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The Need for African Centered Education in STEM Programs for Black Youth

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African centered education is the act of placing the needs and interests of people of African descent at the center of their educational experience. Often, science, technology, engineering, and mathematics (STEM) is thought of as being culturally "neutral;" however, African centered educators argue that the very origins of STEM is cultural and rooted in African history and philosophy. This paper explores a STEM program that is led by African centered educators and provides information on the benefits of having African centered philosophy as part of endeavors involving Black youth.

Keywords: African centered education, Black males, STEM program, African origins of STEM

Working with children of African descent in a science, technology, engineering, and mathematics (STEM) program requires knowledge of African STEM anteriority. We created a program that exposes middle school Black boys to STEM without ignoring the critical importance of the science-African culture connection. The program, held at a Historically Black College and University (HBCU) in the mid-Atlantic region, features 100 middle school Black male youth who are tasked with coming up with the next generation of STEM innovations and technology. We begin our work with Black boys by understanding the African origins of STEM – that they are not "just some kids"; instead, they are part of a tradition of technology innovators. In this program, Black boys take both technology classes and African culture/history classes. STEM courses must never be offered without culture classes because when they are, popular culture leads Black students to believe that technology is "stuff white people created" (ala they are superior). In this article, we provide an overview of an African centered STEM program for Black boys.

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We also discuss the African origins of STEM used to teach Black boys STEM and African history/culture. We conclude by sharing the challenges we faced and successes in operating the program.

An African Centered STEM Program for Black Boys

The STEM program was designed for Black boys in middle school at an HBCU. Families complete an application for admittance into the STEM program via an online portal. Black male students are a part of Black families, so we believe we are admitting the entire family, not just the individual student. The criteria for admittance into the program are twofold a) appropriate grade level and b) when students' application was received. Students are required to be "rising" into grades 6, 7, or 8. For example, if a student completed 8th grade in June, they would not be eligible for the program beginning in the summer because they would be rising into the 9th grade. Conversely, a student who completed 5th grade in June is eligible for the program because they would be rising 6th-grade students in the ensuing Fall.

Program participants come from more than 45 different public or private elementary and junior high/middle schools. Program admittance functions similarly to the notion of "first come, first served," or in this case, "first come, first admitted." Families are admitted in the order in which they apply to the program until we reach our capacity of 100 students. Once at capacity, additional families are placed on a waiting list. Families are admitted from the waiting list when spots become available.

Since African contributions to technology are omitted from texts and common discourse, feelings of inferiority accompany the omissions (Anderson, 2013). Black youth are imbued with a feeling of white superiority and Black inferiority, by design, until they are taught about African technological anteriority simultaneous to being exposed to technology. African youth must learn that technology is a culture but often treated as acultural, which is not true. When technologies are used, culture becomes the main agent of technology. Put differently, technology is the vessel that culture rides upon to deliver itself to the user. For example, social media platforms appear culturally innocuous; however, not only in the form of communication (mostly typewritten messages and virtual meetings) culture, the style of communication within the medium is cultural. Shorthand communication and the determination of online "friendship" or virtual "community" are all cultural.

The way that the concept of "family" has worked for millennia and the kinship of the community for those millennia has been the methods by which Africans have maintained the very essence of African ontology. In other words, what it means to be African is at stake when using technology because of how Africans have clarified what it means to be an African person in existence, practicing an African culture. In those ways, what is created technologically is uber cultural. In that sense, children of African descent must not be exposed to technology without also being exposed to who they are culturally, as Africans.

Student days are segmented into six 50-minute learning periods. Students are taught 3D design, critical and scientific thought, African movement, African history and culture, coding, augmented, and virtual reality. The interconnectedness between culture and technology is discussed in all classes, and students are challenged to think more deeply about what constitutes "technology." For example, when introducing students to African musical instruments such as the Djembe drum and berimbau (African string instrument), the movement teacher noted that they are both examples of "technology." Both instruments require an understanding of physics, acoustics,

mathematics, knowledge of cultural movements and ideas, artistry, and 3D design. Africans prototyped and refined both instruments, and once they were perfected, the models were reproduced and used for millennia, even in the present day. Students learn that "technology" is an idea that can be constructed and deconstructed and, perhaps, adheres to notions that extend from cultural ideas so much that both the Djembe and berimbau are submitted commonly as examples of innovation in music and not technology.

