Relationships are enhanced when educators intentionally connect with their students' cultural differences and similarities and use those to inform their instructional practices. Educator Chris Emdin reminds us "Teaching and learning is so beautiful...it really is a dance, it's really understanding your partner in that process; so that at the end the thing that you create is beautiful and magical" (Office Depot, 2014, 3:11).

Teachers will find it easier to build this positive student relationship when they understand that each student has an interesting story to share. As teachers learn more about their students, they will be able make them feel more welcome, developing a sense of belonging. This opens up a door to embed student culture within the curriculum. Furthermore, students develop a mutual respect for cultures that are not their own (Boaler, 2006).

When teachers create a bridge between their students' home and school lives, while still meeting the demands of the district and state curricular requirements, they also create a culture of rigor and high expectations, along with growth and achievement opportunities for each and every learner. In Holliman and Mack's (2017) bulletin board model of CRP (*Figure 3*), the border represents the continuous challenge of maintaining cognitive demand of high-level mathematics tasks as an essential aspect of the mathematics curriculum. Throughout this process teachers should ask themselves, "Are you cultivating your students to become problem solvers or rule followers?" (Childs, 2016). There is an innate power within an educators' practice to reclaim our students' time as they work to eliminate the use of memorization, procedural, and low-level tasks.

The most appropriate instructional strategies for African American students are those considered the best instructional strategies in mathematics education. Holliman, Allen, and Cain (2013) highlighted strategies identified as brain-based and effective (Figure 4), but it is important to note that the list of best instructional strategies is non-exhaustive and expands with time as technology advances. Effective instructional strategies

create opportunities for students to be problem solvers. These opportunities include: context for which students can relate, careful listening to other's thinking, engagement with technology and manipulatives, and scaffolding to move the learning forward.

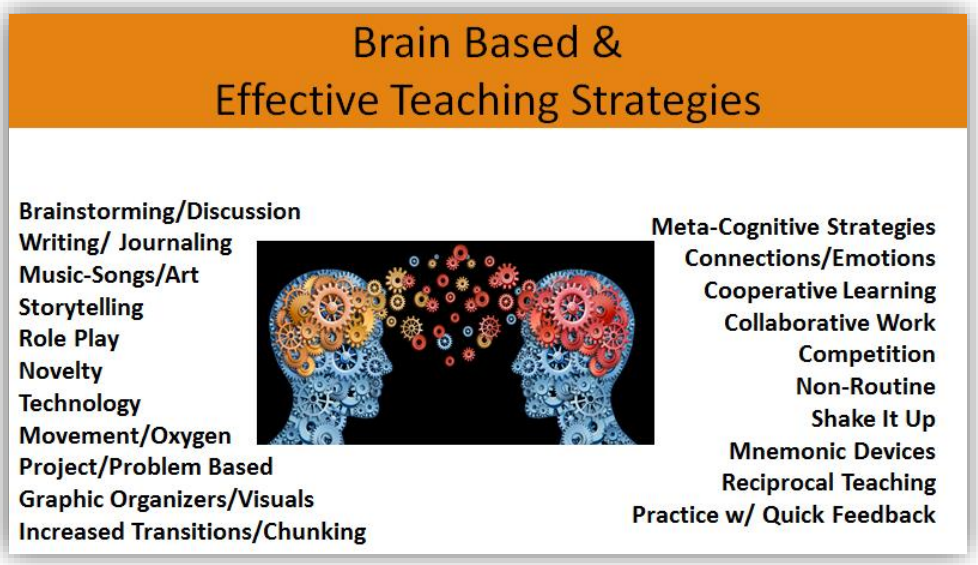

Figure 4. Brain-based, effective teaching strategies (Holliman, Allen, & Cain, 2013).

Ladson-Billings (1992) suggests a pedagogy that "prepares students to effect change in society, not merely fit into it" (p. 382). As a method of teaching that empowers students intellectually, socially, emotionally, and politically, CRP uses cultural referents to impart knowledge, skills, and attitudes. According to the National Research Council (2012),

> Teachers pursuing a culturally responsive approach to instruction will need to understand the sense-making practices of particular communities, the science-related values in them, and the historical relationship that exist between the community and local institutions of education. Instruction can be crafted to reflect these cultural particulars and engage students in related disciplinary practices and associated learning. (pp. 284–285)

To summarize, at its core, CRP has three dimensions: academic achievement, cultural competence, and critical consciousness (Ladson-Billings, 1994). Each dimension serves an integral aspect in the design of learning environments and empowers students to excel in mathematics. As mathematics educators reclaim their students' time, they create a pathway for all students to experience and celebrate success. According to Gay (2002), in order to address the needs of minority students, instructional practices must include the experiences and perspectives of a diverse population (p. 106). Establishing a focus on each and every student with the expectation to ensure that the curriculum, content, and delivery grants each student access reclaims our students' time and is the ultimate goal in mathematics education.

Conclusion

Each one of us can have significant impact to *reclaim our students' time*. The "power of one" is a phrase that recognizes the potential for one person to change the trajectory of a child's life, through direct or indirect efforts. It's our belief that the impact that educators have isn't measured by tenure, titles, or entitlements. Booker T. Washington (1901), a historic and dominant leader, suggested "success is to be

measured not so much by the position that one has reached in life as by the obstacles which he has overcome" (p. 32). We suggest mathematics educators take a critical stand to overcome obstacles brought about through preconceived narratives, micro-inequities, and in our teaching practices to reclaim our student's time and shine a bright light on the brilliance of African American children in mathematics classrooms. These classrooms could be the ones you manage, those in close proximity to you, or others across the country. Advocacy efforts and actions by one person have the potential to change the lives for millions of children nationally. In doing this, we are empowered to illuminate our students' greatness in every area of mathematics.

Standing with the Benjamin Banneker Association's 2018 Lifetime Achievement Award honoree, Danny B. Martin (2013), we believe and emphasize the axiom: *Black children are brilliant*. As logical statements in mathematics, axioms yield an assumption of truth. Axioms are self-evident; therefore, there is no need for proof or evidence in support of them (Martin, 2013).

> They serve as the starting points for deducing and inferring other truths, so once you have the axioms, you build the entire system based on the actions; those are your accepted truths, you don't have to go back and question them. (n.p.)

Reclaiming our students' time as a community of mathematicians and educators fixed on adding to the mantra *Black children are brilliant*, we are dedicated to upholding a practice and build systems of education centered on this axiom. Reclaiming their time requires the education community to change the rhetoric related to the achievement of African American and culturally diverse children, advocate for all teachers to become culturally relevant in their practice and provide avenues to build students up through micro-affirmations.

Ethnic-matching—for example, African American students taught by African American teachers—has been found to have a positive impact on the achievement of minority students (Easton-Brooks, Lewis, Zhang, 2009), suggesting the need for future research to examine the impact of other factors such as gender and socioeconomic status. "Without question, when the majority of students in public schools are students of color and only 18 percent of our teachers are teachers of color, we have an urgent need to act" (U.S. Department of Education, 2016, p. 1). In *reclaiming our students' time*, mathematics educators of all races must advocate for and lead the charge to ensure all students, especially African American and culturally diverse students, are provided with equitable opportunities and avenues to link their cultural backgrounds to their classroom experiences.

