(ONTOLOGICALLY) BLACK AND PROUD

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ABSTRACT

This research is meant to articulate from a pedagogical and empirical sense, how educators and those who engage in educational research conceptualize ways to create opportunities for Black children to participate in mathematics, and how this task is taken up in a way that affirms their identity, cultural practices, and knowledge. Thus, I ask the complex but straightforward question: *what forms of capital do Black students possess that could be advantageous to the learning of mathematics?* In framing this review, I articulate the distinctions from seminal work done on Black children, and suggest that understanding Black students' cultural capital implicates the quality of instruction that they receive. After creating a data set of articles focused on Black children's learning of mathematics, I provide the reader with an argument of discovery outlining what conversations are embedded in the relevant literature. My findings are captured within a framework describing three interconnected claims related to capital: a) macro and micro issues related to their sociohistorical realities as related to resistance and resilience, b) communalism and a collective Black identity, and c) beauty in communication and non-dominant linguistic patterns. I contend that this capital that Black children possess, already predisposes them to advantages within mathematics, and highlight how at least five common theories interact with one another to solidify and explain these forms of capital. I conclude this study with a few implications, indeed ontological, epistemological, and methodological considerations for how educators, policymakers, and researchers might go on thinking about inclusive middle grades mathematics environments, and the research that could be taking place to improve these spaces for Black children.

Throughout this monograph my colleagues and I have considered our analyses with the goal of articulating what it means to produce mathematics environments that are inclusive. As I consider this question, I am forced to think about the relationship that Black children have had with the teaching and learning of mathematics and how they are positioned in regard to the content. I approach this research with the contention that if mathematics learning environments are going to be inclusive, then mathematics education has to consider how Black children are being included in this conversation and within our approaches to teaching. Moreover, this research is meant to articulate from a pedagogical and empirical sense, how we think about the ways we create opportunities for Black children to participate in mathematics, and how we do it in a way that affirms their identity, cultural practices, and knowledge. Those elements which are captured inside of these spheres (i.e., identity, cultural practices, and knowledge), I argue, can be conceptualized as capital that Black children bring into the classroom- a capital that benefits them as mathematics learners and in turn, serves as an advantage to them in the learning of a more formal packaging of mathematics that we see in U.S. curricula.

I expand on this more in the literature review, but briefly, the French sociologist Pierre Bourdieu (1977a, 1977b) described cultural capital as certain cultural signals that may restrict or afford one's access into high status organizations or institutions. This capital comes in the form of cultural attributes, codes, and signals, and Carter (2003) noted that the dominant cultural capital are those attributes that are deemed worthy by those who make up the majority, largely, White people. Alongside this understanding of capital, I utilize Cone's (1991) articulation of liberation theology to think deeper about Blackness from an ontological sense.

Notwithstanding, Jett (2013) and Leonard and Martin (2013) decried that Black children bring brilliant mathematical cultural inclinations into the mathematics space, and Martin (2012) has asserted that Black children can and do engage in rigorous mathematical enterprises. Yet, the conversation I outline here is distinct from a discussion solely focused on brilliance because the capital that I argue exists within Black children is not merely intellect, but wide reaching

across many social markers (I review these in greater detail in the literature review). In this way, brilliance can be thought of as at least one aspect of the capital that I will discuss throughout this manuscript. Other domains in which to evaluate these children's capital, besides the cognitive implications of brilliance, may be rooted in their social, emotional, and physical embodiments of this capital (Boykin, 1994; Nasir, McLaughlin, & Jones, 2013; Yosso, 2005). Notwithstanding, the prevalence of research around brilliance warrants this preliminary discussion in relation to Black mathematics students.

Similar to the discussions of the brilliance of Black children, much work has been done to discuss the role of identity on mathematics learning. I argue that thinking about capital in the ways that I present in this article are consistent with articulations of identity research that exist within mathematics education writ large, and that one goal of middle grades mathematics classrooms is to help establish Black students' conceptions about their own inherent brilliance as a part of their identity. Davis and Martin (2018) stated:

In terms of goals for mathematics learning, teachers might consider adopting the stance that effective teaching not only considers growth in students' mathematical skills but also connects to these students' lives, experiences, and lead them to employ their mathematical knowledge in multiple settings and develop their racial, academic, and mathematics identities (p. 59).

What this suggests, then, is that Black students may also need to recognize their brilliance, and that acknowledging this brilliance is not only a conversation that must be had with teachers. Black people are also susceptible to internalizing deficit narratives about their brilliance and thus the implications for teaching are that, in addition to mathematics content, teachers help students to recognize their own abilities to master mathematics concepts and reposition themselves as competent doers of mathematics, not because they make high scores on tests or earn good grades, but because they engage in mathematical activities beyond those honored in most schooling environments. As Leonard and Beverly (2012) so beautifully articulate, famed Black mathematician Benjamin Banneker, in response to then Secretary of State Thomas Jefferson, stated that "any dismissing of African talents, skills, and abilities by European Americans was a

direct consequence of enslavement and not Blacks' inability to perform" (p. xiv). The overlap between the capital that is exhibited by these children is reflected in the ways they learn to navigate a society that has helped to define their Blackness (i.e., one component of their racialized identities). Nasir (2002) suggests that identity can and does develop while people engage in cultural activities, and thus, I argue, leads to the development and manifestation of capital.

Although related, here I am arguing that since Black children are inherently brilliant, how then does the capital they already possess set them up with privileged experiences to engage in mathematical activities? I contend that *because* Black children are indeed brilliant, teachers should be attempting to build their lessons around the cultural knowledge and interests of their students. The inquiries I propose in this study are related, yet distinct, from other conversations regarding culturally relevant pedagogy (CRP) (Ladson-Billing, 1994; 1995; 2006) where scholars like Leonard (2017), have insisted that we should be connecting our mathematics teaching to the cultural knowledge of these students. CRP literature has produced unequivocal astute scholarship illustrating how to connect mathematics learning to their cultural experiences (e.g., Jett, 2013; Ortiz, Capraro, & Capraro; Tate, 1995), yet I am claiming that Black children are brilliant and skilled (perhaps privileged) because of the cultural capital that they bring into the classroom, and am operating from the notion that they already have skills that exist by virtue of their Blackness. It is my take of the literature that what past research has done in impressive ways is outlined examples of what CRP looks like and/or activities that culturally relevant pedagogues might engage their students in; in this current undertaking, I am taking a closer look at exactly what about these interventions (i.e., teaching practices, perceptions, classroom activities) appeal to Black students' cultural inclinations- what forms of capital might these interventions be implicating, either implicitly or explicitly. Thus this work stems from research related to CRP, but it is devoted to a more nuanced review of the articulation of CRP lessons for Black children. It is important to note here that in many of the published research articles

showcasing examples of CRP in mathematics, authors do not in most cases share explicitly *why* certain interventions are culturally relevant for any particular group of students.

Two Points of Clarification

The work conducted in this synthesis is two-fold, such that I present a discussion of capital in two ways. I am first arguing that there are indeed distinctions between how Black children's mathematical experiences, as a whole, are unique in relation to their other peers, yet, the individual components of these articulations of their experience may not always be unique to them. Consequently, the nuanced understanding regarding Black children's experience is subsumed by a meta depiction of these individual components working together. I am not arguing that one group's experience with and in mathematics learning is more arduous than another, and I do not have the sole goal of highlighting comparisons between Black children and others. I see this work as starting and ending with Black children, focusing on what makes them brilliant and sets them up for success in the mathematics classroom. This work is also grounded in the idea that these forms of capital have been both dismissed and/or underacknowledged in regards to Black children in ways that would seek to render these students as deficient in their mathematics ability. It is not my position that taken individually, these forms of capital are necessarily unique to Black people or students, but that the manifestation of some of these forms of capital are products of how collectively, Black people's history and socialization in America have coalesced into these elements.

Secondly, I posit that the ways in which they learn to navigate this world have roots within a collective Black identity. Yet, it is not my position that all Black people have this capital or that we can assume it is always recognized even by those who identify with the collective, but that it is well represented among those who are Black and living within the United States. I explore this further in the paper by speaking about Blackness as ontology.

The main point is that I see the current undertaking as different because it suggests that the capital Black students possess inherently benefits them in their acquisition of mathematics,

and thus the development of an inclusive middle grades environment first acknowledges that it even exists. Further, it is important to note, that which I have operationalized as capital, has been conceptualized in other ways under a variety of terms. While this may be conceptualized as brilliance, or might inherently make the content relevant to the ways they identify racially and culturally, I am interested in delving deeper into these ideas of capital across different positions and theories (e.g., cultural relevance, cultural capital, brilliance) and helping to create more affirming narratives about Black children. The goal here is to establish links between some of these conceptions.

The research guiding this analysis is stated by asking: what forms of capital do Black students possess that could be advantageous to the learning of mathematics?

Theoretical Grounding

One goal of this work is to build a bridge to other disciplines. With this goal in mind, I pull from the sociology literature to focus on the idea of cultural capital, as well as from the Black Liberation Theology (Cone, 2010) to explicate Blackness and the Black experience. For the purpose of this article, I have extended the definition of Black cultural capital presented by Carter (2003) and operationalized it as the skills, cultural practices, and knowledge that is often associated with Black people and contributes to the joy they experience or enhances the life which they live in some way or another. These practices are closely related to the ways in which they identify with an ontological Blackness that is constantly evolving and which may operate on a variety of spectrums. In suggesting that Blackness has an ontological sense, I wish to acknowledge that there is tension in how Black people exist in this country (and world) and the dominant culture which controls the access to resources and structures, especially those within education (Dumas, 2016). Martin and colleagues (2019) describe an “ontological obstacle of Blackness” wherein education has historically questioned the humanity of Black students and rendered them less educable. While there is no one way to be Black, I believe that capital provides for us a way to think about elements of Blackness that helps them to create a reality

and existence that is affirming. Further, the ontological aspect that I refer to helps Black students to recognize the malleability of Blackness and that forms of capital are constantly aggregating and or shifting.

I approach this work from the lens of Guba and Lincoln (1994) who have stated that the ontological question in an inquiry paradigm is concerned with the nature of reality and what can be known about it. From a critical perspective, this might rest on a historical realism where virtual reality, in this case Blackness, is shaped by social, political, cultural, economic, ethnic, and gender values that are crystallize over time; from a constructivist lens, this helps us to understand the local and specific nature permeating our understanding of Blackness. I suggest here that Blackness is real in the sense that it is constructed, somewhat ambiguously, but indubitably. Cone provides at least one articulation of the Black experience and in essence a Black ontology. It is important to note, however, that scholars like Victor Anderson (1999) have provided critiques to the way that Blackness is conceptualized in Black theology. He has referred to an ontological Blackness as “the Blackness that whiteness created”, and suggests that what we have been offered are essentialized categories that are thought to mirror nature. Eppehimer (2006) explains that Anderson’s concern is that these fixed notions about Black reality and identity are too stringent and that by definition, must apply to all members of the Black community without exception. While I acknowledge the validity of this critique, I have sought to think about the capital that I present here as at least one of the ways that Black people exist in this world and take on their realities. This paper does not attempt to say that Black folks all utilize this capital in the same ways, but that it is merely one of the ways that we begin to conceptualize the many layers of an ontological Blackness.

Literature Review

With this said, I focus first on how Black capital has been articulated in studies among top scholars. I begin with a discussion of capital in the sociology literature and continue to nuance Black cultural capital as it may be utilized by various members within this racial group.

After describing how these forms of capital are deployed or valued by many Black people, I focus on how it may be validated or squelched in Black people's sojourn through educational institutions and degree attainment. In these institutions, teachers have power to affirm aspects of cultural capital by the way they confer upon these students a variety of expectations and obligations. I end the literature review by describing the asset based strategies that have been employed by teachers and researchers that help resolve the tension between how Black students exist, in this world and in mathematics classrooms.

Black Cultural Capital in Sociology

Because Carter (2003) suggests that ideas of normal (e.g., characteristics of good students) were what Black students in her study were really rejecting, my concern is what aspects of this capital exist among them, and which of these can be interpreted as beneficial. Carter asserted that a non-dominant cultural capital might include preferences for linguistic, musical, or interactional styles (preferences that closely resemble those laid out by Boykin (1994) that run counter to those appreciated by members of the dominant cultural group. She goes on to refer to the nondominant cultural capital described in her study as Black, and states that the students she worked with used it in ways to evaluate their own and others' actions, as well as to foster both self and group belonging and cohesion.