Our understanding of technology as a vessel to deliver culture prompted us to develop multiple "culture classes" accompanying the technology courses. In the technology courses, Black boys learn 3D printing, augmented reality, design thinking, coding, and more. In the culture class, the students learn what they mean for them as members of the worldwide African community. Teachers in culture classes reveal the African origins of STEM. In connecting Black male youth to that, the question becomes, what kind of technology complements where we came from, who we are, where we are, and where we are going?

For Europeans and those under their power, that question is not explicit because innovative thinking defaults in the direction of thinking that advances the cultural and political ways of knowing and thinking of European society. Consequently, European inculcation and the prevalence of White supremacy in all areas of human endeavor creates a person who can only think outside of European interest if they are intentionally taught to do so. So, for our young men to think in terms of making a difference for their people, they must have a culture class taught by an African centered teacher with a proven track record of reaching Black children using African centered methods. It is also critical that the STEM experts themselves be African centered in their orientation. Our program hires STEM teachers who teach at local African centered schools to teach the STEM courses so that the Black male students can see that there is no disconnect.

We prefer to see the world as one significant experience where things are connected, not a series of disconnected parts. We teach them that technology is music and vice versa, mathematics is reading and vice versa. Art is as much science as it is art. This means, the matter around them can be discovered individually; however, all the matter is part of a unified "one" that matters more than the separate parts. STEM is part of the spiritual system because it originates from a spiritual space. The only way for a STEM teacher to transmit the necessary African centered knowledge to students while teaching a technology class is for the teacher him/herself to be an African centered person.

We taught African history and culture to our young men through videos, field trips, lectures and discussion, proverbs, riddles, debates, and movies. In our setting, we start the morning with “Endabas,” a Zulu word that broadly means an important meeting or conference. We always come together first as a large group to reconnect with the cultural norms that we set. During this time, we discuss proverbs, developmentally appropriate age, and gender challenges, such as how to properly oppose or challenge ideas or notions presented by others. We discuss our individual and collective mission, responsibility, and how to use our communal agency to address the needs of the global Black community. Program administrators or teachers lead those conversations.

We use the terms "mama" (mother figure) and "baba" (father figure) in our references to each other. In African culture, all adults possess responsibility for Black children and have parental responsibility for those children. We refer to young people as "brother" to continually reiterate our connection and responsibility to one another. We say things like, "don't leave a seat in between, sit directly next to your brother” for our large group meetings. The expectations for both learning and behavior are high. We do not make unnecessary distinctions between our young people from less affluent communities and those from more affluent communities.

We believe that Black children are Africans who have an African origin. We do not use economic status or victimhood as a part of our identity – the only aspect of identity is African identity. We believe that many people use other identity classifications on Black youth to create confusion, and so for numerous reasons (such as personal identity confusion). We believe that Black value systems should be used to reach Black children (Nguzo Saba and Maat). We believe that Africans/Blacks should control the institutions within their community. We use a "community control" mindset in our work with our young people, meaning that we are in constantly communicating with our community. We improve our program based upon what parents and community members say to us.

Finally, we work with young people under the belief that they want us to offer them love and discipline. We are not scared of them. We believe that their families are good and decent people, and no one is "better" than them (or us) regardless of economic status, skin complexion, or any other factor. We believe those things help create an African centered/Pan Africanist environment that is healthy for Black children.

African Origins of STEM

When one contemplates the genesis of STEM, it immediately takes them to Africa, the birthplace of humanity. It was there in the Olduvai Gorge that the earliest human remains (homo habilis) were found by Louis Leakey and colleagues confirming Africa as the birthplace of humanity (Leakey, Tobias, & Napier, 1964). Even earlier, fossilized remains of our ancient ancestors, that predated Leakey's discovery by 150,000 years were discovered by Bernard Ngenyeo in the Lake Turkana region of Kenya. The people of the Lake Turkana region were also the first to use crude stone tools (Kibunjia, 1994). The invention of tools, although crude, was the introduction of technology to humanity, and that locates the genesis of STEM on the African continent over 4 million years ago. Therefore, Africa is the genesis of technology, mathematics, astronomy, maritime navigation, architecture, and engineering.