Mathematics educators enter the field with a shared purpose, a passion to change the lives of children positively. By *reclaiming our students' time,* we refocus on our purpose, and are encouraged by the words of Benjamin Banneker who stated, "Never abandon your vision. Keep reaching to further your dreams" (Banneker Watches, 2018, n.p.). The impact we have today has the potential to affect change for future generations. Instead of engaging the rhetoric associated with the achievement gap, let's arrange our collaborative spaces to instead take on a differentiated approach for each student to support their mathematical achievement and highlight their brilliance. "The critically reflective teacher begins to see how systems of education marginalize others and decides how to change social structures and teaching practices that are more beneficial for diverse students" (Mensah, 2013, p. 67). Teachers are encouraged to become informed about the achievement challenges of each and every student and pave avenues through barriers to access, equity, and success than remain prevalent in American classrooms. Embracing relationships as an essential attribute for student learning, micro-affirmations are a strategy to build students' self-confidence, resilience, and perseverance. To this end, students are empowered to affect change, ultimately reclaiming the time that has been stolen by those who have built barriers to limit their potential.

In this article, we focused on practices mathematics educators could implement to *reclaim our students' time* and showcase their brilliance. We have conceptualized culturally relevant pedagogy through a bulletin board metaphor that examines the importance of educators forming relationships by getting to know your students, ensuring high content expectations for all learners, and tailoring instruction with the best

instructional strategies for delivery. Mathematics education in America relies on today's educators to be leaders by changing the rhetoric concerning African American children while employing pedagogies that reach all students. A culturally relevant school is one that provides educational self-determination, respects and honors the culture students bring with them, and aids students in understanding their world while equipping them to change it for the better (Ladson-Billings, 2009). It is our position to *reclaim their time*, giving them their power back and affecting change for future generations. When mathematics educators heed this charge, they illuminate our student's brilliance and showcase the excellence that exists within. Whether it's the start or the end to an educational revolution, let's begin with *Black Children are Brilliant*.

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Kinesthetic Teaching Strategies and Their Importance to Social Justice

Suzy Koontz

Despite efforts at the federal level to mandate rigorous state and local frameworks to ensure that every child is successful in mathematics, data suggests that the majority of students in the United States test below proficient. In 2015, U.S. high school students ranked 35th among their peers from 72 countries on standardized math tests administered by the Program for International Assessment (PISA; Organisation for Economic Co-operation and Development, 2015). In the United States, racial and ethnic minorities and low-income communities are especially vulnerable to develop feelings of hate and failure in mathematics. There are lifelong consequences related to students' failure in mathematics, yet many people have a misconception that only "gifted" individuals "have what it takes" to learn advanced mathematics.

Civil Rights leader Robert Moses has embraced mathematics as a powerful tool to empower the disenfranchised and motivate young people to change the country as a whole. In the book he co-authored with Charles Cobb, *Radical Equations: Civil Rights from Mississippi to the Algebra Project* (Moses & Cobb, 2001), Moses makes the point that mathematical literacy is a key tool for disenfranchised and poor children to determine their participation in today's society, a tool comparable to the right to vote. Moses and Cobb explain how math literacy is part of the solution to educational discrimination, economic access, and full citizenship. It has been common practice in many U.S. schools to create different pathways (also known as tracks) for math studies based on students' performance in early math classes. Children who are identified as low performers in math are typically tracked into remedial classes, leading to a dead end in their mathematics education (National Council of Teachers of Mathematics, 2018). In turn, this prevents these students access to college-prep curriculum and excludes them from a path to higher education. Nationally, high school graduation rates for Black and Hispanic populations are the lowest among all racial and ethnic groups (National Center for Education Statistics, 2018).

Statistics also reveal that many high school dropouts are kinesthetic learners (Gadwa & Griggs, 1985). Culturally and linguistically diverse students and students from low income families tend to be tactile, kinesthetic learners (Heredia, 1999)[1]; therefore, teaching strategies that employ multiple senses engage them more fully in the learning process.

Undeniably, there is a need to engage our students, from our youngest learners to college age students, in active mathematics education, ensuring that they build confidence in their ability to learn math. In our Math and Movement project, we have seen what is possible if you bring kinesthetic learning to struggling students and students who believe they cannot learn. In a case study of a six-week deep implementation of kinesthetic strategies in the Pre-Kindergarten program of an elementary school, we found that young children can learn easily through movement. The results of the study suggest that a simple, daily, short intervention can have a big impact on student success, including children from low socio-economic status households.

At this school, the Math and Movement project directed an on-site intensive experience, for both teachers and students. The school staff provided 30 minutes of direct teaching to two classrooms of students for five days per week for six weeks using a classroom-tested kinesthetic learning program. We found that participating students significantly increased their math skills, with most students starting with minimal skills and ending six weeks later with solid one-to-one correspondence and the ability to count to ten. They also met

[1] Controversial claim, critiqued by Sleeter and Grant (2002) for example.

a physical education learning outcome of having the ability to perform cross-body movement at the shoulder, hip, or knee.

Other examples of success from across the nation show that kinesthetic learning programs are contributing to the mathematical learning of children from a wide range of abilities and backgrounds. When kinesthetic learning programs are offered consistently, they have the potential to strengthen learning, improve retention, enhance motivation, and engage both students and parents.

To get a small taste of the power of kinesthetic learning, try this short activity on your own or with your children or students. Before you do the activity, do a short pre-test to see how easily you (or your child/student) can county by nines (9, 18, 27, etc.). Then do one or two rounds of the Nines Twist, shown in Figure 1.