What is also true in this discussion of cultural capital is that the preference for Black cultural capital does not reduce the cognitive demand or rigor of one's learning (Carter, 2003). Carter determined this by highlighting that while many of the students in her study preferred the Black cultural capital, they still sought career paths beyond secondary education that were associated with high academic outcomes. Matthews, Jones, and Parker (2012) suggest a similar argument in mathematics stating that culturally relevant type tasks, those that utilize Black cultural capital specifically, do not take away from those mathematical tasks that are high in cognitive demand. It would stand to reason that having conversations on Black children's cultural capital in these ways helps to offset past research that has caused physical, symbolic,

and epistemological violence to Black children (Martin, Groves Price, & Moore, 2018), and sets the compass towards conversations that do more than seek a mathematics education that only diagnoses, intervenes for, remediates, and fixes Black children.

Carter (2003) takes special care in helping us to understand the context in which her articulation of the performance of Black capital exists, and this context can be understood as “poor, African American youth living in Yonkers, New York” (p. 150). She goes on to suggest that many elements of Black cultural capital emerged from the urban ghetto and that values and meanings related to this capital may shift with an individual’s class position. Thus, there are hints here that Black cultural capital may be nuanced within different subgroups of Black people. With these thoughts in mind, it is imperative to then note the “type” of Black people that authors are discussing. While it is true that there are notions of Blackness that transcend class boundaries (Carter, 2003), the same can be true about other aspects related to gender, sexuality, and the like. What I have outlined here is the need to think about Black cultural capital both as it relates to Black people holistically, but also as it relates to specific groups of Black people. In the same way that Carter described how this capital was salient among this group of low-SES Black students, in what ways does this capital exist among those who are Black but not, for instance, low-SES?

Nuancing Black Cultural Capital

Gholson and Wilkes (2017) described their focus on the specificity of African American Blackness, suggesting that the African American experience is a “fulcrum for racialized constructions” (p. 230), and that it is well-represented in identity-based studies. However, research that focuses on African American students does not always highlight the nuances of Black girls, young children, or other subgroups (Gholson, 2016; Gholson & Wilkes, 2017). It is for this reason that they describe the extant literature as a “masculinized narrative of Black adolescence” (p. 247), and claim that there still exists the need to make Black girls and young children’s identities as knowable. This relates to my current undertaking because part of what is

interesting and perhaps lacking in the literature is articulating how the capital that we describe as Black is contextualized mainly among Black boys, Black urban students, or those Black and low income, and this amplifies the concern raised by Anderson regarding Cone's liberation theology (Epperheimer, 2006). In exploring this capital more, it is necessary to consider how the admonitions proposed by Gholson and Wilkes impact our understanding of Black cultural capital, and if it is well represented among various Black subgroups.

Teacher Expectations and Cultural Capital

Earlier, I stated the significance of teacher expectations and how they result from one's position on Black students. If teachers believe that Black children are inherently bad at mathematics, why would they be tempted to challenge them in the classroom? Gholson and Wilkes (2017) lay out three questions that summarize mathematical moments in the extant research related to Black children's learning: *whether* Black children can learn mathematics, *how* they learn mathematics, and *why* they learn it in the way that they do. While much research has detailed arguments related to Black children's rejection and opposition to schooling (Fordham & Ogbu, 1986; Stinson, 2006), more recent studies have focused on identity-based research that paints these learners as competent and rejects the apolitical and acultural notions of mathematics education (Nasir, 2002; Martin, 2000). With this said, responding to the question of how Black students learn and why they learn the way they do opens the door to explore the capital that they possess, and with this capital, teachers can come to new expectations and standards for their students that have traditionally been deficit. I now focus on the power of those expectations.

We see consistently throughout the mathematics education research that high expectations for students is incredibly important to the mathematics success of students, especially those who are Black (Delpit, 2012; Ladson-Billings, 1995; Ortiz et al., 2018). Stinson (2008) stated that one of the sociocultural factors undergirding the success of the African American males in his study, and the one which was most impactful to their stories of success,

was the care and empathy from teachers who held high expectations for these students. We found similar results in working with Black STEM majors reflecting on their matriculation through k-12 and college curricula (Ortiz, Morton, Ridgeway, & Roby, 2019). I contend with Nasir, Hand, and Taylor (2008) that “studies on teacher expectations and race have highlighted the ways that differential treatment and expectations by teachers can greatly affect students’ access to learning opportunities” (p. 205). So not only do these expectations have the power to help these students internalize, either for or against their benefit, the expectations that teachers communicate to them, but it also dictates the kind of mathematics education that teachers see Black students worthy of. With this thought in mind the National Council of Teachers of Mathematics (NCTM, 2000) highlights in the *Principles and Standard for School Mathematics* the need for high expectations and strong support for all students.

Even in the teacher education research writ large, teacher expectations and beliefs about their students, learning, and instructional strategies become mediators of decision making (Nathan, Tran, Atwood, Prevost, & Phelps, 2010). Their views and perceptions of student ability influences their planning decisions (Ball, 1988; Fennema, Carpenter, & Caret, 1992). Indeed, scholars such as Good and Brophy (2003) found that some teachers who perceive that their students are less capable, provided less support, while those who held high expectations for their students saw them attempt and meet or exceed those expectations. Thus, a huge part of this work is responding to the question of why teachers should expect and believe that Black girls can do mathematics, that Black boys can be successful in the classroom, that Black poor and working class students can engage in rigorous mathematics enterprises and tasks, and that a potent indicator as to why teachers should believe this exists in the capital that they enter mathematical spaces with. More succinctly, recognizing that these students have a useful source of capital with which to engage in mathematical tasks is one approach to impacting the expectations that teachers have for these students, provides a response to the aforementioned *how* do Black children learn, and helps to create a more affirming space for Black children to

undertake high cognitive type tasks and become exposed to the type of teaching that they deserve.

Asset-Based Pedagogies

I end this review in discussing briefly the role that asset-based pedagogies have played in educational research. These can be defined as the cultural and racial assets of students, their families, and their communities (Milner, 2018). In tracing a timeline that led to asset-based pedagogies, Paris (2012) outlines the conceptual moves in education that first dealt with *deficit pedagogies* about students of color. In these pedagogies, students' cultural ways of being and their literacies were seen as deficiencies that education was supposed to help them overcome. Later, *difference approaches* to pedagogy popularized the thought that these cultural ways of being were equal but different from those legitimated in teaching and learning. While somewhat of an improvement, neither of these forms of pedagogy honored or valued the language of non-dominant student groups by utilizing them or seeking to sustain those heritage traditions.

On the other hand, resource pedagogies have repositioned the knowledge and cultural ways of being that come from these communities and seek to utilize them as tools that help in the acquisition of those skills that are privileged in schools. This is where the earlier conversation on CRP (Ladson-Billings, 1994,2006) becomes significant. As a major force among these resource pedagogies, CRP sought to join together the beauty of home language, histories, and practices and those of the dominant ones in school. Overall, the important part of this research is that students do not lose or learn to devalue that which they bring from home. This means that they do not learn to devalue the cultural capital that they possess or that has the potential to create links between mathematics content and their own cultural ways of knowing. While my goal in pushing this conversation is similar to what has been outlined in CRP among other resources pedagogies, I am now turning my attention to a different unit of analysis and articulating further what about the ways of home life, as embodied in their Black cultural capital, helps to create those bridges into dominant forms of mathematics knowledge.

Methodology

The first goal in conducting this research study was to identify the problem or phenomenon worth studying. This is what has been laid out in the previous pages. Here, I highlight additional aspects of creating a dataset, analyzing the articles in that data set, and producing claims and findings that are subsequently discussed.

Inclusion/Exclusion Criteria

To get at the problem of identifying Black capital, I needed to create a wieldy data set that I could work through and that would provide some answers. This data set is a collection of research articles from four educational databases provided by my institution. I performed my search on July 10, 2019 within three databases: ERIC, Education Forum, and PSYCHInfo (JSTOR was also searched but for technical reasons, did not provide the same number of articles with the coding scheme used). I did a search that would find and discuss cultural aspects of mathematics learning for Black kids. Three key components were important to this work: the participants, the connection to mathematics, and some discussion of capital or culture. Thus, the search chain I used in each database was: Black or African American AND cultur* AND mathematics.

Table 1 Raw numbers from the databases

Database	ERIC	Education Forum	PSYCHInfo
# of Articles	154	210	74

The table shows the raw numbers before any exclusions or duplicates were accounted for. All of these articles were downloaded to EndNote, a citation management software system that allowed me to easily get rid of duplicate articles and to review abstracts. Once I had all of these articles, I engaged in a process of scanning, skimming, and mapping (Machi & McEvoy, 2016) that eventually left me with 63 articles in my final data set.

The scanning task was related to reading the title and abstract and deciding if I wanted to retain the article in the dataset. During the skimming phases, I looked at the full text to determine if the article was consistent with what I wanted to study, and to find information for my mapping exercise. The mapping was a process I engaged in to record helpful excerpts from the articles that were retained. I used Microsoft Excel to record the following items: a) how the article addressed my RQ, b) what theoretical frameworks were being used c) the descriptions of Black people being studied d) whether there was a macro versus micro focus on issues related to Black people (I describe this more in the findings), and e) a description of where or how the capital was being manifested.

The scanning and skimming phase allowed me to reject articles by certain criteria. For example, it was important for my data to include Black children as the primary participants within the study. Within the literature, however, there was a tendency to group students of color together, or even just Black and Latinx students under the term “urban”. The goal of this work was to hone in closer to the idea that there is something unique about the way Black students are positioned in the mathematics environment. For this reason, I sought to include only articles with a primary focus on Black children. I also tried to keep a focus on mathematics content specifically, but there were some case by case moments where I had to decide on keeping an article that approached the study from a STEM lens. Those geared more towards science were excluded.

Also, I was not concerned much about comparison studies that sought to suggest that Black kids were deficient, but I wanted to focus specifically on how researchers presented some skill or capital, something that benefited these students in their acquisition of mathematics and in turn made the mathematics classroom one that was ultimately inclusive for them. I found that quantitative articles from social psychologists and authors that focused on test scores, for example, were not supporting some of the ideas around capital. I included articles that were explicit in identifying this capital, but also utilized articles that described characteristics around

what I have framed as capital. In this regard, there were some seminal articles from scholars like William Tate, Na'ilah Nasir, Robert Berry, Jacqueline Leonard, and Gloria Ladson-Billings that helped focus this study. Each article from these scholars who focused on the intersection of mathematics learning with Black children and culture, helped me to determine whether additional articles fit within this similar scope. So while there were, for example, profound articulations about Black children learning mathematics from a variety of scholars, with each article I posed the question as to whether the crux of the argument led to some understanding of a type of cultural capital that was inherent to how these Black children exist, and how they experienced mathematics learning. In short, while some did not mention culture or capital explicitly, these forms of capital that I outline helped to operationalize Blackness as an ontology that might be at least partially explained in terms of capital, and these are the articles which populate my data set.

Analyzing the Data

Upon completing my data set, I engaged in what (Machi & McEvoy, 2016) described as producing an argument of discovery. This argument of discovery was built around the items I described in my mapping system, and the overall goal of this argument of discovery is to communicate to the readers what is being said in, or what should be understood from, the authors of the articles within my data set. This open coding process allowed me to make some claims about what is most salient in the literature that I have systematically grouped into this data set, and these have led to the synthesis of the articles and development of associated themes. What is shared in the findings are the claims developed throughout this process, and they are represented as forms of capital.

Findings

As can be gleaned from the research question, a huge aspect of this work has been to identify the capital that Black children possess in mathematics, and to operationalize what scholars like Jett (2013) consider as mathematical cultural inclinations among these children. I

have been interested in which of these inclinations can be associated with Black children, especially in ways that do not perpetuate false, and often times stereotypical assumptions about Black people or suggest that Black children will indubitably demonstrate or utilize this capital. What I present in the following pages are elements about Black life, culture, and knowledge, indeed, capital, that may not necessarily be unique to Black people but has been too often overlooked among members of this group. Additionally, I present forms of capital that have been well documented in the literature, not to say that these examples about a diverse ethnic group exist among, or are taken up by, all members of this group, but that there is some evidence in consistent presence or valuing of these elements among those who may identify as Black. In his theorization of Black Theology, Cone (1997) stated that it must first start with a reflection on Blackness itself. Thus, to describe a Black ontology, I reflect on Blackness through these forms of capital.

In my review of the literature, I have come up with three interconnected claims that are related to the capital that Black children bring within the classroom: macro and micro issues related to their sociohistorical realities as related to resistance and resilience (Martin, 2006, 2012; McGee, 2014; Nyamekye, 2013; Strayhorn, 2013), communalism and a collective Black identity (Davis, 2018; Tate, 1995; Carter, Hawking, & Natesan, 2008; Berry, 2005; Lemons-Smith, 2008; Ortiz, Capraro, & Capraro, 2018) and beauty in communication and non-dominant linguistic patterns (e.g., Blake & Van Sickle, 2001). I expand on these ideas below, and subsequently describe how they may play off one another.