The purpose of this work is derived from a long-documented history of the relationship among African contributions to STEM, the function of African cultural knowledge in STEM innovation and education, and how such knowledge must be used when instructing Black children. We begin by considering the origins of STEM and the historical contributions made by African people. We then discuss the cultural context from which STEM education must begin when instructing Black children. Within the discussion, we highlight a program that successfully developed and implemented an African-centered STEM learning experience for Black children, which ultimately led to increases in academic performance and interest in STEM-related professions. We close with implications and conclusions. This work considers what can be drawn from African history and cultural practices, African notions of STEM, its relationship to culture, and an African-centered STEM program to make a difference for African children in the US and, perhaps, abroad.

The Lebombo Bone

Often when discussing the origins of mathematics, science, and technology, there is a tendency to turn attention to the land ruled by Africans called Kmt (now called “Egypt” under Arabic/European rule), because Kmt was one of the most technologically advanced societies in world history (Asante, 1990). However, 20,000 years before Kmt’ s existence, early Africans in

the Congo region had developed the first mathematical tool known to humanity called the Lebombo bone. Named for the Lebombo mountains where this artifact was found by archeologist Peter Beaumont (Beaumont, 1973), the Lebombo bone is the small femur bone of a baboon with 29 notches on it, which archaeologists believe was used to follow the cycles of the moon.

A similar bone, again the femur of a baboon, was found by another archeologist named Jean de Heinzelin. That bone differed in a few respects. The first was that it was at least 10,000 years younger than the Lebombo bone, and because of how scientists say it was used to mark time, it represents an advancement in mathematical knowledge by Africans. Second, Heinzelin noted that from the top down, the bone possessed a series of markings. Heinzelin suggested that the markings represent knowledge of adding and multiplying by doubling (Heinzelin, 1962). On the reverse side of the bone, there is a different series of markings. Heinzelin hypothesized that the numbers represented 10 and 20 + 1 and 10 and 20 – 1; that is, it represented knowledge of a base ten number system and prime numbers between 10 and 20.

The Lebombo and Ishango bones were the geneses of STEM, particularly mathematics; both practical and abstract mathematics originate in Kmt (Zaslavsky, 1999). An interesting side note is that early Kemetic representations of the god Thoth took the form of a baboon. Perhaps that representation was an acknowledgment of those who laid the foundation for understanding mathematics and science (Finch, 2001). In the STEM program, Black youth learn about the Lebombo and Ishango bones to help them understand the geneses of STEM and how their people used this knowledge.

The Rhind and Moscow Mathematics Papyri

Our understanding of what was known by Kemetic mathematicians comes from two major papyri, the Rhind and Moscow Papyri. The Rhind papyrus is attributed to a scribe named Ahmes, who admits that what he had authored is a copy of an older Kemetic work with an approximate date of 2650 BC, most likely copied after the multi genius Imhotep (Miatello, 2008). The Rhind Papyrus was found in the mid-nineteenth century at Thebes in Upper Kemet and is now housed at the British Museum. It contains 87 mathematics problems covering a range of topics, including fractions multiplied by a factor, area, the slope of the pyramid, and other problems.

The Moscow Papyrus predates the Rhind papyrus and consists of 60 problems primarily centered around geometry (Kalimuthu, 2009). Other minor mathematical papyri such as the Reisner, Berlin, and the Egyptian Mathematical Leather Roll Papyri provide evidence that Kemetic mathematicians had an acute understanding of higher mathematics (Hermoso, Hermoso, Tubio, & Serrano, 2015). Diop (1991) contends that these ancient texts show that Kmt, not Greece, brought to the world an understanding of the area of a sphere, the volume of a cylinder, the area of a circle, and its value pi, and quadratic equations.

Although abstract mathematics origins are easily traceable to Kmt, the Greeks are held in high esteem for the refinement of mathematics despite the fact that the Greek mathematicians like Euclid and Pythagoras studied under priests (professors) at African universities (Asante, 1990). European mathematicians merely translated Kemetic mathematical texts and claimed it as their own (Anderson, 2013). Kemetic knowledge of mathematics, engineering, physics, and other STEM-related fields may best be articulated through the Great Pyramid design and construction. Browder (1992) noted,

The Great Pyramid was engineered with accuracies measured to the hundredths of an inch…the pyramid's height relates to its perimeter as the radius of a circle does to its

circumference. Dividing the perimeter of the pyramid's base by twice its height yields 3.1428, which is a working approximation of *pi* often used by contemporary engineers in construction design. The area of a face of the Great Pyramid is also the same as the square of its vertical height. The square of the vertical height is also the same as one-half the pyramid's base width, times its slant height. This fact indicates that the pyramid's design is in accordance with *phi* (1.618), also called the "Golden Number" (pp. 107-108).