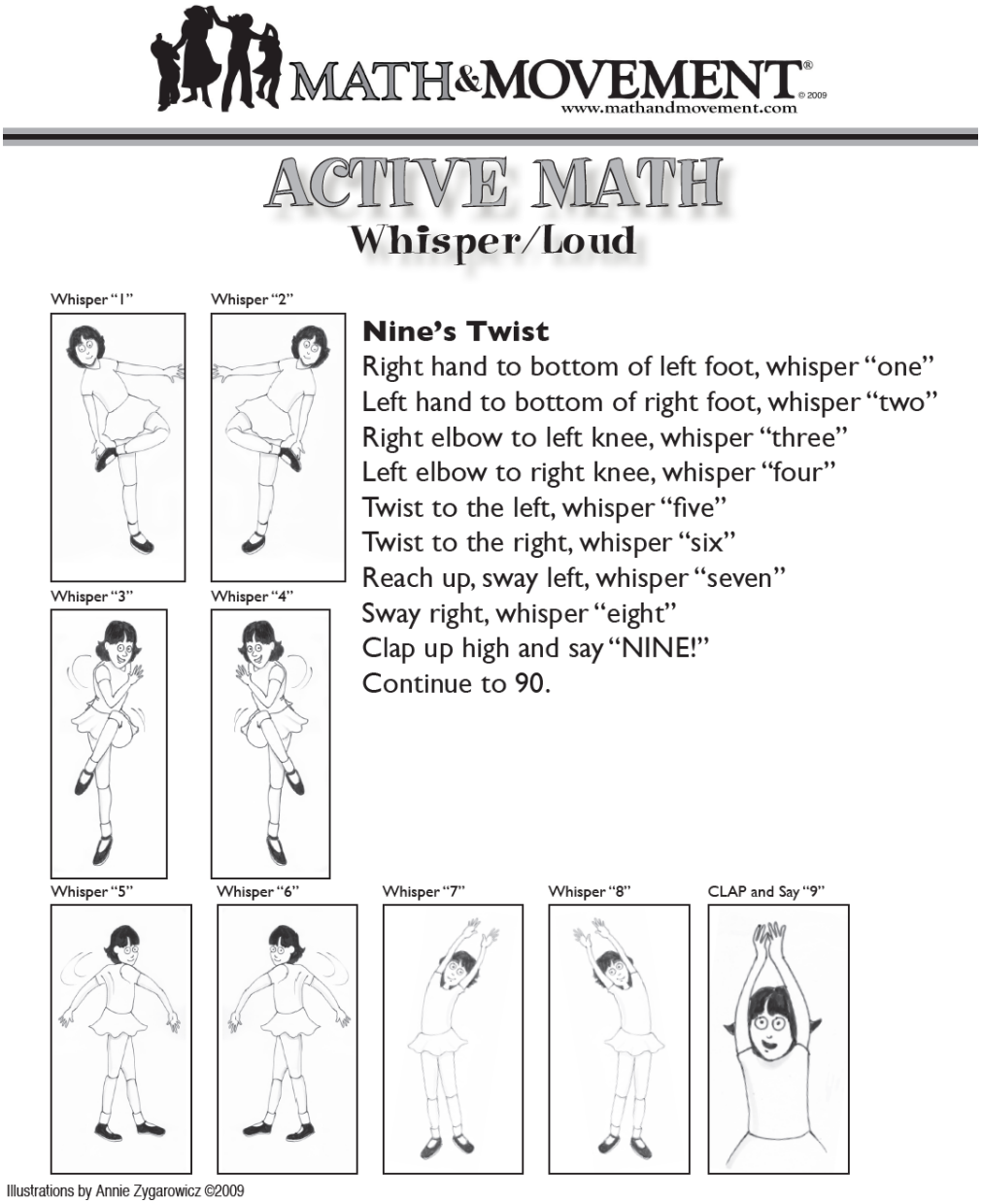

Figure 1. Images of the Nine's Twist, a kinesthetic activity to learn skip-counting by nine.

While it's still fresh in your mind, test yourself again on your ability to skip-count by nine. Notice how much easier it is after you've done the movements. Did your ability to count by nine improve? How does your body feel now? How does your brain feel? Did you get a good laugh when you made mistakes along the way? It's okay to laugh at yourself—laughter and positive emotion anchors learning!

For many students, engaging in kinesthetic learning may be the first time they have felt successful with math. When they realize that they can learn easily and effectively when they are taught in ways that support their dominant learning styles, it is a true game-changer for them. They shift from hating math to getting excited about practicing it. As their confidence grows (and the skills and conceptual understanding deepen), their curiosity about how math can be used in real life situations may open the door to the possibility of pursuing higher levels of math and other STEM subjects.

Kinesthetic teaching meets two key parts of the Benjamin Banneker Association's Social Justice Position Statement. First, it supports teaching "with" social justice by meeting the needs of all students, while particularly supporting students whose needs have not been adequately met to date. It also supports teaching "for" social justice because it helps students shift from dead-end math instruction to opportunities to access college-prep tracks that give them more options for improving their economic status.

Kinesthetic multi-sensory teaching strategies and materials benefit each individual and also improve the outcomes for whole communities. At Math & Movement, we believe this shift toward kinesthetic learning is critical for the overall wellbeing of students, schools, and our communities. We need people to be confident that they can learn whatever they need or want to learn so that they can become all that they are meant to be. We are deeply committed to this shift and we look forward to supporting teachers, parents, and schools as they begin to embrace these strategies.

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Creating Math Communities in the Neighborhood

Lesa Covington-Clarkson and Elena Contreras Gullickson

Prepare2Nspire (P2N) is a multi-grade mathematics tutoring and mentoring program situated in an historically working-class neighborhood comprised of predominantly African American residents. This urban neighborhood is known for its higher than average unemployment rate and the highest crime rate within the surrounding areas (Eligon, 2016). Given these demographics, the residents of this neighborhood along with program participants face social, economic and cultural obstacles. P2N provides a supportive, multi-ethnic academic space for young people to persevere in mathematics. As one participant describes this safe space "…when I come here, it feels friendly and alive. I feel accepted. I feel like I belong…."

Rationale

This innovative project prepares under-served students to succeed on grade-level, high-stakes mathematics exams and to inspire them to continue their study of mathematics. The mission of P2N is to (1) develop mathematics confidence, content-knowledge, connections, communication skills, and community through cascading tutoring/mentoring and technology, and to (2) create a STEM (Science, Technology, Engineering and Mathematics) pipeline for urban underrepresented youth to post-secondary opportunities.

P2N bridges the process of tutoring and mentoring. While the formal act of tutoring between college undergraduate and eleventh-grade student or eleventh and eighth-grade student entails formal acts of assisting in problem-solving and working through mathematics content, the act of mentoring takes the relationship one step further. Mentoring is a function of relationship building. Mentoring initially mirrors tutoring in that it involves passing expertise on to others who need to acquire specific skills. In addition to skill building, mentoring includes cultivating positive behavior and study skills; creating resiliency and self-reliance in students as self-directed learners; providing the context for the exchange of information and knowledge that bridges the gap between mathematical theory and practice; and cultivating the development of leadership competencies in mentees while increasing student capacity for service to others in the future. For the purposes of this program, we created the terms *mentutor* and *mentutee* to describe the combination of mentoring and tutoring.

Culturally responsive mentoring

Culturally responsive mentoring is an approach that involves using the daily, culturally-rich lives of students as a way to empower and strengthen the relationship between mentutors and mentutees. There is a myth that culture does not matter in mathematics teaching and learning (Nasir, 2013). This is troubling because many states continue to have large academic and opportunity gaps between students of color and White students (Ladson-Billings, 2006; National Center for Education Statistics, 2001). However, paying attention to "issues of race and culture in the way we teach mathematics has incredible power to disrupt the

troubling opportunity gap" (Nasir, 2013, p. 13). In the design of P2N, we acknowledge that such issues exist and address them. Drawing upon what mentutees bring to P2N is a key component to successfully mentoring African American students from urban schools.

The Shaping of Mathematical Identity

Prepare2Nspire is built around small communities (that meet as table groups) named for an underrepresented scholar in science or mathematics. For example, one community is named after Katherine Johnson, an African-American mathematician known for her computation work for NASA. The naming of the communities using underrepresented scholars is intentional; to help mentutees see themselves as people who can excel in science and mathematics, they should see and know previous scholars who have succeeded in STEM fields.

Participation in mathematics classes has a profound effect on the development of one's self. The shaping of mathematical identity is a social construction (Bishop, 2012; Boaler, 1997; Boaler & Dweck, 2016; Boaler, William & Zevenbergen, 2000), constantly evolving based upon narrative factors. These factors are often racialized narratives (Larnell, 2016; Nasir, 2003). Historically, schools have perpetuated such narratives by placing students from underrepresented populations into remedial courses, making it nearly impossible to participate in advanced study (National Council of Mathematics Teachers, 2018). Students, in turn, begin to identify as being incapable and unable to perform academically. They are implicitly being told that they are not capable of doing and being better. Students internalize these narratives and begin to have low self-worth even when they have the skill set or prior experiences to demonstrate they can be successful. These "[deficit] identities intersect with already existing stories about other kinds of social identities" (Larnell, 2016, p. 262). P2N pushes back against this notion by transforming student mathematical identity.

An approach to influencing the formation of mathematical identity is to cultivate positive peer relationships (Tate, 1994; Walker, 2011, 2012) through the use of learning communities. Lave and Wenger (1991) suggest using a situated learning model—a model that places learning within social relationships. Lieberman (2013) further asserts that learning increases for low achieving students when placed in empowering roles. That is, allowing the tutee to become the tutor—the "cascading" factor of P2N design in which the eleventh grade mentutee also serves as a mentutor for an eighth-grade student. Positive encouragement from peers is an effective and motivating factor for student success (Walker & McCoy, 1997), and thus, community participation is imperative when cultivating mathematical identity. The P2N near-peer model, mentutor and mentutee are close in age, is an example of mathematics support situated in a social setting. As one P2N participant states, "I really like how when we come here, we build community, and at the same time we're also learning [math]. And we meet people who are from different backgrounds."