Lastly, it is important to note that what I share here are not necessarily new ideas about Black people in general. As Cone 1997 stated

There is no truth for and about black people that does not emerge out of the context of their experience. Truth in this sense is black truth, a truth disclosed in the history and culture of black people... Black theology is a theology of and for black people, an examination of their stories, tales, and sayings. (p. 16)

I do, however, suggest that the ideas I present here have not been considered together as a framework for interrogating the mathematics learning of Black children specifically. These ideas are presented as a synthesis of the discussions that have taken place in regards to these students, and I suggest that these three findings be regarded as capital that accompanies these students' immersion in their mathematics environments and influences their success. In framing the review, I mentioned how exploring these forms of capital help to make the learning of mathematics more humanizing, interesting, and focused on Black children. I believe these three findings directly tackle this goal and speak to the truth and theology to which Cone alluded, and the ontology that I foreground.

Common Theories

In reviewing the research on Black children and the capital that they possess as it relates to mathematics, it was common to see some of the same theories throughout much of the literature. I list these in Table 1 because it is apparent that in searching for capital, scholars have thought about what it means to improve the education of Black children in a variety of aspects. Perhaps the most dominant of these theoretical lenses is related to Yosso's (2005) community cultural wealth and Boykin's (Boykin, 1983; Boykin, 1986) nine dimensions of African American cultural experience.

Table 1
Theoretical Frameworks Related to Black Children and Mathematics

Theory	Brief Descriptions
Afrocentrism (Asante, 1991; Tate, 1995)	Centering African ideology, rituals
Nine Dimensions of Afro-cultural Expression (Boykin, 1986, 1994)	Focused on different aspects of the African American cultural experience
Culturally Relevant Pedagogy (Ladson-Billings, 1995, 2006); Culturally Responsive Teaching (Gay, 2009)	Looks at how teaching can more closely utilize the knowledge and experience of diverse learners
Critical Race Theory (Delgado & Stefancic, 2001)	Critiques the presence of race with a direct look at power
Community Cultural Wealth (Yosso, 2005)	Revisits the forms of capital which exist in communities of Color

In her framework, Yosso delineates several forms of capital within a critical race framing, including aspirational, linguistic, resistance, navigational, social, and familial. It is clear that the capital that exists within communities of color, and among Black children in particular, are consistent across these forms of capital as I will highlight. In this critical race framing, these forms of capital as outlined by Yosso challenge the idea that dominant forms of capital are more legitimate than those most salient in Communities of Color, and reject any notions that their respective knowledge should be ignored. While earlier I address the ways that Bourdieu (1977) has provided us language for discussing how knowledge about the upper and middle class is considered to be capital, Yosso helps to establish that this assumes that People of Color lack social and cultural capital, and as Nasir and de Royston (2013) argue, ignores the role that power exerts over Black students. Concerning Boykin's (1983) work, he presented 9 dimensions of African American culture: spirituality, movement, verve, harmony, affect, communalism, expressive individualism, social time perspective, and an oral tradition. These 9 dimensions represent an ethos of coherence and integrity, expressing things that are cultural to their core

(Boykin, 1994); by this he meant that these dimensions were inherently cultural. He argued for their importance to learning and that learning preferences of Black children are connected to the Black cultural experience; therein lies a connection to Cone's (1997) scholarship. Boykin reminds us that African Americans will express these dimensions to varying degrees, but their presence is nevertheless substantial. Across this work there tends to be a consensus among scholars that verve and movement, as well as communalism are often times consistent with African American ways of socialization; we see this represented in Carter's (2003) framework, and I further articulate this later in this paper.

Afrocentricity can be understood as a "frame of reference wherein phenomena are viewed from the perspective of the African person" (Asante, 1991, p. 171). This frame of reference runs counter to what is typically utilized in American schools where Asante asserts that Black children are de-centered and taught about heroes and heroines that defamed African people. Tate (1995) and Burt and Johnson (2017) described the use of these Afrocentric paradigms as ways to make mathematics learning reflect more valid representations of Black people's contributions to mathematics. Additionally, culturally relevant (Ladson-Billings, 2006) and culturally responsive pedagogies (Gay, 2009) have been used to think about ways to make mathematics instruction tailored towards the lived experiences of Black children (e.g., Bonner & Adams, 2012; Leonard & Evans, 2018; Ortiz et al., 2018). It is based on finding ways in which teachers can use learning to empower our students, especially in ways that acknowledge their academic excellence, their cultural competence and their sociopolitical consciousness. Lastly, critical race theory (CRT) in education conceptualizes the ways that race impacts the learning environment. Race and racism, as characterized by CRT, are endemic to American society and despite one's attempts to overlook or dismiss it with liberal ideologies, it still exists (Larnell, Bullock, & Jett, 2016; Tate, 1997). CRT also: a) asserts that education conforms to the notion of interest convergence, b) critiques liberalism and incrementalism, and c) utilizes counterstories as a legitimate form of data collection. Hence, the commonly seen frameworks discussed in this

section help us to think about how White interests dominate the educational environment, how they suggest minor changes for deep and structural issues, and how research can benefit from the perspectives of people of Color, respectively.

Black Capital in Terms of Racial Pride, Positioning, and Resistance

One thing that Black people, especially African Americans, share is a history of not being part of the dominant group within society (Berry, 2003). What became evident in much of this literature is that Black children are not ignorant to these forms of marginalization and tend to have well-developed notions of how their racialized forms of knowing exist within many of their experiences. I find that what is laid out in much of the research on Black children can be understood in terms of their racial identity (Gholson & Wilkes, 2016). Helms (1996) described this as the “psychological or internalized consequences of being socialized in a racially oppressive environment and the characteristics of self that develop in response to or in synchrony with either benefitting from or suffering under such oppression” (p. 147). This racial identity is one that teaches them early about how to exist in a world that oppresses them, even in the mathematics classroom, and thus resistance may often be developed early among these learners. Boykin (1994) also makes a claim similar to this racial identity when he stated that “there is a minority component bred by the legacy of oppression African American people have faced in America, and there is also the mainstream experience that comes through living and participating in mainstream institutions” (p. 250).

I believe that knowledge of the existence of these institutions is crucial, because they prepare Black children for how they may have to navigate mathematics classrooms. In areas where access to mathematics knowledge is protected, indeed by gatekeepers, and when this reality is understood by students, they are better able to combat its adverse effects (McGee, 2013). I argue that knowledge of these ways of being positioned in mathematics spaces is itself a form of capital, one that manifests many times as resistance. Black children often times come to us with a perspective of the world that is situated in a critical analysis of ways of life for Black

people- both implicitly and explicitly (Milner, 2016; West et al., 2008). In other words, the capital is manifested in the brilliance that is already inherent in these students, and the abilities with which they have to navigate two worlds (Davis, 2018). With this in mind, I believe scholars have acknowledged the ways in which this critical analysis of their own marginalization is a powerful marker for helping them realize how might mathematics become relevant in their own lives (Tate, 1995a, 1995b). It is a significant paradigm shift to begin to think about the fact that Black children, because of their brilliance, have ways in which they become familiar with their communities and have the abilities to pose meaningful and thoughtful questions about the ways in which they are treated. It is clear that a sense of pride in Black people, their histories, aesthetics, and communities from which they come provide a meaningful connection to mathematical investigations that are culturally relevant. For Black people, Black girls and women in particular, hair is a form of resistance and a site of mathematical inquiry (Eglash & Bennet, 2009; Tan & Calabrese, 2018; Young, Young, & Capraro, 2018). My point here is that despite what the published literature or dominant social narratives suggest, Black children provide us with experiential knowledge about Black life that is empowering and liberatory, providing alternative perspectives and context to what counts as mathematics and legitimate solutions to mathematical solutions. Because these perspectives tend to be those which are marginal or nondominant, they are resistant in the way that they allow Black students to share, as well as to internalize, liberating notions about themselves as mathematicians.

Also connected to this brilliance of Black kids is their ability to recognize the shortcomings of the environments in which they reside and the need for resistance in those communities. Yet, this is also connected to a larger point about the reality that they must be that much more cognizant about the world around them than some of their nonBlack peers. With this said, we see that Black students have the ability to recognize and improve their environments, and thus provide questions about their communities (Tate, 1995), because the community helps shape how they develop capital. The fact that they have a knowledge base to share and abilities

to pose questions about their own social realities suggest the maturity of these students' cognitive state and the existing capital (Jett, 2013; Ortiz et al., 2018). The argument I provide here is that much of the literature connects Black students' learning to an operational knowledge about, and deep connection to the communities or places in which they reside (e.g., Ares, 2008, Davis et al., 2011; Ye, Varelas, & Guajardo, 2011). Because Black students have this knowledge and connection to their homes, the literature asserts that this has been one way in which to make the content culturally relevant for them. We can direct our attention to the work of Bob Moses and the algebra project to think about how these connections to one's community served noble purposes in helping students in their learning of mathematics. I argue here that we view this knowledge as a form of capital that benefits how we engage Black children into realistic and high demand types of tasks because their knowledge of the subway systems, as in Bob Moses's example, may set them up to have these deep revelations about mathematics.

Further, their ability to pose questions about their own social realities suggest the maturity of these students' cognitive state. Martin has produced much scholarship on the role of identity and conversations around how the notion of identity is related to the conception of capital that these students have. In their CLIC framework, Varelas, Martin, and Kane (2012) contend that identity construction and the centering of Black children is imperative. What is also true here is that these students' identities were in large part shaped by their abilities to see themselves as mathematicians and scientists. In other words, their resistance was due in large part to the way they learned to offset the stereotypes and doubts that teachers or peers may construct for them in such a way that promotes confidence in their mathematics abilities.

The aforementioned claims help to further establish the resistance capital (Ortiz, Morton, Miles, & Roby, 2019; Yosso, 2005) that Black students often bring with them into the classroom. Resistance capital is that which seeks to overcome and resist systems of oppression and to believe that one's place in some environment or atmosphere is legitimate; it is oppositional and it combats inequity. Within mathematics classrooms, this capital takes a variety of forms, one

being the way in which Black children actively work to dispel myths about their assumed incapacabilities (Burt & Johnson, 2017; Lemons-Smith, 2008). There was evidence in many of the reviewed studies that Black children understood the obstacles that faced them in their desire to enroll in advanced mathematics courses or to pursue STEM degrees, but did so as a form of resistance (Berry, 2005). This capital, I contend, is a strength that says that they can be, and see themselves as, mathematicians, despite what teachers or society has deemed as the norm.

Notable examples include the parents in Martin's (2006) study where they felt it necessary to advocate on behalf of their children. They knew that the futures that were available to their children were in some way related to experiences and access that they had to advanced mathematical knowledge, and that although they may have personally had limited success in the subject, this did not have to be the case for their children. Black parents also passed down this idea of resistance in the perception that education, and mathematics more specifically, is the great equalizer (Burt & Johnson, 2017; Strayhorn, 2013). It was evident that many of these families esteemed exposure to STEM content even outside of the classroom in the form of museums and informal science, or the persistence to enroll in more rigorous courses. The scholars highlight the interconnectedness of the familial and resistance capital that Black children and their parents possess.

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In short, I think that this form of capital, as it relates to racial pride, positioning, and resistance, is powerful because it builds on Black students' knowledge about mathematical situations and their experiences inside of mathematics spaces. I find that racial pride,

positioning, and resistance is significant because when students recognize how they are positioned, in many ways because of schooling environments and mathematics spaces being inherently anti-Black spaces, they find pride in what it means for them to be Black and this manifests in many cases in resistance (e.g., McGee, 2014). This resistance may be in response to biased and demeaning attitudes towards Black mathematics students (e.g., dissenting what Martin et al., (2018) have described as epistemological violence) and manifested by replacing them with more empowering notions about Black life, or resistance may be enacted by finding oneself in the midst of a mathematics environment, perhaps advance mathematics course or STEM field, despite understanding that they are not always welcome there. What intrigues me most about this is that with resistance comes an implicit notion that one's Blackness is not "lost" in a sense. These children do not have to, in many cases refuse (i.e. resist) to coalesce in such a way that renders their ontological Blackness void. I further explicate this in the discussion.

Black Capital in Terms of Communalism and a Collective Black Identity

There is much evidence within the current body of literature that suggests communalism and a collective Black identity are important considerations for Black people. As I have stressed throughout this manuscript, it is not my intention to stereotype Black people in such a way that perpetuates a narrative about all of them being identical. I am much more interested in how issues around the Black experience contribute to the realities that Black people face and thus influences the development of certain aspects of one's identity. Throughout this section I weave in descriptions of how this capital is palpable across Black people in the U.S. as well as the nuances that this conversation warrants by exploring subgroups of Black people.

