

EXPLORING AN INTEGRATIVE LENS OF IDENTITY FOR A HIGH SCHOOL MATHEMATICS TEACHER

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Abstract

Driven largely by societal discourse regarding the underrepresentation of African American males pursuing science, technology, engineering and mathematics (STEM) majors, careers and professions, it becomes salient to understand how African American males experience mathematics in K-12 public schools in relation to their mathematics identity development. Mathematics teachers play a critical role in developing African American male mathematics identity. Utilizing an integrative lens of identity, this study examined one teacher's mathematics identity development and its influence on her teaching of students. The analysis focuses on how mathematics teachers' identities shape mathematics instruction for African American students, ultimately impacting their emerging identities as learners of mathematics. I argue that foregrounding teacher identity in mathematics within an integrative lens of identity can enhance our current understanding of how K-12 mathematics instruction impacts career trajectories in STEM for African American students.

Keywords: African American students, mathematics, teacher, identity

In the current state of K-12 public schooling in the United States only 14% of eighth grade African American students nationwide scored at or above proficient in mathematics, in comparison to 21% Latina/o and American Indian/Alaska Native students, 45% of White students, and 60% of Asian/Pacific Islander students (NCES, 2013). Data further show at the high school level, only 7% scored at or above proficient in mathematics (NCES, 2013). African Americans have historically received inferior public schooling due to structural and institutional racism, and specifically African American males endure collective stereotypes that impact their mathematics achievement and participation (Anderson, 1998; Stinson, 2006). Participation in mathematics at the high school level becomes problematic as only 7.6% of African American males enrolled in at least one advanced placement course, in comparison to 18.4% White males (Schott Foundation, 2015). Therefore, I argue, that K-12 public schooling is not adequately preparing African American male students to identify math as their major for college (Maple & Stage, 1991) thus impacting their ability to pursue science, technology, engineering and mathematics (STEM) majors, careers and professions (National Science Foundation, 2014).

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EXPLORING AN INTEGRATIVE LENS OF IDENTITY

Despite the rich diversity of our world, the culture of mathematics education in the United States remains steeped in White, middle class traditions along with Asian Americans being considered the “model minority” in mathematics achievement (Ladson-Billings, 1997; Lee & Zhou, 2015; Noguera, 2009). This myopic view of mathematics achievement continues to marginalize African American youth from seeing themselves as STEM participants. The culture of mathematics can have tremendous impact on African American males as learners of mathematics since their marginalization in the discipline gives rise to a collective identity for African Americans in mathematics. According to Appiah (2005), collective identities are manifested in the following ways: 1) terms in public discourse used to describe bearers of the identity where some people are recognized as members of a group, 2) the internalization of those labels as parts of the individual identities, and 3) the existence of patterns toward a group – i.e. discrimination, media imagery, mass incarceration, and poverty. Since African American males experience structural and institutional racism in public schooling, are stereotyped and remain marginalized in the cultural positioning of mathematics, this collective identity can impact their identity as learners of mathematics as well as social relations within public schooling. While mathematics serves as a gateway subject to STEM participation and males are often privileged (Riegle-Crumb & Humphries, 2012), mathematics learning and achievement becomes problematized when the collective identity of African American males positions them at a disadvantage (Howard & Reynolds, 2013; Jett, 2011).

McAdams (2001) describes identity as “internalized and evolving narratives of self” which are reflective of cultural values and norms, which includes assumptions regarding gender, race and class. Since images of African American mathematicians are not prioritized in public school spaces, this can impact how African American males view themselves as learners and participants in mathematics, ultimately impacting identity development (Picker & Berry, 2000). Even though research has shown African American male agency in public schooling to resist oppressive mathematics positioning (McGee & Pearman, 2014; Stinson, 2008), the vast majority of African American males still occupy space in K-12 public schools where inferior mathematics instruction remains an everyday occurrence (Guiton & Oakes, 1995).