Structure of Prepare2Nspire

"*Prepare": Reverse the current trend*

On all accountability measures in Minnesota (MCA-II, MCA-III) certain student groups are consistently lagging behind their peers. The tests identify that African American, Native American, Hispanic and students from low socioeconomic backgrounds are underperforming in academic preparation, high school graduation and college attendance. Moreover, these same student groups are enrolled in fewer science, technology, engineering, and mathematics courses in high school and college. The national job market is currently growing in the STEM fields therefore leaving students from these groups without adequate preparation for entering a specialized job market. In addition, there is an epidemic of failing Algebra among Black urban youth in the

United States. In a study by the National Assessment of Educational Progress, the "overwhelming number of low-achieving students in Algebra are Black and Hispanic and attend big urban, high-poverty schools where they are more likely to fall through the cracks" (Loveless, 2008, p. 8). In a similar study by Adelman (1999), African-American and Hispanic students were found to be disproportionately underrepresented in advanced mathematics courses. There is a reason why this problem has become acute: researchers (Adelman, 1999; Larnell, 2016; Tate, 1995) suggest the highest predictors of college readiness and completion is the taking of higher level of mathematics courses during the high school years. If this trend is to be reversed, failure in foundational mathematics courses must be seen as the number one priority for students in urban educational settings where the numbers are most staggering, like the urban neighborhood where P2N resides. Well-prepared students can reverse this trend. P2N supports participants in the development of their mathematics content, confidence and communication skills to continue their engagement in STEM disciplines.

"2": The participants

The "2" in the program name, Prepare2Nspire, identifies two distinct cohorts of students who are beneficiaries of the program's tutoring and mentoring (mentutees): middle-school and high-school students. It is important for each student regardless of their grade-level group, to see other students who are pursuing higher education especially in mathematics. Likewise, undergraduate mathematics students who tutor and mentor (mentutor) should not be overlooked as active participants and recipients in the project. Students who put themselves in the position to tutor other learners also benefit from the teaching and leadership opportunity. A P2N community is comprised of one university undergraduate, three eleventh-graders, and six eighth-grade participants (Figure 1). The undergraduate mentutor oversees the community and offers support as needed. The eleventh graders mentor/tutor the eighth grade mentutees. All participants provide support and encouragement to other members of their community.

Figure 1. A P2N community: one undergraduate, three 11th graders, and six 8th graders

"Nspire": The role of technology

The inspiration for "Nspire" comes from the name of a handheld graphing calculator that is a part of the P2N participants' mathematics toolkit. This innovative technology is used to help the fundamentals of algebra come to life. Since technology is the basis of many STEM occupations, all of the P2N participants are given the advantage of learning how to use the technology and then use the technology to learn and enhance algebraic skills. Fundamentally, successful students can move between multiple representations which can be visually displayed on the calculator. Moreover, this graphing calculator is a tool that students can use on standardized tests. While many schools are moving away from the use of handheld technologies in classrooms to use web and app-based graphing technologies, standardized tests are not. A handheld graphing calculator is a useful tool on such assessments, but it is only a tool if students know how and when to use it.

Impacts and Successes

The informal mathematics learning environment created in the P2N program provides a safe space for underrepresented students to find the support they need to persist in the study of mathematics, thus providing increased access and more opportunities to engage in STEM content and career options. In the process, more immediate student needs were met through this organic experience.

First, the small learning communities were an essential element to support students because they nurtured relationships between mentutors and mentutees and between mentutees. A mentutor described her experience by stating, "I think that having the table communities is a large factor on getting the participants to be interactive with one another and help each other with not only math, but life problems. This program has helped my tutees become more comfortable in math and have a safe place to share any issues they have."

Second, participants' mathematical identities became more positive by seeing themselves as mathematicians. In addition, the near-peer relationships provided the anticipated safe-space for developing communication skills centered around mathematics discourse. A mentutor asserted, "At the beginning of the program, I sensed hesitation in the participants when asking for help. Now my tutees are much more comfortable asking for help and more comfortable telling me when something doesn't make sense." Participants not only developed more positive mathematical identities, they increased their ability to communicate their understandings. A mentutee shared, "Before P2N, I was hesitant about learning more about math and me teaching it to others, but after my participation, I was more confident about teaching math to others in different ways and this program made math more appealing to me."

Finally, participants reported that they were engaged in more mathematics courses and their scores were improving in both schoolwork and college admissions tests. These successes were confirmed through the use of pre- and post- practice ACT test scores, noting an increase of three points in the mean scores. This is a significant amount of growth considering that this standardized test is scored on a 36-point scale. Success meeting the needs of the P2N participants is further affirmed as previous participants send periodic updates about themselves and their higher education endeavors, demonstrating their feelings of connectedness to P2N.

The successes described above demonstrate how P2N is exceeding its mission of developing confident urban learners who persist in their study of mathematics as they begin to understand the true meaning of "community." In a neighborhood that is easily identified as one full of hardship and tragedy, P2N creates math communities through support and empowerment. Contact the authors for more information about Prepare2Nspire.

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Where Am I in My Equity Walk?

John Staley

How might we, the mathematics education community, make a difference in the teaching and learning of mathematics so as to promote rich, rigorous, and relevant mathematical experiences for all students? This one question has been on my mind for several years now and especially during the past few years as I have come to the realization that answering this question requires us to get to the root of the underlying issues related to equity, in other words multiculturalism, diversity, culturally responsive pedagogy, and most recently social justice.

As I reflect on my career as a teacher, teacher leader, district leader, parent, and grandparent, I look back and see three important questions that frame my journey: *Why is this work important? What is the purpose for teaching Mathematics?* and *What shifts in our instructional practices must we consider?* In this reflection, I will use each question to structure our conversation by sharing snapshots from my journey, a journey that includes conversations with many educators, attendance at conferences, and study of professional literature such as those listed in *A Call for a Collective Action to Develop Awareness: Equity & Social Justice in Mathematics Education* (https://www.nctm.org/uploadedFiles/News_and_Calendar/Messages_from_the_President/Archive/Matt_Larson/CollectiveAction-EquityAndSocialJusticeInMathEducation_09_01_2016.pdf). I will also answer the question, *where do I go from here?*

Before we begin, I would like for each of us to think about one child in our lives, be it a relative or friend, for whom we care for and would do all that is within our control to help them achieve their dreams. For those who have heard me speak, you may remember my granddaughter Bevelyn. My understanding of equity issues is closely connected to my dreams for Bevelyn and thus impact my words, thoughts, actions, and beliefs, especially when working with students, parents, teachers, administrators, and the community. Now, prior to reading my reflections, pause, reflect and ask yourself, *where am I in my equity walk?*

Why is this work important?

We all have the responsibility to develop students' mathematical identity, "the dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the contexts of their lives" (Aguirre, Mayfield-Ingram, & Martin, 2013, p. 14). Too often, many individuals' negative beliefs and attitudes about mathematics, the value of mathematics, and their ability to do mathematics are shaped during their K–12 schooling experience. As we work to help students develop a *positive* mathematics identity, Cobb, Gresalfi and Hodge (2009) offer the following perspective on mathematical identity, specifically that it involves "the ways that students think about themselves in relation to mathematics and the extent to which they have developed a commitment to, and have come to see value in, mathematics as it is realized in the classroom" (pp. 1–2).

I invite you to pause and reflect as you unpack the term, mathematical identity, making note of key words or phrases that you may need to revisit at a later time. The following two phrases "Use mathematics in powerful ways" and "are engaged in and see value in mathematics" remind me of the importance of having a purpose for teaching mathematics that extends beyond the learning of content and deeply connects to helping students believe in and see themselves as doers and thinkers with mathematics.