In discussions on a collective Black identity, I find that it is very important to acknowledge the "type" of Black people we are discussing, in ways that highlight or distinguish if we are approaching what Martin (2009) has described as micro or macro levels of societal problems. In the context of this study I understand macro issues to be those that inherently impact the Black experience and dictate the ways in which we are capable of navigating the

current political, economic, schooling, and other structures. In terms of micro-level concerns, I see these as some of the connections that might be specific to certain groups within the collective Black. This might be in the ways that certain topics or trends appeal to subgroups of Black people (e.g., Black girls and women, low SES, or Atlanta natives). While the macro level issues deal a lot with critiquing systems of inequity and privilege, I see more micro level issues related to pedagogy, home life, and interests. The point here is that there are going to be issues that pertain to Black people just by virtue of them being Black, and there will be more nuanced aspects of these phenomenal Black realities (Martin, 2012) as we survey the needs of other subgroups of Black people. It is also true that there are consistent overlaps in what might be placed into these categories. When we think about the connections to a sociohistorical and heritage culture (Eglash & Bennett, 2009), or one tied to histories within given communities, these may traverse both macro and micro kinds of issues. I highlight both, macro and micro issues, throughout this conversation.

Scholars have helped us to acknowledge the need for this disaggregation in being clear if we are talking about Black people in general or looking over some other identities within the collective, such as Black girls or young people (Gholson & Wilkes, 2017). This connection is relevant also to how Eppeheimer (2006) described Anderson's critique of Cone's work. The question posed was whether what Cone presented reflected all Black people, specifically Black women, and whether these claims by Cone about Blackness were too stringent. I take this consideration into account in thinking about how I frame capital for Black students, and in thinking about these different subgroups among Black people. Seemingly, there does not tend to be much disaggregation among members of the Diaspora within this data set. Some noteworthy exceptions do occur in Bermuda (Matthews, 2008). However, it is important to note that this work was focused on how work is done within US classrooms that have Black students. My point, however, is that some of these groupings may provide us a bit more context if we

knew that ideals such as communalism were stemming from one's roots within, for example, Black Jamaican paradigms.

Clarifications presented in this section also allow us to think about other aspects related to Blackness within regional contexts. Canigla (2003) discussed the role of Detroit's Black history and how content might be relevant for Black children within that locale because they have a connection to the city. Regional pride and identification are important because what may be familiar to Black children in one part of the country may not have the same meanings or intuitiveness in other areas; Blackness may be performed much differently in Detroit versus Atlanta.

Notwithstanding, it makes sense that communalism is within my findings (e.g., Thompson & Davis, 2013). As I mentioned the prevalence of certain theories, it became apparent that the work of Boykin is well-represented within the literature and claims about Black children, and this is one of the 9 dimensions of socialization for Black people. As defined by Boykin (1994), this denotes "a commitment to the fundamental interdependence of people and to social bonds and relationships" (p. 249). In short, the concern of the group takes priority over self-exaltation (Boykin & Toms, 1984). With this stated, the role of competition embedded in our mathematics classrooms (e.g., tracking efforts, standardized tests measures), exist in direct opposition to how Black children may be socialized outside of these classrooms (Davis & Martin, 2018; Lim, 2008; Moody, 1998).

I have found much evidence concerning the idea that advancement for Black people groups has to be a collective effort (e.g., Collins, 2018; Davis, 2018; Lewis, Pitts, & Collin, 2002). Davis suggested that within historical movements of civil rights, the goal has been, and should remain, to evaluate ways in which to improve social conditions for Black people and how to move the community forward collectively. He juxtaposes this with the ways in which a Eurocentric ideal has established individualistic goals and a tendency towards competition.

These run counter to ideas of communalism and thus assessments should acknowledge the role that collective work and progress can serve Black mathematics students.

Davis (2018) is not alone in highlighting the role of collective effort (see Battey & Neal, 2018; Bonner & Adams, 2012; Ladson-Billings, 1997). What is described by Davis is also connected to the ways in which Clarkston and Johnson (2011) described the Afrocentric connections that Black students felt in one school. In this school, they promoted ujima, a sense of collective work, because it aligned more with collaboration than a Eurocentric frame of reference. These students explored mathematics learning in terms of group work, similar to ways described by Jett (2013) and Hubert (2013). When this happens, students are introduced to new perspectives and ways of engaging in mathematics that bring new perspectives and arguments to the fore. We see this also in the work of Eglash (1997) in describing the brilliance of Benjamin Banneker to a wider, African history of counting number systems, or in Tate (1995) who described a scenario where Black students' reasoning behind purchasing a bus pass that was more costly was because of the benefits it would bring to their family. Their decisions were not based simply on them calculating the cost for themselves, but new perspectives were considered when the students explained that their family members could also use this bus pass to make it to the places they needed to go throughout a given month. I assert that this capital is invaluable in thinking about how mathematics can influence the lives of Black people, or even the uptake of certain self-concepts that stem from collectivist views (Woodland, 2008).

What I have sought to address in this section is the ways that Blackness exists on both macro and more micro, nuanced levels regarding capital. In describing capital for these students in all of its complexity, it is important to consider the ways that capital exists for all those who identify as Black, as well as what might be more relevant to individual subgroups.

Black Capital in terms of Communication and Verve

Given this discussion on a regional specificity in the previous section, ideas around regional language are of utmost importance as well. Word choice and context may be different

for a Black child growing up in the heart of Atlanta, and one who grew up on a sea island in South Carolina (Blake & Van Sickle, 2001). However, there is capital in all of these forms of language. One finding that I have seen within this research, albeit somewhat controversial, is the reality that Black children do not always abide by what one may identify as dominant American English (Paris, 2012). It is true that Black children, in a variety of contexts and scenarios, may choose to engage in a form of speaking that is not consistent with the majority. This may, for example, take the form of the occasional dropping of the possessive -s (e.g., my mama house) or the 3rd singular -s (e.g., she cry too much) (Hudley & Mallinson, 2017), or it may also occur in the use of *been* or *had* to replace -ed in the past tense (Blake & Van Sickle, 2001), such as in the phrase “we been arrived”. Within mathematics, language that may be commonly used by some Black students does not always disappear when they enter the classroom; this remains true especially in the ways that students seek to respond to teachers’ prompts and inquiries (Hudley & Mallinson, 2017). Even such language that we take for granted in mathematics must be analyzed, such as when we ask students to find a solution, evaluate, or solve certain tasks, many of these directions may be synonymous. Hale (2016) provided another example of how communication styles for Black children may privilege more approximate answers, in ways similar to that described in Nasir (2000). The point here is that the discursive styles do not weaken mathematical understanding.

In these cases, we see that language is important because they communicate directives to our students. Orr (1997) gave much evidence for how Black English needed to be understood because students’ nonstandard use of English differed from the teachers, and thus the students’ ability to convey their knowledge to teachers was not always evident. For example, Orr described that in Black English, there were different standards for the use of prepositional phrases and ways to construct comparisons. Students would use “as” and “than” in nontraditional ways in their everyday language and bring them into the classroom when analyzing problems about whether a car was covering a greater distance than a train. Orr

contended that while many teachers may have written this usage off as a misuse of comparison words (e.g., *less than* or *more than* in algebraic expressions representing a son and his father's age), these students often blended multiple grammatical forms but produced mathematically robust solutions and justifications. While not described as capital in Orr's study, I suggest that this is a capital that many Black students possess that can help to create bridges between African American Vernacular English (AAVE) and more dominant forms of the language.

I argue that we can view this non-standard English as another form of capital that Black children may utilize and that does not mitigate the soundness of their logical arguments. Battey and Neal (2018) provided evidence of this in how they suggested that one student recounted a logically sound mathematics argument for why he had been overcharged recently at a store, but the teacher missed the depth of this argument by focusing on the fact that the student did not conform to the speech patterns she deemed appropriate. The point here is that this language should be regarded as an asset inside of the classroom and not a hindrance. In looking at this language more as an asset and in my opinion, as capital, we can follow the suggestions of Hudley and Mallinson (2017) who say that it is important not to dishonor the language that these students use by suggesting that they use "proper" English. This creates a condescending view of their home life and linguistic patterns. They also suggest that additional wait time is provided so that there is ample time to think about how linguistic forms may vary between students and teacher and how they might allow Black children to feel comfortable enough to not have to code-switch (Blake & Van Sickle, 2017). More importantly, as Corey and Bower (2005) allude to, these children recognize when there are differences in language. The student that they studied felt some tension between the language that was being used inside of the classroom, and while it was legitimate mathematics terminology, there was a disconnect in his understanding of that language and the one that he was most familiar with.

Scholars like Nasir and de Royston (2013) assert that mathematics learning does take place even within the context of African American discursive styles. These discursive styles may

include symbolism, teasing, call and response, and clever quips (Bonner & Adams, 2013; Carter, Hawkins, & Natesan, 2008; Lim, 2008; Nyamekye, 2013). Similarly, Chrismalis (2013) provided an example of the way that the word greatness was used as a motivational and ideological tool that also communicated the communal efforts of learning in mathematics. For the Black students in this study, it was a mandate to demonstrate greatness all the time, and this language inspired them to achieve this standard.

Further, I am particularly drawn to the idea of verve (Berry, 2005; Carter et al., 2008). Although distinct from language and communalism, verve can be understood as a propensity for high levels of stimulation that maintain high energy and liveliness (Boykin, 1983). It can be thought of as being intense, having expressive body language, and a tendency to attend to several concerns at once (Carter et al., 2008). Verve has the potential to make way for the other 8 dimensions defined by Boykin, such as movement and oral traditions. Yet, this form of capital, much like language, is not always favored in the classroom. Berry provided an example of one Black male student who was denied entry into advanced mathematics not because of his mathematical knowledge, but because the teacher felt that his behavior was not typical of a high achieving mathematics student. Berry contended that verve, as demonstrated by this student, was viewed as a conflict with mathematics as a passive discipline. This work relates back to the original framing of Black cultural capital because Carter (2003) reported how one student noted how her teacher valued passivity in the classroom. This student felt, much like some of the mathematics students in this synthesis, that they were being evaluated according to this standard of capital that was not always preferred by her or her classmates.

A Helpful Framework

To this end, I would like to leave the reader with a helpful framework to take from this lengthy conversation. I have conceptualized much of these discussions around Black children's capital in mathematics, noting the attention that needs to be given to these ontologies. I wish to convey these ideas, indeed a framework for thinking about Black capital in terms of ontological

Blackness benefiting mathematics engagement, and have captured this in Table 2. The table not only highlights some of the major takeaways from the findings, it also suggests how the five frameworks from Table 1 interact with one another to operationalize these forms of capital. This speaks to the synthesis work that has been conducted across disciplines and different theories to develop a palatable analysis of how mathematics learning has been talked about in reference to Black children.

Table 2

Operationalizing the Five Theoretical Frameworks for Black Children and Mathematics

Relevant Theories	Current Findings	Operationalization of the Findings for Mathematics Instruction
Community Cultural Wealth Critical Race Theory Afrocentricism	Black capital in terms of <i>resistance</i>	<ul style="list-style-type: none"> • Their presence and aesthetic in your course is often resistance alone • They know how they have been positioned and thus have an experiential knowledge about their communities and Black life that counters more dominant narratives, and thus bring nuance and context into mathematical tasks
Critical Race Theory Culturally Relevant Pedagogy/Culturally Responsive Teaching 9 Dimensions Afrocentricism	Black capital in terms of <i>communalism and a collective Black identity</i>	<ul style="list-style-type: none"> • Multiple assessment options may be favorable; pairing students together does not reduce the rigor of mathematics learning, but it does reduce competition
Community Cultural Wealth Critical Race Theory Culturally Relevant Pedagogy/Culturally Responsive Teaching 9 Dimensions	Black capital in terms of <i>communication</i>	<ul style="list-style-type: none"> • AAVE still communicates a) mathematical understanding and b) counterstories about students' <i>experiences</i> with mathematics • AAVE can be honored AND utilized in accessing more formal mathematics vocabulary and language

It is important to note that although Martin has had a profound impact on my understanding of what this work means for Black students, I would be remiss to forgo acknowledging the Black intellectual tradition from scholars and educators like DuBois, Mary McCleoud Bethune, Carter

G. Woodson, or Ida B. Wells who have long had these realizations about what it means for Black people to exist in the world and for us to take seriously the {mathematics} education of these children. I contend that these children's ontological Blackness, that which helps them to understand how they are viewed by others and themselves, how they are ascribed and revoked access and/or privilege, and multifaceted and constantly evolving dimensions of Black life with all of its joy and pain, that which no one person has a hold of, necessarily shapes the way they navigate the mathematics space generally and the world writ large.