When considering the genesis of most aspects of human knowledge, most signs point to Kmt as the origin point. In addition to the aforementioned, we also find the origins of various other technologies that began on the African continent (such as shipping, aviation, and astrology, to name a few). Many Black youths learn about the various mathematical topics (e.g., slope, area, pi, equations) from a European perspective without ever knowing the African origins of those topics. In the program, they learn about African peoples' contributions to STEM.

The African Iron Age

Schmidt and Avery (1978) reported another form of technology developed by the Haya, a Bantu-speaking people in Tanzania, is a furnace capable of burning at high temperatures to make carbon steel a feat not believed capable in Africa. Yet, the Haya has a 2000-year history of producing carbon steel (Schmidt & Avery, 1978). As quoted in Van Sertima's (1983) *Blacks in Science*, Schmidt says, "We have found a technological process in the African iron Age which is exceedingly complex" (p. 87). He explains, "To be able to say that a technologically superior culture developed in Africa more than 1,500 years ago overturns popular and scholarly ideas that technological sophistication developed in Europe but not in Africa" (p. 87). The complexity of what the Haya did is a product of their industrious nature. The Haya used materials from their natural environment like an old termite mound whose floor served as the perfect refractor of heat. Goat skinned bags make the bellows with which air is blown into the furnace and create their charcoal. The heat generated from this furnace exceeds 3275 degrees Fahrenheit, which is nearly 700 degrees hotter than ancient European furnaces. This process, Avery contends, is akin to semi-conductor technology (Shore, 1998). In the program, Black male youth learn about how Africans created iron using a complex technological process.

The Kahun Papyrus

One of the earliest medical texts is the Kahun Papyrus, often referred to as the "Gynecological Papyrus" because a significant portion of the text focuses on fertility, contraception, diseases, and other reproductive issues (Merskey & Potter, 1989). The Kahun Papyrus is constructed into three sections: symptoms, diagnosis, and treatment. Saffron was often prescribed to help with conception. Crocodile dung was placed on the back of a woman's cervix as a prescription for birth control. The medical needs of women made up a large portion of the Kemetic physician's work. According to Ritner (2001), women had their guild, which was overseen by a female physician named Peshet during the 5th or 6th dynasty.

Suffice it to say that Africa has played a major role in all STEM areas, and within European-based societies, too little recognition has been given to the African continent for those contributions. For example, we know that Africans from the Mandinka Empire hundreds of years before Columbus sailed to the Americas and develop amicable relationships with Native Americans (Sertima, 1995). Columbus himself testifies to this in his logs, stating that natives

informed him of the Cape Verde Islands that West Africans had long been making trips to the West Indies (Sertima, 1995). In fact, historian Bartolomé de las Casas reports that on Columbus' third voyage he was told by the natives of Hispaniola that, "Black people had come from the south and southeast and that their spear tips were made of a metal that they call "quanin"" (Symcox & Sullivan, 2005, p. 49). Sea travel was not foreign to Africans. Early Africans had mapped the world thousands of years before Columbus ever set sail anywhere (Van Sertima, 1995).

Charles Hapgood's book, *Maps of the Ancient Sea Kings,* is an exhaustive study of ancient maps used by explorers of Columbus's age. One map, the Piri Reis map, correctly shows the west coast of Africa, South America, and Antarctica. Interestingly, Antarctica has only been correctly mapped with the assistance of satellites. In the STEM program, Black boys learn about their African ancestors' contribution to medicine, shipbuilding and navigation, and metal for weaponry. The young men also develop a critical consciousness about the fallacy that Christopher Columbus found America with the understanding that Africans traveled the world long before Columbus and possessed a more sophisticated understanding of the world and maritime navigation.

The Dogon

An even more remarkable testament to the advanced knowledge coming from the African continent is that of the Dogon cosmological system and their knowledge and understanding of the stars. Particularly their understanding of the star Sirius A and its companion star Sirius (Diop, 1991). The Dogon are said to understand facts about this star and have known these things for hundreds of years before modern astronomy. Without the aid of telescopes, the Dogon knew:

1. Sirius A has a companion star Sirius B which they call *po tolo* and cannot be seen with the naked eye.
2. Sirius B is so massive that all the beings on earth could not lift a small portion of material from that star. Sirius B is a white dwarf star, one of the densest forms of matter in the universe and extremely heavy.
3. Star's material makeup, saying it was made of *Sagala*, a shiny metal like iron. Finch (2001) states that the Dogon's findings have only been recently confirmed through the star's spectrographic analysis.
4. How long it took for Sirius A to orbit Sirius B, marked by a ceremony every 60 years (Diop, 1991; Finch, 2001). To be confirmed is the Dogon belief that another star, "Sirius C," which they say have a small planet orbiting it.