Socio-cultural research on identity development helps to understand the importance of social interactions that enable individuals to construct emerging identities based on relationships with significant others (Chen, Boucher & Tapias, 2006), group identification (Postmes, Spears, Lee & Novak, 2005) and everyday language (De Fina, Schiffrin & Bamberg, 2006). Teachers in K-12 public schools are positioned as significant others since they interact with African American males on a daily basis. Because of this significant interaction, it is necessary to understand how mathematics teachers of African American males developed their mathematics identity and how this formed identity impacts African American male learners of mathematics.

The necessity of studying the identity of a mathematics teacher, is because an integrative lens of identity manifests itself in the way an individual leads students’, makes decisions about mathematics instruction, engage mathematics students and negotiate responsibilities within the mathematics classroom. In operationalizing an integrative lens of identity, Vignoles, Schwartz & Luyckx (2012) believes that in understanding identity one must go beyond the singular focus of personal identity, and also include the relational, collective and material components of identity. In deconstructing a mathematics teacher’s identity development, investigation into how she defines her own mathematics skills (personal), what she believes the role of a mathematics student is (relational), how she views African Americans in mathematics (collective), and what mathematics means to the African American community (material) represents the four

components of identity. Utilizing an integrative lens of identity will foster an understanding on the impact a teacher's own experiences in developing her mathematics identity shapes her approach to teaching mathematics to African American students.

Conceptual Framework

In this article I use an integrative framework of identity to understand a high school mathematics teacher's identity development in mathematics in her own K-12 schooling (Vignoles, Schwartz & Luyckx, 2011). Cullingford (2006) found the process of recollection beneficial, because it allowed children to uncover the daily events of schooling. Combining the integrative framework of identity with recollection, provides the opportunity to uncover how teachers experienced mathematics learning as a student, to gain insight into how these experiences shape mathematics instruction in their role as teacher. An integrative framework of identity encompasses four components – *individual/personal identity*, *relational identity*, *collective identity* and *material identity*. An *individual/personal identity* represents the self-definition of the individual person. The *relational identity* refers to one's role in relation to others. The *collective identity* is a person's identification with a group and social categories to which they belong. *Material identity* refers to identification with treasured material possessions and sense of where she belongs in geographical space.

Employing recollection through an integrative framework of identity provides a deeper understanding of teacher identity both as a mathematics student and mathematics teacher, and proves salient as teachers play a critical role in developing African American male mathematics achievement (Clark, Badertscher & Napp, 2013; Milner, Pabon, Woodson & McGee, 2013, Tate, 1995). Lortie (1975) concluded that teachers teach the way they were taught – apprenticeship of observation; however, more inquiry is needed to explore how teaching practices get replicated (Mewborn & Tyminski, 2006), and how one's own mathematics identity development and agency is consciously or subconsciously transmitted to students through everyday classroom practices. Understanding ways in which mathematics teachers construct their disciplinary identities, particularly the relational, collective and material aspects of identity become critical if the goal is to have mathematics teachers who provide mathematics instruction that is caring, culturally relevant and responsive (Gay, 2000; Ladson-Billings, 1995; Noddings, 1988).

Methods

Case study methodology (Miles, Huberman & Saldana, 2014; Yin, 2013) was used to examine one high school mathematics teacher mathematics identity development as a K-12 student, and how her formed identity impacts mathematics instruction for students, particularly African American males. Two questions guided this case study: 1) What were the experiences and supports of a high school mathematics teacher as a K-12 student that shaped her mathematics identity? How does a mathematics teacher identity impact classroom instruction and relationship with students as it relates to mathematics, particularly for African American males?

Participant and Context

Linda (pseudonym), is a high school mathematics teacher at a magnet school, and was selected from a larger research study aimed at understanding how African American males at a research university developed mathematics identities in K-12 schooling. Linda was selected because she is a white, female teacher, which represents the majority of schoolteachers in K-12 schools in the United States (NCES, 2013) and because of her experience teaching mathematics to African American males in K-12 public schools. Linda grew up in a two-parent, middle-income, military family and as a result moved to different cities quite frequently. Linda’s parents divorced when she was seven years old, and her father retained full custody. Linda attended both public and private schools during her elementary, middle and high school years. Linda held a corporate position before entering into the teaching profession. Linda has been teaching for five years. Linda currently teaches Algebra I, Geometry intervention, and advanced placement statistics. At the time of the study, Linda was the mathematics teacher for three African American males, Donovan, Sean and Trevor (all pseudonyms) all Algebra I students. Currently, the magnet school has an enrollment of 700 students and is predominantly Latin@ and Asian, followed by African American, Filipino and White. The African American population at this school is 6.5%.