It is important to state also that these forms of capital are not necessarily distinct or mutually exclusive, as is depicted in Figure 1. It is true that AAVE is a form of resistance and that collectively, Civil Rights movements have been impactful because of the resistance of Black people (as well as other groups). This is reflected in the ways that the theories are laid on top of the arrows, emphasizing what is shared in Table 2 regarding which theories are undergirding the forms of capital; the arrows identify how the forms of capital exist within multiple theories. What is also made clear in this figure is that Critical Race Theory can be seen in each of the forms of capital I have laid out. This does not suggest that CRT is sufficient for understanding all of these forms of capital. Rather, it highlights that there are elements, sometimes only implicitly, that arise in CRT that can be seen in other theories more explicitly.

Figure 1 Conceptualizing Ontological Blackness in terms of Capital

I believe the framework I provide, however, strengthens the claims for elements of capital possessed by many of our Black students. An ontological Blackness, particularly within mathematics, must grapple with the ways that resistance, communalism, and communication infiltrate what mathematics teachers may designate as legitimate mathematics practices, including but not limited to, conjecturing, mathematics discourse, assessment both formative and summative, and explanation (NCTM, 2000).

Discussion

Resistance

A recent documentary of the life of Toni Morrison also highlights aspects of her grandfather who she stated engaged in a revolutionary act because he read the Bible over five times, from cover to cover (Greenfield-Sanders, 2019). Cone (1972) might point out here that

this revolutionary act was connected to the ways in which a Black Liberation Theology used religion, specifically Christianity, to resist. What made this act so impressive was that Black people were not allowed to read, and White people would be penalized for teaching them to read. Yet, I argue that what is represented within many of our Black ancestors is a spirit of resistance that understands that a government's distaste for Black bodies and their subsequent uptake of antiBlackness (Dumas & ross, 2016) is worth combatting. I contend that much like Toni Morrison's grandfather's act of resistance, Black children who enter spaces and career paths that they desire to be in, yet bear this burden between their Black selves and the mathematics content, are operating within this resistance capital in ways similar to what Yosso (2005) described.

When teachers begin to think about the ways in which their Black students are already resisting, just by being present in these mathematics spaces that were not constructed for them (Berry, 2005; McGee, 2014), then they can find ways to attend to both the cognitive and socioemotional needs of these students (Nasir, 2000). I believe the sociopolitical tenet of CRP as articulated by Ladson-Billings (1997) provides space for how one can think about the way Black students understand how they are positioned in these classrooms and in society (George Mwangi, Fries-Britt, Peralta, & Daound, 2016; Tate, 1995b), and interrogate these claims mathematically. Leonard and Evans (2018), as well as many others, show us how these students bring with them a knowledge base about Black people that serves as a catalyst for more exploration of mathematical thought and context. Also pertinent to this discussion is the way that Afrocentric thought and CRT has helped to make the case for thinking about capital. Too often the curriculum and policies take capital that is White middle class as the norm, and overlooks the range of experiences that Black children may bring to the classroom (Tate, 1995b, 1995c). When the knowledge they have is honored, teachers are able to recognize that these students resist by offering context about one's neighborhood, self, or perhaps access to transportation that are not always privileged by mainstream mathematics education. I think what

is most valuable in this lesson is that because of this knowledge, Black children, who are often seen as lacking mathematics knowledge, are able to pose mathematically complex questions about their own experiences that researchers and educators would overlook.

To this discussion of resistance I would also like to refer back to Tupac Shakur's (1999) metaphor of the rose that grew from concrete. What this conveys is that Black people, especially within the US, have been exposed to some tumultuous times. Yet, in navigating that resistance, we have found ways to make the extremely horrible somewhat lighthearted instances. We have found joy in our art and have healed, through painful laughs, in ways that could not swallow our spirit or joy because humor has been the best medicine. I can only imagine the way that our ancestors, though riddled with the strikes and blows from unrelentless slave owners, found some hope and laughter in the eyes of one another, and in the humor that may have existed even on the field that they worked. I see this occurring in the mathematics classroom. Part of the resistance that I claim is exhibited by Black students is finding humor and joy even in environments that do not want them to succeed. In speaking on the iconic writings of Toni Morrison who is known for depicting images of Black life, poet Sonja Miles said that despite the turmoil in her novels you have to laugh; if you do not laugh, you will not survive (Greenfield-Sanders, 2019). This kind of resilience and resistance should not be punished, especially if it comes across as somewhat alternative to what "good" mathematics student behavior looks like. These children are navigating spaces that must welcome the joy that they are able to find in the eyes of one another and not criminalize it. In working towards a more inclusive mathematics environment, we would realize that joy among these students is not disruptive, it is healing.

On a related note, I have begun to think more about how resistance on behalf of Black students may not always serve our models or understanding of ideal mathematics learners. Take two students, Marvin and Tammi. Marvin represents the student that does well in mathematics and resists by making his presence known in a classroom full of his White counterparts. On the other hand, Tammi is brilliant mathematically, but she resists schooling in

the traditional sense; scholars in psychology might refer to this as externalization. Thus, Tammi refuses to do her homework, participate in class that promotes others' mathematics learning, and prepares to drop out of school. In terms of resistance, Tammi has renounced any affiliation with this educational system and practices a refusal of the system (Martin et al., 2018). While this refusal of the system is somewhat different from what Martin and colleagues suggested, I am concerned with how this form of capital has far reaching implications for Black participants. As educators and policy makers, this speaks to the systemic changes that must take place concerning Black children. Varelas and colleagues (2012) demonstrate that part of this task occurs in the mathematics classroom and is related to work around identity. One idea that I offer the readers is that we begin to think about why these children resist, utilize the knowledge that they possess about the systems and validate what they are feeling, and help them to propose mathematical models for thinking about what justice looks like. They have valuable information to contribute to our thinking about these topics.

Communalism

Perhaps at least one way that communalism might be targeted in mathematics classrooms is through the use of group work. To be clear, I am not suggesting that all Black students want to work in collaboration at all times, or that some do not prefer to work alone. What I am saying, is that we have to be cognizant of the ways that we assume the existence of neutrality in the teaching of mathematics and the ways we assess our students (Gutierrez, 2013; Jett, 2019; Ortiz et al., 2018). We must be open to the fact that those who do not perform well on current assessments are still brilliant, and perhaps we are still utilizing far too many antiquated ways of evaluating students' knowledge when alternative mathematics tasks can and do exist. Some of these assessments might be better completed together. Mathematics educators and policy makers might consider what are the pros and cons to these types of assessments. Would standardized tests completed within small student groups negatively impact the learning that is taking place among our students? Boykin and Toms (1985) would

seem to disagree, stating that communalism, which may be seen as dependency to the mainstream, exudes a range of social values. These values seem to align with the idea proposed by the scholars foregrounding Afrocentric curricula that promote ujima and family (Clarkston & Johnstone, 2011; Nyamekye, 2013). These scholars help to support the idea that mathematics teaching and learning can still be rigorous in these contexts, and that mathematics can be taught alongside cultural values. And what harm could occur from allowing students different ways to demonstrate their knowledge, particularly in ways that may align more with the forms of capital that are well represented among Black learners. Weissglass (2002) described how evaluation and assessment have been used, particularly in mathematics, as barriers to social access, and how these assessments may cater to cultural values and practices not shared by nonWhite student groups.

One thought that I have tried to reiterate within this study is that Black people are not a monolithic people. It is so important to produce research that highlights the capital that we utilize collectively, and that which may be possessed by subgroups of Black populations. In proposing their dimensions, Boykin and Toms (1985) highlighted the focus on Afro-Americans and links to traditional African ethos. They suggested that Black people express alignment with these dimensions at varying degrees. My question is whether we might see the varying degrees along the lines of certain subgroups of Black people. We have to acknowledge that the ways in which Black women utilize Black capital may not be identical in the same ways that Black men do, and I believe that this is part of the critique that Anderson (1999) raised in relation to Cone's (1997) work. This is also true when we think about Black Christians or Black Muslims, Blacks across the Diaspora, and Black people on a variety of spectrums of sexuality. I admire this research because it has helped me to think more about Blackness as this multifaceted ontology, and has allowed me to think deeper about what unites us and what makes us special. With this said I think we learn an important point from the CRP literature, and it is that context is always important. We do not assume that Black people crystalize forms of capital in identical ways, but

recognize the beauty in multiple similarities but celebrate even those who do not conform with the majority. CRP teaches us to think about the context of our classrooms and to be intentional about the ways we ensure the instruction is culturally relevant. For example, we see a lot of these discussions surrounding lower income Black students (e.g., Coleman, Bruce, White, Boykin, & Tyler, 2017; Jackson & Remillard, 2005; Powell-Mickel & Patton, 2004). How might this capital still be impacted if we compared it to others?

My data set has helped me determine that more research seems to be needed that focuses on diversity within Blackness alongside these notions of collective Black. What else unites us, and what other differences should we be celebrating and maximizing? In the same way that Carter (2003) was explicit about how these poor African American youth living in Yonkers, New York, used certain forms of capital, it may be worthwhile to see who is being left out of the conversation when we talk about Black capital. In other words, do Black girls and Black affluent children utilize these forms of capital to the same extent as their other Black counterparts. Herein lies a worthwhile inquiry. Davis (2018) contended that a “liberatory paradigm is responsive to the distinct historical and contemporary needs of the collective Black community in mathematics education and society at large” (p. 70). I leave this charge to the research community, to include more research that explores the ways Black children make sense of Blackness, and how this can be understood, alongside cultural relevance, as situated within their experiences as Black girls, Black LGBTQ students, Black Muslims etc.

With this said, culturally relevant and responsive pedagogies (Ladson-Billings, 1997; Corp, 2017) help us understand that what is relevant for Black children in Atlanta may not be culturally relevant for Black children in Detroit, as stated earlier. Our assignments do well to build on community knowledge, but these assignments and capital must take these considerations into account, because as CRT tells us, mathematical tasks have largely been products of White intellectual property and imaginaries (Davis, 2019). Group work is not something that is magically going to allow Black children to exert their capital. Teachers still

have a responsibility to help facilitate what mathematical practices are occurring in these groups (Sengupta-Irving, 2014). What may be different in the way that group work and collaborative assignments are implemented in classrooms with high populations of Black children is that group work must still promote what is considered to be high quality mathematics instruction (Munter, 2014). These children can be pushed to higher levels and should not be exposed to group work only for trivial tasks; we see that this kind of lazy instruction occurs far too frequently in classrooms with Black children when low expectations are abundant (Stinson, 2008). Communalism, and this collective Black identity have the power to inform our instructional activities without compromising mathematics instruction.

Communication and Verve

One way that I can see mathematics education taking up this work is in the ways that it allows and fosters a receptive environment wherein we acknowledge the importance of AAVE in mathematics discourse; this may in fact be the biggest contribution of the current scholarship to the field. In reflecting on some of the work that is included within this synthesis, as well as the connections that I have argued that exist as capital, I am interested in what it would look like for us to think seriously about the role that AAVE plays in promoting mathematics discourse and how it is inherently related to what Boykin (1994) has described as one of the dimensions of socialization for Black children. Munter (2014) described mathematics discourse as it occurs in communities, and posited that it includes “student-to-student talk that is student initiated and does not depend entirely on the teacher for soliciting strategies, pressing for explanations, or explicating connections between mathematical ideas” (p. 591). Understanding the brilliance of Black students and that their linguistic patterns serves as capital suggests that these strategies, as described by Munter, already occur in much of their conversations, but I believe we overlook them and do not allow enough space in the mathematics classroom for these to materialize.

I am interested in thinking deeper about how AAVE is imbued with elements of mathematical thought. The current research landscape does not typically connect these ideas of

high quality mathematics instruction in the form of mathematics discourse to AAVE, and as researchers we may find it worthwhile to study the ideas that Black students propose and the way they interrogate these ideas in conversation with one another. The reality is that although some Black children choose to speak in a nondominant form of English, they do not compromise the complexity of their thoughts by doing so. Further, how might this language also be utilized alongside formal mathematics vernacular. It would be worthwhile to take a closer look at how Black students may intertwine that which is considered more mathematical language (use of terms like functions, proofs, or sequences) and their own forms of AAVE. This is a noteworthy investigation, and I am interested in understanding how this is done within an inclusive environment. How might we lose out or deny contributions because they are not presented within our notions of good language, like in the example provided by Battery and Neal (2018)?

I contend with Martin and colleagues (2018) that Black children are both bidialectal and bilingual in this sense, because AAVE is a “full blown language with a grammar and syntax of its own that emanates from and reflects the historical and lived experiences of Americans of African descent” (p. 206). This suggests that we should recognize this speech, not as deficient or lacking mathematical logic, but as another resource in which we can explore how Black children propose robust solutions to mathematical tasks. Community cultural wealth would suggest that this too, is a form of linguistic capital (Yosso, 2005), and critical race theory demands that we recognize that Whiteness as property has privileged one form of communication over others, even despite the fact that our conception of “proper English” is not the same as it was in say, 1796.