Although not confirmed, Benest and Duvent (1995) suspect that there is a small celestial body orbiting Sirius A, which has not yet been confirmed. Dogon contributions to science and technology has mysteriously been left out of most modern astrology texts.

In the Laws part 7 by Plato, there occurs a dialogue between Athenian and Clenias. In this dialogue, Athenian suggests that free people should be taught as the children are taught in Egypt (Kmt), and then he proceeds to give examples of how Egyptian (Kemetic) children are taught. He concludes by saying that teaching like the [Kemites] teach frees us (Greeks) from ignorance. Clenias responds, "what ignorance?" Athenian responds by saying that we (Greeks) appear more like pigs than men (compared to Kmt). Going further, he says that he is ashamed of himself as well as all of Hellenes. Plato, Pythagoras, Thales, and Eudoxus all studied in Kmt and pay homage to the wealth of knowledge they received there and testify to Kmt's brilliance and origins of science, mathematics, philosophy, and other disciplines. The movement to erase African contributions has

been a more recent historical event that seems to have been done to bolster claims of African inferiority.

Kmt was not to last forever as the intellectual capital of the world. However, in its decline, other intellectual centers in Africa emerged to take Kmt's place as the intellectual center, such as Timbuktu. Early Arab travelers have painted detailed pictures of Africa that speak to Africa's intellectual heritage. Leo Africanus reports that the king in Timbuktu's region surrounds himself with judges, professors, and scholars of faith, and holds scholars in high regard. He also mentions that the book trade in Africa is more profitable than any other trade in the land (Brown, 2010). In the North African country of Morocco, we find the University of al-Karaouine, founded in 859 AD in the city of Fez, stands as one of the oldest universities (Griffiths & Buttery, 2018). The university was founded and funded by two sisters, Mariam and Fatima. The "firsts" that Africa has produced in every aspect of human activity are countless. The future holds many more first for African people in the STEM field if we take the time to properly prepare our young people.

Perhaps an understanding of the African origins and contributions to STEM both, historical and contemporary, is likely to empower Black youth to tap into their full potential. They will also contribute to civilization as their brilliant African ancestors have done over millions of years.

Technology and Its Use through the Lens of Culture

Considering the intellectual advancement that existed on Africa's continent, some scholars have asked why Africa did not develop on a trajectory like Europe (Rodney, 1972; Williams, 1971). We believe that the key to exploring that question is to understand what Jones and Nichols (2013) call the framework for understanding the philosophical aspects of cultural differences. In Jones and Nichols' framework, he asserts that a group's culture can provide guidelines related to how the group socializes their people, instructs their youth, shapes thinking among their people, and creates norms and values for their community (Hilliard, 2002). The cultural framework of a people guides them within the culture and impacts every aspect of life, education, economics, religion, entertainment, etc. It is filtered through the cultural norms that they create.

Utilizing Jones and Nichols' (2013) framework, we can examine and theorize why Africa, a land of high intellect and vast mineral resources, did not develop on a similar course as Europe. They outline the cultural differences among people of African and European descent through axiology (values), epistemology (knowledge), and logic (how one reasons). They were related to epistemology, Jones and Nichols, outline how knowledge is applied, taught, and what methods are used for teaching youth. They contend that the highest value in European cosmology is the member-object relationship and the acquisition of the object. Jones and Nichols contend that Europe's natural environment (caves and hillsides) led them to place enormous value on objects that could help with resource acquisition. In Europe's environment, there was a constant race to plant and harvest crops in the short window of temperate weather provided by nature. Europeans had to work to maximize food production within the short window. Hence, food becomes an object, and producing that food becomes necessary for survival, and thus, "objects" become important. According to Jones and Nichols, from a psychological perspective, an environment such as Europe, creates an antagonistic relationship between (wo)man and his/her environment. The difficult environmental conditions lead to more individualistic/materialistic relationships between humans.

Jones and Nichols (2013) theorize that in African cosmology, a member-member relationship is valued, and relationships between and among people are valued above other things.