As I think about how to support Bevelyn in developing a positive mathematical identity, I have concerns about the messages she may receive about mathematics from adults inside and outside of the classroom based on their previous experiences. I am mindful of the labels that are often attached to African Americans, females, and children from single-parent households. I also know that I am here to support her

and advocate for her as she learns mathematics, but what about those children who don't have someone on the inside? Who will be there to speak up for them?

What is the purpose for teaching Mathematics?

It is time for us to humanize the teaching and learning of mathematics so that students see value in the mathematics they are learning and how it extends beyond the goal of being college and career ready. Extending one's purpose for teaching mathematics will allow students to answer for themselves the age-old question, "When will I ever use this?" The following thoughts from Danny Martin (Aguirre, 2007) on humanizing mathematics caused me to pause and reflect on the relationship between equity, diversity, social justice, and humanizing.

> I've read about it, this idea of humanizing mathematics and mathematics education. I'm starting to wonder why we haven't been more explicit about that. We have these big umbrella terms. We have equity and diversity. But humanizing has a different tone to it: Social justice versus humanizing. If I had to choose, moving forward, it would be this humanizing piece. (p. 14)

Reflecting on Martin's statement, I now see the importance of being more explicit in calling out issues related to inequities that might impact the teaching and learning of mathematics for students of color, especially African American students. I am also reminded of the need to be explicit in localizing and personalizing issues when addressing inequities. I have found that adding names to the conversation reminds people that we are talking about a child that they may know.

We must also consider that humanizing the teaching and learning of mathematics means more than addressing the content but also how we view the students in our classrooms. Francis Su, Past President of the Mathematical Association of America, shared the following in his speech, *Mathematics for Human Flourishing* (2017),

> I want us as a mathematical community to move forward in a different way. It may require us to change our view of who should be doing mathematics, and how we should teach it. But this way will be no less rigorous and no less demanding of our students. And yet it will draw more people into mathematics because they will see how mathematics connects to their deepest human desires. (n.p.)

Su's words call for a change in "who" we see as doers of mathematics and "how" we teach the mathematics. Change is often met with resistance, especially when questioning someone's preconceived notions about students' abilities or the need for teachers to adjust how they go about their daily craft of teaching mathematics.

It is time for us to humanize the teaching and learning of mathematics so that students see value in the mathematics they are learning and how it extends beyond the goal of being college and career ready.

As you reflect on Martin's and Su's statements, I invite you to consider your purpose for teaching mathematics and who you see and value as doers of mathematics. A purpose of this nature requires you to extend your thinking beyond a sole focus on student achievement on unit tests, report cards, high stakes assessments, and college and career readiness. This sort of extended purpose is one that may be difficult to measure on paper. It will likely require you/us to consider shifts in both teaching practices and the types of

experiences we provide so that all students "see how mathematics connects to their deepest human desires" (Su, 2017, n.p.).

What shifts must we consider?

As you ponder this third question, I offer three shifts to consider in our work as mathematics educators, each of which will be addressed in more detail: mathematics knowledge, teaching practices, and mindset.

Shifts in What is Valued as Mathematics Knowledge

Shifts in mathematics knowledge are needed as we work to help our students develop a positive mathematical identity. In *Teaching Social Justice for Mathematics: Conversations with Educators* (Wager & Stinson, 2012), Gutstein (2012) shares how his 3C Framework for Mathematics Knowledge—Classical, Community, and Critical—can be used to help us think about how we teach so that students have an opportunity to make connections to the mathematics they are learning.

> ***Classical Knowledge***: the learning of "school mathematics" content with understanding,
> ***Community Knowledge***: the mathematics people gain and use in their out-of-school lives, and
> ***Critical Knowledge***: the mathematics necessary to understand, analyze, address, and critique issues of social (in)justice.

Gutstein's 3C Framework reminds me of the importance of building relationships with our students so that we can address their learning of mathematics and help build experiences that allow students to connect, use, and make sense of classical, community, and critical mathematics knowledge.

Shifts in Teaching Practices

Next, as we look at shifts in our teaching practices, consider the following: equity-based mathematics teaching practices, an assets-based approach to learners, and pedagogical styles. First, equity-based teaching practices—going deep with mathematics, leveraging multiple mathematical competencies, affirming mathematics learners' identities, challenging spaces of marginality, and drawing on multiple resources of knowledge—as described by Aguirre, Mayfield-Ingram, and Martin (2003) in *The Impact of Identity in K–8 Mathematics, Rethinking Equity-based Practices*, provide a starting point for teachers to examine their mathematics teaching practices. The authors' examples and non-examples for each practice was helpful to deepening my understanding of what each practice might look like and sound like in the classroom. NCTM (2014) recently expanded on these equity-based teaching practices by connecting them to the eight research-based essential mathematics teaching practices advanced in *Principles to Actions*. Examine NCTM's *Taking Action: Implementing Effective Mathematics Teaching Practices* series (Boston, Dillon, Smith, & Miller, 2017; Huinker, & Bill, 2017; Smith, Steele, & Raith, 2017) or *Catalyzing Change*

in High School Mathematics (NCTM, 2018) to learn more about how to integrate the equity-based practices and mathematics teaching practices into your classroom.

The second shift in teaching practices, an assets-based approach, involves how we view the learner. Koestler (2012) describes an assets-based approach to learners, in which "the teacher seeks out the knowledge, skills, and interests in students and their out-of-school lives and builds connections from this knowledge to school mathematics" (p. 83). I find that an assets-based approach connected with Gutstein's 3C Framework for Mathematics Knowledge helps me better understand how I can support teachers' efforts to develop and maintain students' identities while also recognizing and valuing the knowledge that students bring to the classroom.

A third shift in teaching practices involves our willingness to examine various teaching styles and make adjustments to support our students. I will share two pedagogical styles described by Chris Emdin (2016) in *For White Folks Who Teach in the Hood... and the Rest of Y'all Too: Reality Pedagogy and Urban Education* that have left an impact on me and unbeknownst to me have become a part of my teaching practices. *Pentecostal Pedagogy* and *Reality Pedagogy* are two pedagogies discussed that I can relate to because they are rooted in my personal up bringing in the church and in my continued desire to help all learners value and make sense of what they are learning. Pentecostal Pedagogy, an approach to teaching that reminds us that teaching is not just telling students what you know, emphasizes the importance of knowing how to share what you know so that it can be optimally received (p. 51). It requires the educator to learn how to value voice and foster family within the classroom by providing students with an opportunity to have their thoughts, words, and ideas about the classroom and the world beyond it heard and incorporated into instruction (p. 59). This approach reminded me of the various styles preachers used to teach biblical knowledge. Sermons often came in the form of lessons where the preachers used words to create images, visual illustrations, body movement and gestures, and voice inflections to help the congregation learn. Many times, preachers words and actions were greeted with an "amen," "tell it," or "preach now" from the congregation to illustrate some type of understanding or recognition that a connection was being made.

Emdin (2016) explains Reality Pedagogy as an approach to teaching and learning that has a primary goal of meeting each student on his or her own cultural and emotional turf. It focuses on making the local experiences of the student visible and creating contexts where there is a role reversal of sorts that positions the student as the expert in his or her own teaching and learning, and the teacher as the learner (p. 27). Reality Pedagogy focuses on privileging the ways that students make sense of the classroom while acknowledging that the teacher has very different expectations about the classroom (p. 30). Both of the pedagogical styles once again confirmed for me the importance of relationships with our students, valuing their voice, and collectively establishing expectations for the classroom.