Thus, the question becomes how do we honor the language that many Black children utilize outside of school in such a way that they do not feel as though it is necessary for them to code switch. For Black children to feel like they *must* code switch implies that they do not feel like they can be authentically themselves inside of the classroom, and this erodes the tenet of culturally relevant pedagogy related to cultural competence. Recognizing AAVE as a legitimate

form of discussion that does not lack the brilliance of ascertaining or formalizing complex mathematics thought is crucial. Further, I argue that mindsets that look down on students' use of this language as rejecting a schooling culture or academic success should be shifted and reevaluated- these students are keen to know the assumptions that are being made about them. Additionally, what this means is that we have to help teachers recognize this language, not as a hindrance, but as an asset, and one that helps them evaluate their worlds and communities (Tate, 1995) in the most authentic ways.

Furthermore, I am struck by the way that mathematics knowledge is ever-changing and ideas about what counts as mathematics shifts constantly (Davis & Hersh, 1981). Logic has for a long time been taught as a part of mathematics courses, and these courses usually begin with descriptions of what counts as mathematical proof. In geometry, for example, it is customary to describe what may be converse, inverse, or contrapositive statements. The role of language is built into our understanding and teaching of formal proof.

What is also true is that I think Black people have always been creative with their use of, and infatuation with, language. If we take for example hip hop, which is infused with constantly changing language and use of metaphors, this implicates ways in which to make mathematics learning more culturally relevant for Black students. Rigney (2001) has described the power of metaphors to our understanding of philosophy and I contend that some of our greatest mathematicians (e.g., Descartes or Euclid) are recognized for their contributions to philosophy (Davis & Hersh, 1998). It takes a brilliant mind, in my opinion, to rhyme mansion with Wisconsin, as T-Pain did in one popular song. My point here is that in the same way we can value calculations, how might we value the use of metaphor as a mathematical skill that accomplishes the same goals that we as a mathematics community argue is foundational to the study of, for example, geometry. Counterexamples, contradictions, and deductive reasoning are mathematical skills that we see occur inside of hip hop and AAVE, but are not always valued in the formal environment or identified as existing within these frames of communication styles or

orality (Boykin, 1994) among Black children. This too, I argue, needs to be recognized for the capital and potential to engage in mathematical inquiry.

Conclusion

It is my desire to provide the reader with a few implications, indeed ontological, epistemological, and methodological considerations for how educators, policymakers, and researchers might go on thinking about inclusive middle grades mathematics environments, and the research that could be taking place to improve these spaces for Black children. What I have tried to capture in this work is the basis for the capital that Black children possess that already predisposes them to advantages within mathematics, and how at least five common theories interact with one another to solidify these forms of capital. I began articulating the importance of these thoughts in opening this paper and suggesting that teachers' understanding of these forms of capital might impact their pedagogical and assessment strategies, helping to foster new notions about the abilities of their Black mathematics students. I am interested, for example, in how these students come to learn trigonometry in ways that stem from their cultural capital and knowledge, what I have highlighted as this ontological Blackness. How might they learn the unit circle as a result of certain capital, and how do we explore that capital to understand how to approach their engagement with the content?

To this point, I believe these forms of capital serve as benefits a) in the comprehension and sense making of the mathematics content specifically, as well as b) that which serves as significant to these students' participation and presence within the mathematics environment. In short, the capital impacts the way the content is taught, as well as the learning environment for these students. For example, understanding Black children's affinity for communication and communalism might be best understood as capital that helps them come to more substantive understandings of proportional relationships. On the other hand, knowledge of these students' resistance might help teachers understand that Black students' learning inside of the mathematics classroom is not only content-specific. They may be dealing with the

socioemotional ramifications of developing more of the resistance capital necessary for tenacity in that historically exclusive setting.

Next, I brought up assessment in my discussion of communalism. States would do well to develop standardized testing that offers some component that might be taken in collaboration with small groups of students. Consider, for a moment, the epistemological outcomes that could stem from group enhancement of the mathematical knowledge, and how this should be informing what constitutes mastery of this content. However, teachers must be strategic in their preparation of students to work in these ways because urban students, Black students in particular, are not always provided the same quality of instruction as their nonBlack counterparts. While the teacher serves a role as facilitator throughout the course, building on what some Black students exhibit as communalism, quality instruction in these environments must also help these students learn the skills of professional mathematicians (e.g., conjecturing, justifying) and prioritize providing reciprocity in helping their group members. Researchers and methodologists could pilot this strategy as a first look at how students perform on an overall skills test when 30% of their composite score is based on a portion of the test that is collaborative. Researchers would find it worthwhile to find empirical evidence that either supports or nullifies statements about improved outcomes.

Additionally, how might we begin to allow genuine, more organic means for AAVE to find its place in discussing a variety of mathematical concepts. Resistance, as highlighted in the framework I have provided, suggests that students find a way to maintain these ways of being and existing as ontologically Black, and the uptake of this vernacular is one way in which many Black students oblige. Perhaps teacher educators would be more inclined to think about training teachers to honor AAVE when it is used in mathematics discourse, and teaching them to help students understand the connections between their home dialect and more formal and standard mathematics vocabulary. As a researcher, I am interested in studying what metaphors might exist that help students to come to better understandings of conceptual meanings behind ideas

that, for example, seek to equate two quantities. Study designs could be developed around the ways that these students use language to communicate mathematical ideas, and more importantly, how they commit to explaining mathematics concepts to their peers. My sense is that AAVE may permeate their explanations to one another, and it may teach the research community new insights related to Black students' mathematics epistemology by analyzing their selection of metaphors, language, and vernacular chosen, especially when we juxtapose it with the way teachers would traditionally cover mathematics topics. The implications here might be for us to help mathematics teachers develop more robust knowledge of the ways students make meaning of definitions and vocabulary. We might do well to train mathematics teachers in similar ways that English teachers teach vocabulary, because proofs (geometric, algebraic, etc), for example, are inherently built around language and definitions. Black children have a body of language that is familiar to them and has the potential to be imbued within these conversations.

If I can leave the reader with a sentiment of AAVE and resistance and connected to a Black Liberation Theology, I would say that there has always been blessing in the storm, even if the storm is raging. This is the exact sentiment that has undergirded much of Black people's experiences in this country and a huge element of the Negro spirituals and the blues (Cone, 1972). I see this metaphor as heavily represented within a Black Christian undertaking of one's own reality, and I would suggest that this sentiment is no less useful within the mathematics environment.

References

- Adams, T. L. (2008). Multicultural mathematics: Revelations from an exploratory assignment. *Multicultural Education*, 15(4), 51-55.
- Ares, N. (2010). Political and cultural dimensions of organizing learning around funds of knowledge. *Yearbook of the National Society for the Study of Education*, 109(1), 192-206.
- Anderson, V. (1999). *Beyond ontological Blackness: An essay on African American religious and cultural criticism*. New York: Continuum.
- Baker, C. E., & Iruka, I. U. (2013). Maternal psychological functioning and children's school readiness: The mediating role of home environments for African American children. *Early Childhood Research Quarterly*, 28(3), 509-519. doi:10.1016/j.ecresq.2013.02.004
- Battey, D., Leyva, L. A., Williams, I., Belizario, V. A., Greco, R., & Shah, R. (2018). Racial (mis)match in middle school mathematics classrooms: Relational interactions as a racialized mechanism. *Harvard Educational Review*, 88(4), 455-482.
- Battey, D., & Neal, R. A. (2018). Detailing relational interactions in urban elementary mathematics classrooms. *Mathematics Teacher Education & Development*, 20(1), 23-42.
- Bempechat, J., Eleanor, D. S., & Boulay, B. A. (2002). Attributions for success and failure in mathematics: A comparative study of catholic and public school students. *Catholic Education: A Journal of Inquiry & Practice*, 5(3), 357-372.
- Berry, R. Q., III. (2003). Mathematics standards, cultural styles, and learning preferences: The plight and the promise of African American students. *Clearing House*, 76(5), 244-249.
- Berry, R. Q. III. (2005). Building an Infrastructure for Equity in Mathematics Education. *Symposium*, 88(4), 1-71. doi:10.1353/hsj.2005.0006
- Bicer, A., & Capraro, R. M. (2019). Mathematics achievement in the secondary high school context of STEM and non-STEM schools. *School Science & Mathematics*, 119(2), 61-71. doi:10.1111/ssm.12321
- Blake, M. E., & Sickles, M. V. (2001). Helping linguistically diverse students share what they know. *Journal of Adolescent & Adult Literacy*, 44(5), 468-475.
- Bonner, E., & Adams, T. (2012). Culturally responsive teaching in the context of mathematics: A grounded theory case study. *Journal of Mathematics Teacher Education*, 15(1), 25-38. doi:10.1007/s10857-011-9198-4
- Bourdieu, P. (1977a). Cultural reproduction and social reproduction. In J. Karabel & A. H. Halsey (Eds.), *Power and Ideology* (pp. 487-511). New York: Oxford University Press.
- Bourdieu, P. (1977a). *Outline of a theory of practice*. London: Cambridge University Press.
- Boyce, A. S., Avent, C., Adetogun, A., Servance, L., DeStefano, L., Nerem, R., & Platt, M. O. (2019). Implementation and evaluation of a biotechnology research experience for African-American high school students. *Evaluation & Program Planning*, 72, 162-169. doi:10.1016/j.evalprogplan.2018.10.004
- Boykin, A. W. (1994). Afro-cultural expression and its implications for schooling. In E. R. Hollis, J. E. King, & W.C. Hayman (Eds.), *Teaching diverse populations: Formulating a knowledge base* (pp. 243-273).
- Brand, B. R., Glasson, G. E., & Green, A. M. (2006). Sociocultural factors influencing students' learning in science and mathematics: An analysis of the perspectives of African American students. *School Science and Mathematics*, 106(5), 228-236.
- Burt, B. A., & Johnson, J. T. (2018). Origins of early stem interest for Black male graduate students in engineering: A community cultural wealth perspective. *School Science and Mathematics*, 118(6), 257-270.
- Caniglia, J. (2003). Math in the city: Experiencing mathematics through visiting Black historic sites. *Journal of Experiential Education*, 26(2), 70-74.

- Carter, N. P., Hawkins, T. N., & Natesan, P. (2008). The relationship between verve and the academic achievement of African American students in reading and mathematics in an urban middle school. *Educational Foundations*, 22(1), 29-46.
- Carter, P. (2003). "Black" cultural capital, status positioning, and schooling conflicts for low-income African American youth. *Social Problems*, 50(1), 135-155.
- Chappell, M. F., & Thompson, D. R. (2000). A raisin in the sun: Fostering cultural connections with a classic movie. *Mathematics Teaching in the Middle School*, 6(4), 222-235.
- Charity Hudley, A., & Mallinson, C. (2017). 'It's worth our time': A model of culturally and linguistically supportive professional development for K-12 STEM educators. *Cultural Studies of Science Education*, 12(3), 637-660. doi:10.1007/s11422-016-9743-7
- Charleston, L. J., Charleston, S. A., & Jackson, J. F. L. (2014). Using culturally responsive practices to broaden participation in the educational pipeline: Addressing the unfinished business of brown in the field of computing sciences. *Journal of Negro Education*, 83(3), 400-419. doi:10.7709/jnegroeducation.83.3.0400
- Chazan, D., Brantlinger, A., Clark, L. M., & Edwards, A. R. (2013). What mathematics education might learn from the work of well-respected African American Mathematics teachers in urban schools. *Teachers College Record*, 115(2).
- Chrisomalis, S. (2013). Greatness in the math corps family: Integrating ethnographic, corpus, and cognitive approaches to a cultural model. *Language & Communication*, 33(3), 155-166. doi:10.1016/j.langcom.2013.03.007
- Clarkson, L. M. C., & Johnstone, J. R. (2011). When the African-Centered paradigm is not enough: Lessons from an urban charter school. *Journal of Negro Education*, 80(2), 108-120.
- Cobb, P., & Jackson, K. (2013). Lessons for mathematics education from the practices of African American mathematics teachers. *Teachers College Record*, 115(2), 1-14.
- Coleman, S. T., Bruce, A. W., White, L. J., Boykin, A. W., & Tyler, K. (2017). Communal and individual learning contexts as they relate to mathematics achievement under simulated classroom conditions. *Journal of Black Psychology*, 43(6), 543-564. doi:10.1177/0095798416665966
- Collins, K. H. (2018). Confronting color-blind stem talent development: Toward a contextual model for Black student STEM identity. *Journal of Advanced Academics*, 29(2), 143-168.
- Cone, J. H. (1992). *The spirituals and the blues*. Maryknoll, NY: Orbis Books. Original work published in 1972.
- Cone, J. H. (1997). *God of the oppressed*. Maryknoll, NY: Orbis Books. Original work published in 1975.
- Cone, J. (2010). *A Black theology of liberation*. Philadelphia: Lippincott.
- Corey, D. L., & Bower, B. L. (2005). The experiences of an African American male learning mathematics in the traditional and online classroom: A case study. *Journal of Negro Education*, 74(4), 321-331.
- Davis, D. J., Davis-Maye, D., Thomas, C. M., Seals, C., Alfred, D. M., Tripp, L. O., King-Jupiter, K. L., & Lovett, G. L. (2011). KEMET Academy: A university outreach model for addressing the wholeness of learning in a rural context. *International Journal of Progressive Education*, 7(1), 6-27.
- Davis, J. (2014). The Mathematical experiences of Black males in a predominantly Black urban middle school and community. *International Journal of Education in Mathematics, Science and Technology*, 2(3), 206-222.
- Davis, J. (2018). Redefining Black students' success and high achievement in mathematics education: Toward a liberatory paradigm. *Journal of Urban Mathematics Education*, 11(1), 69-77.