Data Collection and Analysis

An audio-recorded face-to-face semi structured interview in a conversational tone was conducted to build rapport with Linda to elicit depth and detail regarding her K-12 experiences learning mathematics as a student and her role as a mathematics teacher (Creswell, 2013; Rubin & Rubin, 2011). Linda completed a two-and-a-half-hour interview; at the time of the interview she was on maternity leave. Linda’s interview provided important themes that correspond to understanding a teacher’s mathematics identity development and its impact on African American male learners of mathematics.

Data was analyzed using an integrative lens of identity by labeling Linda’s interview data based on the integrative framework of identity which consists of personal/individual identity, relational identity, collective identity, and material identity. Once Linda’s interview data and sample lesson plan were labeled, in vivo coding was used to contextualize data within the integrative framework of identity to prioritize and honor the participant’s voice (Saldana, 2013).

Findings

In this section I contextualize the integrative framework of identity and recollection, to understand how Linda’s personal, relational, collective and material identity as both a K-12 mathematics student and as a mathematics teacher impacts mathematics instruction for students, specifically African American males.

Integrative Framework of Identity	Theme	Brief Description	Example
Personal identity	Natural Ability	The self definition at the level of the individual person as a mathematics	“I had a natural ability in mathematics. I am naturally wired to be good

EXPLORING AN INTEGRATIVE LENS OF IDENTITY

		student	at mathematics.”
Relational identity	Good student	The aspect of identity that refers to one’s role in relation to others, as a mathematics student	“I am good at mathematics because I can do it fast, I work independently, and I never received a grade lower than a B.”
Collective identity	Student Responsibility	The aspect of identity that refers to an individual’s identification with a group, as a mathematics teacher	“I set up my mathematics classroom that it is the student’s decision to fail. I introduce the concept, give them group work and they have to work their way through it.”
Material identity	Location matters	The aspect of identity where an individual belongs in geographical space, school location and demographics	“I have taught in an inner city school in predominantly African American neighborhood, realized that’s not the area I wanted to teach in.”

Personal Identity Represents Natural Ability

During the interview, I asked Linda to describe her mathematics interest and ability. Linda described herself as an individual who has a “natural ability” in mathematics. In recalling her K-12 schooling experiences, mathematics learning required minimal help from teachers and she saw the role of the mathematics teacher simply as someone who could push her natural ability further. Linda’s self-definition of “natural ability” impacts the way she thinks about mathematics instruction in her classroom, which causes tension in her role as a mathematics teacher. She said,

Now that I teach Common Core (Mathematics), like this is what I did in my head to understand. You know if someone gave me a direct lecture, and if they tell me this is how it works, I am over on the side like drawing the picture making the connection and thinking that’s how a Ferris wheel would go. I am naturally doing that so I guess I must be wired to be good at it and now we are trying to teach everyone to think like that even if they wouldn’t naturally.

Linda’s self-ascribed personal component of her identity is embedded in the concept of “natural ability”. She positions her self-ascribed personal identity to make meaning of the mathematics curriculum and instruction used to teach mathematics to her students. In positioning “natural ability” within the context of mathematics learning, Linda has the potential to marginalize students that may not fit her “natural ability” standard of mathematics acquisition.