In more temperate zones, like the African continent, where food grew in excess in many places, humans were released from seasonally constrained food production pressures, which allowed them to develop more collaborative interactions. As such, Africans develop values along the lines of the famous African idiom, "I am because WE are and because WE are I am" (Mbiti, 1970). As well as the popular African proverb, "It takes a village to raise a child." An outgrowth of this value is a collective, collaborative social orientation that is generally held in common by other ethnic groups that develop in more temperate zones.

To understand the epistemological aspects of cultural differences, Jones and Nichols (2013) ask three questions:

1. How do people know what they know? (Applied Knowledge).
2. How do people transmit what they know? (Pedagogy).
3. How do people implement knowledge? (Methodology).

Two prominent intellectuals answer the first question: W. Edwards Deming, engineer and statistician and economist Peter Drucker. Drucker is credited with saying, "if you can't measure it, you can't prove it." While Deming is most famous for saying, "In God we trust, all others must bring data." That speaks to the question of how Europeans "know."

In other words, the European cultural thrust is in line with Drucker – to understand the world, you must be able to count or measure it in some form. Nichols (1986) contends that the focus on counting and measuring harkens back to Greek culture, which divorced the spiritual aspect of understanding for a focus on the material aspects of mind and body or the material aspects of understanding. African cultural cosmology, according to Jones and Nichols (2013), emphasizes knowing through symbolic imagery and rhythm. In actuality, the use of words, gestures, tones, rhythm, objects, and feelings provides a synthesis to holistically understand phenomena. It follows then that pedagogically Europeans need to break things down into smaller parts to comprehend them. In European based cultures, we are taught to break things into parts such as nouns, verbs, or subjects to understand, for example, how to compose a sentence (van Wyk, 2014), which is why there are specialized subjects that have, until the recent interest in interdisciplinary studies, remained in academic silos (Mathison & Freeman, 1997). For people of African descent, there is a focus on taking the subject as a whole before going in-depth, breaking down the various parts of the whole (Howard, 2001).

Methodologically, Europeans use step by step processes linearly and sequentially (Guthrie, 2015). While people of African descent often use what Jones and Nichols (2013) call critical path analysis, finding a solution to a problem out of "sequence," perhaps skipping steps yet still finding a way to the solution, i.e., cutting to the chase.

Finally, reasoning or logic in European cosmology is dichotomous and often presents an either/or proposition. We see this most in the Eurocentric judiciary system. There is often a little gray area or context; it is either yes or no or guilty or innocent. In African cosmology, context and meaning are interrogated, and the idea of a middle path may be presented rather than an either-or proposition. Applying Jones and Nichols' (2013) philosophical aspects of cultural differences model helps us understand why intellectual capital and technology differ so much between people of African and European descent. Since Europeans value the acquisition of material wealth, there was more of a disposition toward conquering and controlling the environment and other people, and the use of intellect, wealth, and technology served such purposes.

Conclusion

There are challenges related to incorporating African centered elements into a STEM program. The greatest challenge is working with parents and students who are still convinced that mainstream approaches to reaching/teaching Black children have utility. Even in the face of so much failure, many people (including Black people) believe that with changes and tweaks, the system can work for Black people and our youth. There is evidence that African centered education works for Black children (Shockley, Burbanks, & McPherson, 2015). There is no history of violence, educational failure, or low expectations for Black children in African centered schools. Yet, the US educational system will only support African centered education efforts when the effort is led by people who are against African centered education.

African centered education is a solution for Black youth in STEM spaces. Our approach has yielded 75% greater knowledge in STEM-related topics, 74% more confidence in mathematics and science, and over 70% of our young people report that they are likely to choose a STEM career. In addition, the students in our program have created 3D models of things that they have innovated and must discuss how their innovation addresses a specific need in the Black community. For example, a drone cleans up their community, a solar operated city bus, and a talking robot that comes to your house to tutor you. We believe part of our success is being grounded in knowledge of the African origins of STEM and the humanities.

References

Anderson, S. E. (2013). Historical, cultural, and social implications of mathematics. In E. (. Gustein, & B. Peterson, *Rethinking mathematics: Teaching social justice by the numbers* (pp. 19 - 21). Milwaukee, Wisconsin: Rethinking Schools Ltd.

Beaumont, P. (1973). Border cave - A progress report. *South African Journal of Science, 69*, 41-46.

Brown, R. (2010). *The history and description of Africa.* Cambridge: Cambridge University Press.