Shifts in Mindset

The last of the three shifts for mathematics educators involves mindset, and more importantly how it influences equity work in two areas: taking ownership for what happens to students and valuing a new focus for teacher professional learning. In *Excellence through Equity*, Blankstein, Noguera and Kelly (2016) share stories of how school systems have addressed equity issues. Two major themes appear in many of the stories and resonated with me as a learner, teacher, and teacher leader. First, educators in those school systems expressed a sense of ownership and willingness to do what it takes to change the teaching and learning experience for all students. And second, educators understood that equity work is transformational work, takes time, and involves changes in people's beliefs and actions. The following quotes illustrate how one high school's literacy initiative helped them focus their work on what they could control and the importance of educators taking ownership: "We transformed ourselves from being a school accepting every excuse for failure to a school with high standards, high expectations, and no excuses" (p. 33), and "No longer would the quality of a student's education be totally dependent upon the luck of the draw with teachers" (p. 35).

The second area where a mindset shift is needed relates to valuing a new purpose for teacher professional learning, a purpose that provides a dual focus on mathematics and social justice (National Council of Supervisors of Mathematics and TODOS: Mathematics for All, 2016). This dual focus will require those who provide professional learning for teachers to integrate opportunities that allow teachers to learn about students' mathematical thinking and in-and-out of school competencies, while also examining cultural differences between the teacher and the student. The use of resources such as *Cases for Mathematics Teacher Educators: Facilitating Conversations about Inequities in Mathematics Classrooms* (White, Crespo, & Civil, 2016) is just one way to provide opportunities for educators to experience various classroom settings, reflect on their own personal remedies for handling situations, and also read about multiple perspectives from educators in the field.

As I consider the three shifts discussed above—mathematics knowledge, teaching practices, and mindset—I find myself reflecting on my personal experiences as a student learning mathematics, a teacher facilitating the teaching and learning of mathematics for my students, and as a district leader supporting mathematics teachers. I think first about how my understanding and beliefs about equity issues have influenced my resolve to make sure that all students in my charge, as a classroom teacher and then district leader, have access and the opportunity to learn the full mathematics curriculum. Secondly, I am mindful of the instructional practices I have used while in the classroom and those instructional practices I continue to advocate for in all classrooms. Lastly, I now have a deeper understanding, supported by research, of some of the actions and decisions I made while in the classroom and as a district-level leader. For those things that just seemed to make sense, like building relationships that valued my students' background and lived experiences, helping students make connections to mathematics inside-and-outside of the classroom, and always valuing and respecting the voice of each and every student, I now had greater conviction.

Where do I go from here?

Three words come to mind as I ponder my next steps: *activism*, *advocacy*, and *action*. As I consider how I will embrace being more of an activist, I am drawn to Gutiérrez's (2007) article, *Strategies for Creative Insubordination in Mathematics Teaching*, in which she provides the following strategies and guidance for when you might use them:

Strategies for addressing political situations we face as mathematics educators

1. press for explanation
2. counter with evidence
3. use the master's tools
4. seek allies
5. turn a rational issue into a moral one
6. fly under the radar

Guidance for selecting and implementing strategies for creative insubordination

- recognize the kind of issue at stake
- identify what power dynamics are operating
- determine how the issue relates to student learning and social justice
- consider the speaker(s), your relationship with them, and the context in which we find ourselves

I invite you to read the article to gain a better understanding of each strategy and to understand the guidance provided from lessons learned shared by Gutiérrez for when you might choose to use one of the strategies. This guidance will be useful as I navigate this space; people often become defensive and/or reactionary when equity issues are at the center of the conversation.

As I pursue my role as an advocate, I am reminded of two questions Danny Martin (2018) posed in his Iris M. Carl Equity Address at the National Council of Teachers of Mathematics 2018 Annual Meeting and Exposition, *Taking A Knee in Mathematics Education: Moving from Equity Discourse to Protest*: "What does it mean to be Black in the context of mathematics learning and participation? What does it mean to be a learner and doer of mathematics in the context of being Black?" As I consider these questions Bevelyn returns to my mind and I am galvanized by the sense of urgency for her, and others like her, as they only have one K–12 opportunity to develop positive and healthy beliefs about her abilities to use mathematics to make sense of the world around them.

Lastly, ACTION. Some would say that typing in all caps is shouting. So, let me say it again, ACTION. I have identified the following ACTIONS to take as I continue my journey:

1. Study criticalmathematics education (Powell, 2012), specifically the notion of a "criticalmathematics educator as a mathematician, educator, and activist" (p. 26), for this seems to be the genesis of many of the terms that have been connected to equity—multiculturalism, diversity, culturally responsive pedagogy, social justice, and most recently humanizing mathematics.
2. Work to address issues in high school mathematics.
3. Become more involved in the Benjamin Banneker Association, Inc. as they work to expand understanding of the concept of social justice in the mathematics classroom and more importantly improve the learning and teaching of mathematics for African American children.

I have shared questions I have been challenged with, and questions I have raised of myself during this career-long journey along my equity walk in mathematics education. I hope these questions and my reflections serve to further engage you in the conversation around equity issues, but also provoke a sense of urgency for change, requiring us together to step boldly as we continue our equity walks. Each of us have our Bevelyn, a friend, family, or neighbor that demand our best.

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Dr. John W. Staley currently serves as the Director of Mathematics PreK–12 for Baltimore County Public schools. He earned his Bachelor of Science in Mathematics from the University of Maryland, College Park; Masters in Secondary Education from Temple University; Ph. D. from George Mason University in Mathematics Education Leadership. Dr. Staley taught middle and high school mathematics in private and public school settings in Pennsylvania, Virginia, and Maryland and has also served as an Adjunct Professor at George Mason University, Loyola University, UMBC, and Morgan State University. During his career he has presented at state, national, and international conferences; served on many committees and tasks forces; conducted workshops and professional development sessions on a variety of topics; received the Presidential Award for Excellence in Teaching Mathematics and Science; and served as President and on the Board of the National Council of Supervisors of Mathematics (NCSM).

2017-2018

"Build Like Benjamin Banneker" Challenge Winners

Congratulations to Christian Oluwatimilehin Parkinson and Nahshon Cannad – our national winners for the 2017 competition!

Christian Oluwatimilehin Parkinson

Los Angeles, CA

2017 National Winner
Elementary Category

Nahshon Cannad

Los Angeles, CA

2017 National Winner
Middle School Category

As part of this competition, participants were asked to provide a written project reflection to accompany their structure that explained the personal, civic, scientific, and mathematical significance of what they built.