- Davis, J., & Martin, D. B. (2018). Racism, assessment, and instructional practices: Implications for mathematics teachers of African American students. *Journal of Urban Mathematics Education*, 11(1), 45-68.
- Davis, P. J., & Hersh, R. (1998). *The mathematical experience*. Boston, MA: Houghton Mifflin. (Original work published 1981)
- Delpit, L. (2012). *"Multiplication is for White people": Raising expectations for other people's children*. New York, NY: The New Press.
- Eddy, C. M., & Easton-Brooks, D. (2011). Ethnic matching, school placement, and mathematics achievement of African American students from kindergarten through fifth grade. *Urban Education*, 46(6), 1280-1299. doi:10.1177/0042085911413149
- Eglish, R. (1997). The African heritage of Benjamin Banneker. *Social Studies of Science*, 27(2), 307-315.
- Eglish, R., & Bennett, A. (2009). Teaching with hidden capital: Agency in children's computational explorations of cornrow hairstyles. *Children, Youth & Environments*, 19(1), 58-73.
- Eglish, R., Bennett, A., O'Donnell, C., Jennings, S., & Cintorino, M. (2006). Culturally situated design tools: Ethnocomputing from field site to classroom. *American Anthropologist*, 108(2), 347-362. doi:10.1525/aa.2006.108.2.347
- Eglish, R., Gilbert, J. E., Taylor, V., & Geier, S. R. (2013). Culturally responsive computing in urban, after-school contexts: Two approaches. *Urban Education*, 48(5), 629-656.
- Eppehimer, T. (2006). Victor Anderson's *Beyond Ontological Blackness* and James Cone's Black theology: A discussion. *Black Theology*, 4(1), 87-106.
- Esmonde, I., & Langer-Osuna, J. M. (2013). Power in numbers: Student participation in mathematical discussions in heterogeneous spaces. *Journal for Research in Mathematics Education*, 44(1), 288-315.
- Eugene, W., & Clark, K. (2012). E-Learning, engineering, and learners of African descent: A needs analysis. *Journal of STEM Education: Innovations and Research*, 13(2), 45-57.
- Fakayode, S. O., Yakubu, M., Adeyeye, O. M., Pollard, D. A., & Mohammed, A. K. (2014). Promoting undergraduate stem education at a historically Black college and university through research experience. *Journal of Chemical Education*, 91(5), 662-665.
- Gholson, M. L. (2016). Clean comers and algebra: A critical examination of the constructed invisibility of Black girls and women in mathematics. *Journal of Negro Education*, 85(3), 290-301. doi:10.7709/jnegroeducation.85.3.0290
- Gholson, M. L., & Wilkes, C. E. (2017). (Mis) Taken Identities: Reclaiming Identities of the "Collective Black" in Mathematics Education Research Through an Exercise in Black Specificity. *Review of Research in Education*, 41(1), 228-252.
- Gilbert, J. E., Eugene, W., Swanier, C., Arbuthnot, K., Hood, S., Grant, M. M., & West, M. L. (2008). Culturally relevant design practices: A case study for designing interactive algebra lessons for urban youth. *Journal of Educational Technology*, 5(3), 54-60.
- Ginsburg, H. P., Posner, J. K., & Russell, R. L. (1981). The development of knowledge concerning written arithmetic: A cross-cultural study. *International Journal of Psychology*, 16(1), 13-34. doi:10.1080/00207598108247400
- Greenfield-Sanders, T. (Director). (2019). *Toni Morrison: The pieces I am* [Film]. Magnolia Pictures.
- Hambacher, E., Acosta, M. M., Bondy, E., & Ross, D. D. (2016). Elementary preservice teachers as warm demanders in an African American school. *Urban Review*, 48, 175-197.
- Hubert, T. L. (2014). Learners of mathematics: High school students' perspectives of culturally relevant mathematics pedagogy. *Journal of African American Studies*, 18(3), 324-336.

- Hudley, A. H. C., & Mallinson, C. (2017). "It's worth our time": A model of culturally and linguistically supportive professional development for k-12 stem educators. *Cultural Studies of Science Education*, 12(3), 637-660.
- Hurley, E. A., Allen, B. A., & Boykin, A. W. (2009). Culture and the interaction of student ethnicity with reward structure in group learning. *Cognition and Instruction*, 27(2), 121-146.
- Hurley, E. A., Boykin, A. W., & Allen, B. A. (2005). Communal versus individual learning of a math-estimation task: African American children and the culture of learning contexts. *The Journal of Psychology: Interdisciplinary and Applied*, 139(6), 513-527. doi:10.3200/JRLP.139.6.513-528
- Jackson, C. (2013). Elementary mathematics teachers' knowledge of equity pedagogy. *Current Issues in Education*, 16(1), 1-15.
- Jackson, K., & Remillard, J. T. (2005). Rethinking parent involvement: African American mothers construct their roles in the mathematics education of their children. *School Community Journal*, 15(1), 51-73.
- Jett, C. C. (2013). Culturally Responsive Collegiate Mathematics Education: Implications for African American Students. *Interdisciplinary Journal of Teaching and Learning*, 3(2), 102-116.
- Jett, C. C., Stinson, D. W., & Williams, B. A. (2015). Communities for and with Black Male Students. *Mathematics Teacher*, 109(4), 284-289.
- Johnson, I. R., Pietri, E. S., Fullilove, F., & Mowrer, S. (2019). Exploring Identity-Safety Cues and Allyship Among Black Women Students in STEM Environments. *Psychology of Women Quarterly*, 43(2), 131-150. doi:10.1177/0361684319830926
- Johnson, J. M. (2016). Managing Transitions, Building Bridges: An Evaluation of a Summer Bridge Program for African American Scientists and Engineers. *Journal for Multicultural Education*, 10(2), 206-216.
- Johnson, W., Nyamekye, F., Chazan, D., & Rosenthal, B. (2013). Teaching with Speeches: A Black Teacher Who Uses the Mathematics Classroom to Prepare Students for Life. *Teachers College Record*, 115(2), 1-26.
- Keck-Staley, T. L. (2010). The Role of Human Resource Capital of Black and Latino Middle Schoolers' Mathematics Identities. *Negro Educational Review*, 61(1), 7-40.
- Kellow, J. T., & Jones, B. D. (2005). Stereotype Threat in African-American high school students: An initial investigation. *Current Issues in Education*, 8(20), 1-12.
- Korenman, M., Korenman, T., & Lyutykh, E. (2009). Checkmate: A Chess Program for African-American Male Adolescents. *International Journal of Multicultural Education*, 11(1), 1-14. doi:10.18251/ijme.v11i1.186
- Lachney, M. (2017). Computational Communities: African-American Cultural Capital in Computer Science Education. *Computer Science Education*, 27(3), 175-196.
- Ladeji-Osias, J. O., Partlow, L. E., & Dillon, E. C. (2018). Using Mobile Application Development and 3-D Modeling to Encourage Minority Male Interest in Computing and Engineering. *IEEE Transactions on Education*, 61(4), 274-280. doi:10.1109/TE.2018.2826466
- Ladson-Billings, G. (1995b). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465-91.
- Ladson-Billings, G. (1997). It Doesn't Add Up: African American Students' Mathematics Achievement. *Journal for Research in Mathematics Education*, 28(6), 697-708.
- Langer-Osuna, J. (2015). Linear Equations and Rap Battles: How Students in a Wired Classroom Utilized the Computer as a Resource to Coordinate Personal and Mathematical Positional Identities in Hybrid Spaces. *Mathematics Education Research Journal*, 27(1), 51-64.
- Lee, D. M., & Harmon, K. (2013). The Meyerhoff Scholars Program: Changing Minds, Transforming a Campus. *Metropolitan Universities*, 24(2), 55-70.

- Leitze, A. R., & Melser, N. A. (2005). Multiculturalizing Creative Writing and Mathematical Problem Solving. *Kappa Delta Pi Record*, 41(2), 87-91.
- Lemons-Smith, S. (2008). Dr. Asa G. Hilliard III: Trumpeter for the Academic and Cultural Excellence of African American Children. *Review of Educational Research*, 78(4), 908-920.
- Leonard, J., Davis, J. E., & Sidler, J. L. (2005). Cultural Relevance And Computer-Assisted Instruction. *Journal of Research on Technology in Education*, 37(3), 263-284.
- Leonard, J., & Evans, B. R. (2018). Math Links: Building Learning Communities in Urban Settings. *Journal of Urban Mathematics Education*, 11(1), 118-141.
- Leonard, J., & Guha, S. (2002). Creating Cultural Relevance in Teaching and Learning Mathematics. *Teaching Children Mathematics*, 9(2), 114-118.
- Lewis, B. F., Pitts, V. R., & Collins, A. C. (2002). A Descriptive Study of Pre-service Teachers' Perceptions of African-American Students' Ability to Achieve in Mathematics and Science. *Negro Educational Review*, 53(1/2), 31-42.
- Leyva, D., Tamis-LeMonda, C. S., Yoshikawa, H., Jimenez-Robbins, C., & Malachowski, L. (2017). Grocery games: How ethnically diverse low-income mothers support children's reading and mathematics. *Early Childhood Research Quarterly*, 40, 63-76. doi:10.1016/j.ecresq.2017.01.001
- Liccardo, S. (2018). A SYMBOL OF INFINITE (BE)LONGING: PSYCHOSOCIAL RHYTHMS OF INCLUSION AND EXCLUSION AT SOUTH AFRICAN UNIVERSITIES. *South African Journal of Higher Education*, 32, 12-29. doi:10.20853/32-3-2575
- Lim, J. H. (2008a). Double Jeopardy: The Compounding Effects of Class and Race in School Mathematics. *Equity & Excellence in Education*, 41(1), 81-97. doi:10.1080/10665680701793360
- Lim, J. H. (2008b). The Road Not Taken: Two African-American Girls' Experiences with School Mathematics. *Race, Ethnicity and Education*, 11(3), 303-317.
- Machi, L. A., & McEvoy, B. T. (2016). *The literature review: Six steps to success*. Corwin Press.
- Mallinson, C., & Charity Hudley, A. H. (2018). Balancing the communication equation: An outreach and engagement model for using sociolinguistics to enhance culturally and linguistically sustaining K-12 STEM education. *Language*, 94(3), e191-e215. doi:10.1353/lan.2018.0048
- Malloy, C. E. (1997). Including African American students in the mathematics community. *Yearbook (National Council of Teachers of Mathematics)*, 1997, 23-33.
- Malloy, C. E., & Malloy, W. W. (1998). Issues of Culture in Mathematics Teaching and Learning. *Urban Review*, 30(3), 245-257.
- Martin, D. B. (2006). Mathematics Learning and Participation as Racialized Forms of Experience: African American Parents Speak on the Struggle for Mathematics Literacy. *Mathematical Thinking & Learning: An International Journal*, 8(3), 197-229.
- Martin, D. B. (2012). Learning Mathematics while Black. *Educational Foundations*, 26(1), 47-66.
- Martin, D. B., Gholson, M. L., & Leonard, J. (2010). Mathematics as gatekeeper: Power and privilege in the production of knowledge. *Journal of Urban Mathematics Education*, 3(2), 12-24.
- Matthews, J. S. (2018). When Am I Ever Going to Use This in the Real World? Cognitive Flexibility and Urban Adolescents' Negotiation of the Value of Mathematics. *Journal of Educational Psychology*, 110(5), 726-746.
- Matthews, L. E. (2003). Babies Overboard! The Complexities of Incorporating Culturally Relevant Teaching into Mathematics Instruction. *Educational Studies in Mathematics*, 53(1), 61-82.
- Matthews, L. E. (2008). Lessons in "Letting Go": Exploring Constraints on the Culturally Relevant Teaching of Mathematics in Bermuda. *Diaspora, Indigenous, and Minority Education*, 2(2), 115-134.