Coffeen, L. (2009, March 20). *Marketculture Blog*. Retrieved from Marketculture Blog: http://blog.marketculture.com/2009/03/20/if-you-cant-measure-it-you-cantmanage-it-peter-drucker/

Deming, E. W. (2018). *The New Economics for Industry, Government, and Education.* Cambridge, MA: MIT Press.

Diop, C. A. (1991). *Civilization or barbarism: An authentic anthropology.* Chicago: Chicago Review Press, Inc.

Finch III, C. S. (2001). *The star of deep beginnings: The genesis of African science and technology.* Decatur: Khenti, Inc.

Griffiths, C., & Buttery, T. (2018, March 19). *The world's oldest centre of learning*. Retrieved: http://www.bbc.com/travel/gallery/20180318-the-worlds-oldest-centre-of-learning

Guthrie, G. (2015). Culturally grounded pedagogy and research methodology. *Compare A Journal of Comparative and International Education, 45*(1), 163-168.

Heinzelin, J. D. (1962). ISHANGO. *Scientific American, 206*(6), 105-118.

Hermoso, J. A., Hermoso, F. M., Tubio, F. D., & Serrano, A. J. (2015). Geometry and proportions in the funeral chapel of Sarenput II. *Nexus Network Journal, 17*(1), 287 - 309.

Hilliard III, A. G. (2002). *Affirming African indigenous socialization in the face of the cultural wars.* Gainesville: Makare Publishing Company.

Howard, T. C. (2001). Powerful pedagogy for African American students: A case of four teachers. *Urban Education, 36*(2), 179 - 202.

Kalimuthu, S. (2009). The parallel postulate: Return of the roaring lion. *Indian Journal of Science and Technology, 2*(4), 16 - 22.

Kibunjia, M. (1994). Pliocene archaeological occurrences in the Lake Turkana Basin. *Journal of Human Evolution, 27*(1-3), 159-171.

Leakey, L. S., Tobias, P. V., & Napier, J. R. (1964). A new species of the genus Homo from Olguvai Gorge. *Nature, 202*(4927), 3.

Mathison, S., & Freeman, M. (1997). The logic of interdisciplinary studies. Paper presented at the Annual American Educational Research Association. Chicago, 1997. Retrieved from: http://www.albany.edu/cela/reports/mathisonlogic12004.pdf

Mbiti, J. (1970). *African religions and philosophies.* New York: Doubleday and Company.

Merskey, H., & Potter, P. (1989). The womb lay still in Ancient Egypt. *The British Journal of Psychiatry, 154*(6), 751-753.

Miatello, L. (2008). The difference 5 1/2 in a problem of rations from the Rhind mathematical papyrus. *Mistoria Mathematica, 35*(5), 277-284.

Nichols, E. J. (1986). Cultural foundations for teaching black children. *Teaching mathematics*, *1*, 1-7.

Rodney, W. (1972). *How Europe underdeveloped Africa*. United Kingdom: Bogle-L'Ouverture Publications.

Ritner, R. K. (2001). Medicine. In R. K. Ritner, *Oxford encyclopedia of ancient Egypt, vol. 2* (pp. 321 - 356). Oxford: Oxford University Press.

Schmidt, P., & Avery, D. H. (1978). Complex iron smelting and prehistoric culture in Tanzania. *American Association for the Advancement of Science, 201*(4361), 1085 - 1089.

Shore, D. (1998). Steel-making in ancient Africa. In I. V. Sertima, *Blacks in Science: Ancient and modern* (pp. 157 - 162). Piscataway: Transaction Publishers.

Symcox, G., & Sullivan, B. (2005). *Christopher Columbus and the enterprise of the Indies: A brief history with documents.* New York: Palgrave MacMillian.

van Wyk, M. M. (2014). Conceptualizing an Afrocentric-indigenous pedagogy for an inclusive classroom environment. *Mediterranean Journal of Social Sciences, 5*(4), 292 - 299.

Van Sertima, I. V. (1995). *Blacks in science: Ancient and modern.* Piscataway: Transaction Publishers.

Williams, C. (1971). *The destruction of the Black civilization: Great issues of a race from 4500 BC to 2000 AD*. Dubuque: Kendall/Hunt Publishing Co.

Zaslavsky, C. (1999). *Africa counts: Number and pattern in African culture.* Boston: Prindle, Weber & Schmidt.