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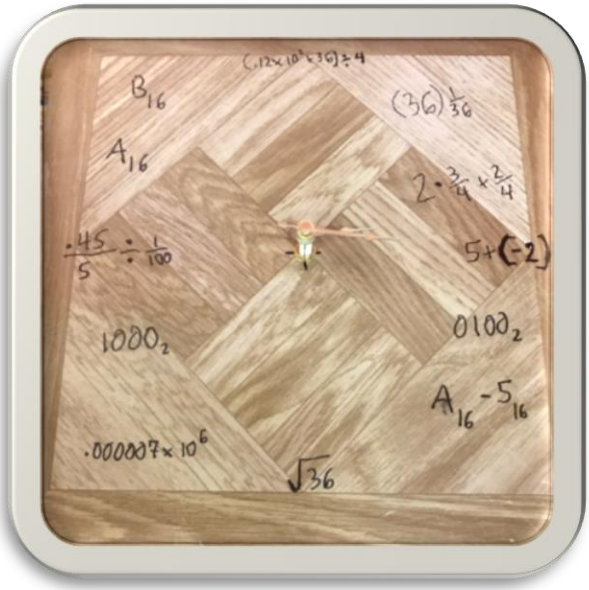
*"The **personal significance** of my clock is that it tells time in an interesting way. Instead of simply showing the digits, I used grade level and above mathematical expressions that exhibited my intellect and taste in mathematical equations.*

*The **civic significance** of clocks is that they tell time without the need to look to the sky to measure or guess the time based on the sun's position. Instead, the exact time is known simply by looking at a well-designed clock such as the one I designed.*



*The **scientific significance** of clocks is that we have "biological" clocks (at least that's what my mother says). The human body can learn to wake up at a specific time every day. The body knows when to kick into puberty and a bunch of other stuff. The body's clock is not our own design though, but we can learn to use it to our advantage.*

*What is the **mathematical significance** of a clock? It's the same reason why there are 24 hours in a day, 60 minutes in an hour, and 60 seconds in a minute. Let's start with 24 hours: The ancient Egyptians used a sundial shaped like the letter "T" to divide the half of the day when the sun was shining into 12 parts. Since sundials were not useful at night, the Egyptians looked to the stars. They choose a handful of stars to follow. The sum? 12 hrs of light + 12 hrs of darkness = 24 hrs in a day. Now for the hour, the ancient Babylonians liked to use the number 60. Since a circle can be cut into 6 triangles thus came 60 min. = 1 hr. same with seconds.*

Benjamin Banneker inspired my structure because like me, Banneker was drawn to mathematics and astronomy. He is known as America's first black man of science because of his contribution in mathematics and astronomy. This makes me very proud.

My structure has impacted my immediate community because after designing it, I gave it to my teacher. My choice of mathematical expressions began a very interesting dialogue in my classroom. Most of my classmates had not been exposed to many of the expressions that I used.

While creating this structure, I learned about the hexadecimal system. I was able to grasp the concept very quickly.

*During the design and creation of the structure, I worked through some mental blocks. I wanted to write expressions that were challenging, but I had to first stretch myself to learn some new concepts." – **Christian Oluwatimilehin Parkinson***

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*"I loved making my Benjamin Banneker clock. He was such a brilliant mathematician and he inspired me while working on this project. I love math, so this activity was great. I tried to think of the hardest math expressions to write. Building a working clock was exciting. There were so many little parts, it was a bit challenging at first. But I worked hard and was able to complete the project. If I could, I would do it again." – **Nahshon Cannad***

Build Like Benjamin Banneker

A 2018-2019 Global Cardboard Challenge Event

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*Use **cardboard** to construct your own invention like Benjamin Banneker!*

A Brief History of Benjamin Banneker

> Born on November 9, 1731 outside Baltimore, Maryland, Benjamin Banneker was an extraordinary, self-educated, free African American. His zest for knowledge led him to become an accomplished mathematician, abolitionist, and surveyor of our nation's capital. When Banneker was not star gazing, you could find him maintaining his one hundred acre tobacco farm, orchard, and apiary. Today his property serves as the location of the Benjamin Banneker Historical Park and Museum, part of the Baltimore County Department of Recreation and Parks.

"About Benjamin Banneker". Authored by the Benjamin Banneker Foundation, Inc. (www.bannekerfoundation.com)

This challenge is a **cross-curricular activity** addressing **mathematics, science, history/social studies, language arts, reading, and the arts**!

The Benjamin Banneker Association, Inc. (BBA) is an advocacy organization which supports high-quality learning in mathematics by converging these three ideas:

Focus

Perseverance

Inspiration

We hope Benjamin Banneker's amazing focus and perseverance will also inspire your inventiveness and desire to exercise your creative talents through the "Build Like Benjamin Banneker" Cardboard Challenge.

Why the cardboard challenge?

Clock created by student at Knox Gifted Academy in Arizona
image taken from https://www.flickr.com/photos/buistbunch/21114218824/

- Cardboard is a strong and lightweight material made up of the same resource Benjamin Banneker used over 250 years ago – wood! Corrugated cardboard (the type often used for packaging materials) is made of pine chips which have been manufactured as kraft paper. (Advameg, 2017).
- Building models with cardboard fosters creativity, ingenuity, resourcefulness, perseverance and teamwork; particularly providing an opportunity for younger children to engage in creative play (Cherry Creek Schools Foundation, 2014).
- Provides individuals with an opportunity to explore their interests and passions and create things that have an impact on others.
- Bottom line - **it is fun and challenging**!

- Cardboard is being considered as a building material because it is "inexpensive, environmentally friendly, and cheap to manufacture" (Rose, 2012).
- For a more in-depth look at how cardboard can be used for major constructions, check out this presentation on Cardboard as a Building Material.

Instructions

1. **Learn About Benjamin Banneker:** After studying the life Benjamin Banneker and his many inventions, design your own using cardboard as the primary material. Your invention should:
    a. reflect the resourcefulness and imagination of Benjamin Banneker
    b. provide purpose for / impact your community (school, neighborhood, city, etc.)
2. **Design Your Invention:** A design blueprint must be drawn on graph paper before any cardboard construction begins.
3. **Time to Build!** Build your structure using cardboard and other approved building materials (see list below).
4. **Show the World Your Masterpiece!** Take pictures of your completed structure. Make a short video (less than 5 minutes) showing how it was constructed, and how it works.

Approved Building Materials

The following materials approved for this project include (**but are not limited to**):

- measuring tools (such as ruler, measuring tape, meter / yard sticks, protractor, or a compass)
- paper
- tape
- glue
- brads
- scissors
- pencils
- re-used / empty containers (such as plastic bottles milk cartons, egg cartons, paper towel, toilet paper tubes, stuffed animals)
- clock movement kit / parts from a working clock (which can be purchased from Hobby Lobby, Michaels, Amazon, etc.)
- art supplies (such as markers, paint and confetti to decorate your invention)
- lenses (for a telescope)

The primary material used in any invention submitted for this competition must be cardboard!

Competition Guidelines

1. There are **5 competition categories**:
    - Pre-school (ages 2 – 4);
    - Elementary (students in Kindergarten – Grade 5);
    - Middle (students in grades 6 – 8);
    - High School (students in grades 9 – 12); and
    - Adults (ages 18+)
2. You may work alone, with a partner, or in a group. Invite friends, family, classmates, and community members to help!
3. **Elementary – Adult Categories**: You must provide a written project reflection to accompany your invention that explains the **personal**, **civic**, **scientific**, and **mathematical** significance of what you've built. For example:
    - How did Benjamin Banneker inspire your invention?
    - How does your invention help or impact your community, our country or the world?
    - What did you learn while creating this invention?
    - Benjamin Banneker persisted in developing his inventions. Sometimes taking years to create one invention. How did you persist while creating your invention?
4. Inventions will be evaluated by the following criteria:
    - Creativity and originality of concept
    - Design blueprint
    - Long-term stability (*Benjamin Banneker's clock ran for over 40 years!)*
    - Use of cardboard as a primary material
    - Project reflection

Submission Information

- Your submission packet should be emailed to **Brea Ratliff (bratliff@bbamath.org)** no later than **February 4, 2019**. The following materials must be included in your submission packet:
  - Project reflection
  - Registration Form (please submit one form per individual)
  - Copy of the design blueprint
  - Pictures of final structure
  - Link to video showing the structure in use
- Submissions will be accepted via email only.

Awards

The top participants in each category will be featured in national BBA publications, including our website, newsletter, as well as our annual journal, The Lighthouse Almanac.

Special prizes will be awarded to the 1st, 2nd, and 3rd place participants in each category.

What Can I Build?