- Matthews, L. E., Jones, S., & Parker, Y. A. (2013). Advancing a framework for culturally relevant, cognitively demanding tasks. In J. Leonard & D. B. Martin (Eds.), *The brilliance of Black children in mathematics: Beyond the numbers and toward new discourse* (pp. 323-339). Charlotte, NC: Information Age.
- McGee, E. O. (2013). High-Achieving Black Students, Biculturalism, and Out-of-School STEM Learning Experiences: Exploring Some Unintended Consequences. *Journal of Urban Mathematics Education*, 6(2), 20-41.
- McGee, E. O. (2014). When It Comes to the Mathematics Experiences of Black Pre-Service Teachers... Race Matters. *Teachers College Record*, 116(6), 1-50.
- McPherson, E. (2014). Informal Learning in Science, Math, and Engineering Majors for African American Female Undergraduates. *Global Education Review*, 1(4), 96-113.
- Milner, H. R. (2016). A Black Male Teacher's Culturally Responsive Practices. *Journal of Negro Education*, 85(4), 417-432. doi:10.7709/jnegroeducation.85.4.0417
- Milner, H. R. (2017). Where's the race in culturally relevant pedagogy? *Teachers College Record*, 119(1), 1-32.
- Moody, V. R. (1998). Conceptualizing the Mathematics Education of African American Students: Making Sense of Problems and Explanations. *Mathematics Educator*, 9(1), 4-10.
- Moody, V. R. (2004). Sociocultural Orientations and the Mathematical Success of African American Students. *Journal of Educational Research*, 97(3), 135-146.
- Moses-Snipes, P. R. (2005). The Effect of African Culture on African American Students' Achievement on Selected Geometry Topics in the Elementary Mathematics Classroom. *Negro Educational Review, The*, 56(2), 147-166.
- Moses-Snipes, P. R., & Snipes, V. T. (2005). The Call: The Importance of Research on African American Issues in Mathematics and Science Education. *Negro Educational Review, The*, 56(2), 103-105.
- Munter, C. (2014). Developing visions of high-quality mathematics instruction. *Journal for Research in Mathematics Education*, 45(5), 584-635.
- Murrell, P. C. (1994). In search of responsive teaching for African American males: An investigation of students' experiences of middle school mathematics curriculum. *The Journal of Negro Education*, 63(4), 556-569.
- Mwangi, C. A. G., Fries-Britt, S., Peralta, A. M., & Daoud, N. (2016). Examining intraracial dynamics and engagement between native-born and foreign-born Black collegians in STEM. *Journal of Black Studies*, 47(7), 773-794. doi:10.1177/0021934716658860
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- Nasir, N. (2000). "Points Ain't Everything": Emergent Goals and Average and Percent Understandings in the Play of Basketball among African American Students. *Anthropology & Education Quarterly*, 31(3), 283-305.
- Nasir, N. (2002). Identity, goals, and learning: mathematics in cultural practice. *Mathematical Thinking & Learning*, 4(2/3), 213-247. doi:10.1207/S15327833MTL04023_6
- Nasir, N., Hand, V., & Taylor, E. (2008). Culture and mathematics in school: Boundaries between "cultural" and "domain" knowledge in the mathematics classroom and beyond. *Review of Research in Education*, 32(1), 187-240.
- Nasir, N., & de Royston, M. M. (2013). Power, Identity, and Mathematical Practices Outside and Inside School. *Journal for Research in Mathematics Education*, 44(1), 264-287.
- Nasir, N., McLaughlin, M. W., & Jones, A. (2009). What does it mean to be African American? Constructions of race and academic identity in an urban public high school. *American Educational Research Journal*, 46, 78-114.

- Natesan, P., & Kieftenbeld, V. (2013). Measuring urban teachers' beliefs about African American students: A psychometric analysis. *Journal of Psychoeducational Assessment*, 31(1), 3-15. doi:10.1177/0734282912448243
- Nathan, M. J., Tran, N. A., Atwood, A. K., Prevost, A., & Phelps, L. A. (2010). Beliefs and expectations about engineering preparation exhibited by high school STEM teachers. *Journal of Engineering Education*, 99(4), 309-426.
- Newkirk-Turner, B. L., & Johnson, V. E. (2018). Curriculum-Based Language Assessment with Culturally and Linguistically Diverse Students in the Context of Mathematics. *Language, Speech, and Hearing Services in Schools*, 49(2), 189-196.
- Nyamekye, F. (2013). Separate Schooling for Black Adolescent Mathematics Learners. *For the Learning of Mathematics*, 33(3), 7-13.
- O'Brien, L. T., Blodorn, A., Adams, G., Garcia, D. M., & Hammer, E. (2015). Ethnic variation in gender-STEM stereotypes and STEM participation: An intersectional approach. *Cultural Diversity and Ethnic Minority Psychology*, 21(2), 169-180. doi:10.1037/a0037944
- Orr, A. J. (2003). Black-White Differences in Achievement: The Importance of Wealth. *Sociology of Education*, 76(4), 281-304. doi:10.2307/1519867
- Orr, E. W. (1997). *Twice as less: Black English and the performance of Black students in mathematics and science*. WW Norton & Company.
- Ortiz, N. A., Capraro, M. M., & Capraro, R. M. (2018). Does it Really Matter? Exploring Cultural Relevance within a Majority White Classroom. *The Journal of Negro Education*, 87(4), 404-419.
- Owens, E. W., & Waxman, H. C. (1998). Sex-and Ethnic-Related Differences among High School Students' Technology Use in Science and Mathematics. *International Journal of Instructional Media*, 25(1), 43-54.
- Paris, D. (2012). Culturally sustaining pedagogy: A needed change in stance, terminology, and practice. *Educational Researcher*, 41(3), 93-97.
- Park, H.-S., & Bauer, S. (1999). Computational mathematical abilities of African American girls. *Journal of Black Studies*, 30(2), 204-215. doi:10.1177/002193479903000204
- Parks, A. a. u. e., & Bridges-Rhoads, S. (2012). Overly Scripted: Exploring the Impact of a Scripted Literacy Curriculum on a Preschool Teacher's Instructional Practices in Mathematics. *Journal of Research in Childhood Education*, 26(3), 308-324. doi:10.1080/02568543.2012.684422
- Powell-Mikle, A., & Patton, M. M. (2004). Meaningful Learning with African American Families: The Freedom Quilt FunPacks. *Childhood Education*, 80(4).
- Raju, C. K. (2017). Black thoughts matter: Decolonized math, academic censorship, and the 'Pythagorean' proposition. *Journal of Black Studies*, 48(3), 256-278. doi:10.1177/0021934716688311
- Rhodes, V., Stevens, D., & Hemmings, A. (2011). Creating Positive Culture in a New Urban High School. *The High School Journal*, 94(3), 82-94.
- Rhymer, K. N., Henington, C., Skinner, C. H., & Looby, E. J. (1999). The Effects of Explicit Timing on Mathematics Performance in Second-Grade Caucasian and African-American Students. *School Psychology Quarterly*, 14(4), 397-407.
- Rigney, D. (2001). *The metaphorical society*. Lanham, MD: Rowman & Littlefield.
- Robinson, A., Bradley, R. H., & Stanley, T. D. (1990). Opportunity to achieve: identifying mathematically gifted black students. *Contemporary Educational Psychology*, 15, 1-12. doi:10.1016/0361-476X(90)90001-H
- Ron, E., & Audrey, B. (2009). Teaching with Hidden Capital: Agency in Children's Computational Explorations of Cornrow Hairstyles. *Children, Youth and Environments*, 19(1), 58-73.

- Rosa, K. k. g. c. (2018). Science identity possibilities: a look into Blackness, masculinities, and economic power relations. *Cultural Studies of Science Education*, 13(4), 1005-1013. doi:10.1007/s11422-018-9859-z
- Rowser, J. F., & Koontz, T. Y. (1995). Inclusion of African American Students in Mathematics Classrooms: Issues of Style, Curriculum, and Expectations. In (Vol. 88, pp. 448-453): Mathematics Teacher.
- Rubin, D. F., & Belgrace, F. Z. (1999). Differences between African American and European American College Students in Relative Mathematical Time Orientations: A Preliminary Study. *Journal of Black Psychology*, 25(1), 105-113.
- Russell, M. L., & Atwater, M. M. (2005). Traveling the Road to Success: A Discourse on Persistence Throughout the Science Pipeline With African American Students at a Predominantly White Institution. *Journal of Research in Science Teaching*, 42(6), 691-715. doi:10.1002/tea.20068
- Sengupta-Irving, T. (2014). Affinity through mathematical activity: Cultivating democratic learning communities. *Journal of Urban Mathematics Education* 7(2): 31–54.
- Shah, N. (2013). *Racial discourse in mathematics and its impact on student learning, identity, and participation*. University of California, Berkeley.
- Sheppard, P. (2009). Prospective Teachers' Experiences Teaching Mathematics to African American Males. *Education*, 130(2), 226-231.
- Sheppard, P. A. (2011). Experience-Centered Instruction as a Catalyst for Teaching Mathematics Effectively to African American Students. *Journal of Negro Education*, 80(3), 254-265.
- Smith-Maddox, R. (2000). Educational Aspirations of African American Eighth Graders. *Race, Gender & Class*, 7(3), 58-80.
- Sonnenschein, S., & Galindo, C. (2015). Race/Ethnicity and Early Mathematics Skills: Relations between Home, Classroom, and Mathematics Achievement. *Journal of Educational Research*, 108(4), 261-277.
- Stinson, D. W. (2008). Negotiating Sociocultural Discourses: The Counter-Storytelling of Academically (and Mathematically) Successful African American Male Students. *American Educational Research Journal*, 45(4), 975-1010.
- Stinson, D. W. d. g. e. (2013). Negotiating the "White Male Math Myth": African American Male Students and Success in School Mathematics. *Journal for Research in Mathematics Education*, 44(1), 69-99. doi:10.5951/jresmetheduc.44.1.0069
- Stolle-McAllister, K. (2011). The Case for Summer Bridge: Building Social and Cultural Capital for Talented Black STEM Students. *Science Educator*, 20(2), 12-22.
- Strayhorn, T. L. (2010). The Role of Schools, Families, and Psychological Variables on Math Achievement of Black High School Students. *High School Journal*, 93(4), 177-194.
- Tan, E. e. t. u. e., & Calabrese Barton, A. (2018). Towards Critical Justice: Exploring Intersectionality in Community-based STEM-rich Making with Youth from Non-dominant Communities. *Equity & Excellence in Education*, 51(1), 48-61. doi:10.1080/10665684.2018.1439786
- Tate, W. (1995). Mathematics Communication: Creating Opportunities to Learn. In (Vol. 1, pp. 344-349): Teaching Children Mathematics.
- Tate, W. F. (1995a). Returning to the Root: A Culturally Relevant Approach to Mathematics Pedagogy. In (Vol. 34, pp. 166-173): Theory into Practice.
- Tate, W. F. (1995b). *School Mathematics and African American Students: Thinking Seriously about Opportunity-to-Learn Standards* (0013-161X).
- Varelas, M., Martin, D. B., & Kane, J. M. (2012). Content Learning and Identity Construction: A Framework to Strengthen African American Students' Mathematics and Science Learning in Urban Elementary Schools. *Human Development*, 55(5), 319-339.

- West-Olatunji, C., Shure, L., Pringle, R., Adams, T., Baratelli, A., Milton, K., . . . Lewis, D. (2008). Running Head: Rites of Passage Programs as Strength-based Interventions to Increase Mathematics and Science Achievement among Low-Income African American Youth. *International Journal of Learning*, 15(9), 1-9. doi:10.18848/1447-9494/CGP/v15i09/45953
- Wilson, T. L. Y., & Banks, B. (1994). A perspective on the education of African American males. *Journal of Instructional Psychology*, 21(1), 97-100.
- Winston, C. E., Philip, C. L., & Lloyd, D. L. (2007). The Identity and Success Life Story Method: A New Paradigm for Digital Inclusion. *Journal of Negro Education*, 76(1), 31-42. [5](#)
- Young, J., Young, J., Cason, M., Ortiz, N., Foster, M., & Hamilton, C. (2018). Concept Raps versus Concept Maps: A Culturally Responsive Approach to STEM Vocabulary Development. *Education Sciences*, 8.
- Zaslavsky, C. (2002). Exploring World Cultures in Math Class. *Educational Leadership*, 60(2), 66-69.