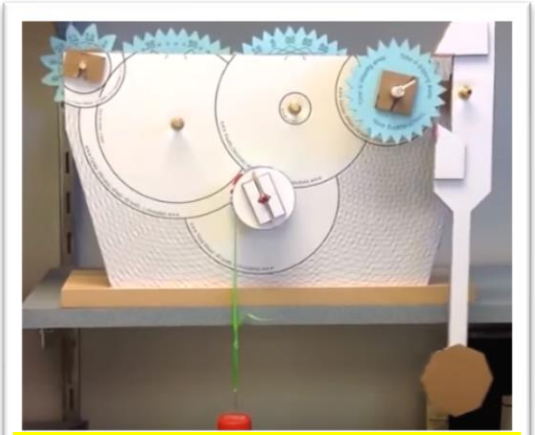
You can build anything!

We want you to be inspired by Benjamin Banneker, who was a mathematician, astronomer, author, abolitionist, surveyor, and farmer. Mr. Banneker, often recognized as the first African-American Man of Science, was a creative problem solver. Through this challenge, we hope you use and continue to increase your own innovative abilities!

Here are a few examples of things you could build - or build upon – as well as some content connections:

Did you know farmers are mathematicians and engineers in action? Use data, mathematical modeling and technology to create a farming or gardening tool.

Observe magnification and ratio in action using a telescope!



Learn more about gears and gravity by creating a working clock made out of cereal boxes!

Images taken from http://bit.ly/2lsl2v7 , http://bit.ly/2yYUW8F and https://www.youtube.com/watch?v=jNgHeLYcTh8

Recommended Resources

These resources will help you learn more about Benjamin Banneker and other cardboard creations:

Books

- Tick Tock, Banneker's Clock by Shana Keller
- Dear Benjamin Banneker by Andrea Davis Pinkney
- Hand in Hand: Ten Black Men Who Changed America by Andrea Davis Pinkney
- The Life of Benjamin Banneker: The First African American Man of Science by Silvio A. Bedini

Websites

- The Benjamin Banneker Association (www.bbamath.org)
- The Benjamin Banneker Foundation (www.bannekerfoundation.com)
- Mathematicians of the African Diaspora (http://www.math.buffalo.edu/mad/special/banneker-benjamin.html)
- PBS Africans in America: Benjamin Banneker (https://www.pbs.org/wgbh/aia/part2/2p84.html)
- Mathematics of Telescopes (http://www.peterboroughastronomy.com/LearningCentre/Telescope%20Math.pdf)
- Agriculture, Food and Natural Resources Integrated Projects (http://www.stemtransitions.org/ag.php)

Cardboard Creations

- Cereal Box Clock (https://newgottland.com/2013/06/09/cereal-box-clock-working-prototype/) and PDF gear patterns (http://bit.ly/ng-cereal-clock)
- Homemade Telescope (https://www.savvyhomemade.com/building-a-homemade-telescope/)
- Cardboard Gardening Containers (http://www.birdsandblooms.com/gardening/gardening-basics/cardboard-gardening/)
- Global Cardboard Challenge (https://cardboardchallenge.com/events/build-like-benjamin-banneker-challenge/)

Special Thanks

The Benjamin Banneker Association would like to thank the following individuals and groups for their contribution to our Benjamin Banneker Celebration and Challenge:

- Dr. Vanessa Cleaver, Past President of the Benjamin Banneker Association (BBA); creator of BBA's Benjamin Banneker Week Celebration.
- Natalie Holliman, first chairperson and organizer of BBA's Benjamin Banneker Week Celebration
- Brea Ratliff, BBA President; creator of the "Build Like Banneker Challenge"
- The Benjamin Banneker Foundation, Inc.
- The Benjamin Banneker Historical Park and Museum

“Build Like Banneker” Registration Form

Name _____

City / State _____

Contact Information (email and mailing address) _____

_____

Title of Invention _____

Category (circle one): Pre-school Elementary Middle High School Adult

☐ I give my permission to allow my photograph to be used on the Global Cardboard Challenge website, and in Benjamin Banneker Association, Inc. publications.

☐ I give my permission be interviewed for Benjamin Banneker Association, Inc. publications.

_____ _____

Participant Signature Parent Signature (for children under the age of 18)

I confirm this submission contains my / my child’s original design and work and I understand that all judges’ decisions are final.

_____ _____

Participant Signature Parent Signature (for children under the age of 18)

Please email this form and your submission packet to Brea Ratliff (bratliff@bbamath.org) no later than **February 4, 2019.**

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Join the Benjamin Banneker Association today!

BBA is an affiliate of NCTM and a member of the Conference Board of Mathematical Sciences

Mission

Banneker members are deeply committed to finding solutions to the problems that must be solved for children of African ancestry to reach parity of opportunities to study and achieve in mathematics.

Membership

Dues are $30 per year, $50 for 2 years, and $80 for 3 years. Discounts are available for students, schools, and pre-service teachers. BBA Student Group dues are $50 per year and include 1 membership for the group adviser. Silver and Gold Lifetime memberships are available.

Payment can be mailed to The Benjamin Banneker Association, PO Box 55864, Little Rock, AR 72215 or you can join online at bbamath.org.

What Do I Get?

BBA Professional Webinars
Opportunities to present at local and national conferences
Free access to members only lessons, activities, and classroom resources
Quarterly newsletters
Scholarships and grants for teachers
Access to members-only website for shared research, events, resources and opportunities
Free access to the BBA peer-reviewed journal, The Lighthouse Almanac

What Do We Do?

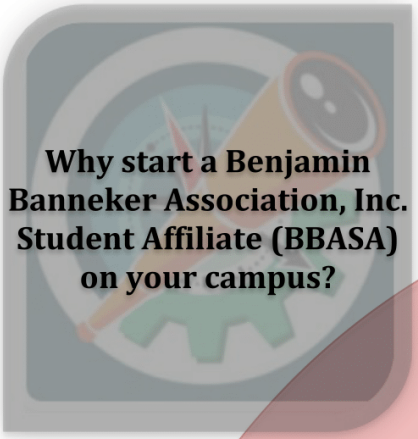
Promote equity and excellence in mathematics education through publications, presentations at conferences, and our online presence.

Collaborate with other organizations such as NCTM, NCSM, TODOS, AMTE, NAM and WME to take a social justice stance that includes fair and equitable teaching practices, high expectations for all students, access to rich, rigorous, and relevant mathematics, and strong family community relationships to promote mathematics learning and achievement.

Partner with community learning spaces such as the Boys and Girls Clubs of America.

Sponsor students competing in local, regional, or national math/science activities.

Benjamin Banneker Association, Inc.
Student Affiliates



Why start a Benjamin Banneker Association, Inc. Student Affiliate (BBASA) on your campus?

- *Encourage your students to learn more about **Benjamin Banneker** and the **contributions of other amazing African-American mathematicians**;*
- *Help your students gain **confidence in their ability to learn mathematics**;*
- *Provide a platform for students to discuss and **develop solutions** for **issues related to their world**; and*
- *Teach your students how to become **advocates** for their own education, their school, and their communities.*

Membership Benefits include:

- One complimentary individual membership to the Benjamin Banneker Association for the BBASA advisor
- Access to student scholarships, culturally-relevant teaching resources, and the BBA newsletter
- Mentoring opportunities from local and national leaders
- Expanding students' public speaking skills as presenters at local and national conferences
- Connect with other BBASA groups nationwide semi-annually
- Developing leaders as student delegates to represent their communities and provide input on the goals and direction of the Benjamin Banneker Association, Inc.
- Participation in the nationally renown Benjamin Banneker Week

Cost of Membership: $50

BBASA groups are recognized as Institutional Members of the Benjamin Banneker Association, Inc.