Relational Identity and the Role of a Good Student

In discussing her K-12 mathematical experiences as a student, Linda characterized herself as a good mathematics student in relation to her peers. Linda's relational identity in mathematics consisted of: 1) completing mathematics problems quickly, 2) working independently, 3) receiving a mathematics grade no lower than a B, and 4) challenging mathematics teachers if she did not understand a mathematics concept. Linda explained,

I never questioned that I could do it (mathematics) or could figure it out. In fact, this is interesting and very culturally different than my students. If I didn't understand what the teacher was saying (regarding mathematics), then it was his fault. He wasn't explaining it well. I told a teacher to, "Wait, wait, wait, go back and explain how you did this one again." I remember being annoying and flabbergasted that I didn't understand. Me and my fellow classmate made him explain it better until we understood.

Linda's four-tiered self-ascribed relational identity included mathematics performance, agency, achievement, and questioning authority. Linda's self-ascribed relational identity is thrust upon her students, as she questions why her students do not challenge her by asking her to re-explain mathematical concepts. She states that this is culturally different, however her response is not one of trying to adapt her teaching to meet the needs of her students, but rather indicating it is a deficit of her students.

Collective Identity means Student Responsibility

Linda acknowledges that she is a mathematics teacher who establishes a high school classroom environment that places the responsibility to achieve academically in mathematics on her students. Her collective identity of student achievement in mathematics is a direct reflection of her relational identity where she admits that as a mathematics student she never received a grade less than B in mathematics. She states,

I set my classroom up in a way that I would have appreciated. I really want to make sure I set up my classroom in a way that it is their decision that they are going to decide to fail. This is why it is hard to identify with my inner city students because for me, the F [grade]. I think they genuinely choose an F.

In explaining the collective positioning of her students as it relates to math, Linda designs her mathematics classroom the way "she" would have wanted it, which exhibits power, and privileges her voice and way of learning over her students. To establish culturally relevant teaching, students must be co-constructors of knowledge. She has not asked for input of her students on ways in which may empower them in mathematics, instead, she defers to the type of classroom environment that she would have thrived in.

Material Identity where Location Matters

Geographical space matters to Linda. Linda began her teaching career in urban public schools with predominantly low-income African American students. Through this experience

EXPLORING AN INTEGRATIVE LENS OF IDENTITY

Linda realized that this was not the type of school environment she wanted to teach. Linda explained,

At a (predominantly low income African American high school) was my realization that that's not what I want to teach, like that's only teaching how to be a citizen. You think you are teaching any mathematics you are out of your mind. Ability wise it was way too low for me. God bless the teachers that are there and I hope that they are teaching them to love themselves and be confident and that they can do it, but it is not my skill set. It is not why I came into teaching.

The current school that Linda teaches in is a magnet school that has a diverse student body, including African Americans. While the geographical location of Linda's current school is different, African Americans comprise 6% of the population of her current school setting and may exhibit the same mathematical characteristics that African American students in her previous school held due to the culture of mathematics in K-12 public schooling.

Formed Identity and its impact on African American Males

After discussing her formed mathematics identity, I asked Linda to recollect her experience teaching mathematics to African American students, specifically African American males. Linda discusses her perception of the collective identity of African Americans and the three African American males that she currently teaches. Linda said,

Black students always the lowest, not always, but definitely the lowest in the class, and Algebra I is where our Black population are. My experience is the same approach to every student. The three Blacks in my Algebra I class, all friends, all want to work together, all failing, all never do their homework, and want to fight each other. The three students that I am thinking of [Donovan, Sean, Trevor] all are quite earnest, all of them are always kind of looking for the easy way to do mathematics, always looking for the shortcut. They definitely prescribe to the notion that if you can do mathematics faster, you are good at it, so if you can't do mathematics fast, you are not good at it, so stop trying to do it. Black students are more prone to a constructivist approach; they glaze over direct instruction. One thing that I do instructionally different for Black males is that when talking with Black mothers I start with my grading structure, because their sons have faced discrimination in the past.

Linda's collective identity of African American students is deficit based. In her remarks that "Black students are always the lowest", Linda has positioned the collective identity of African American students in mathematics as underperforming, and her self-ascribed personal as well as relational identity structures her mathematics instruction on natural ability and taking student ownership, which will not support a constructivist approach which she believes supports African American mathematics student learning.

Discussion

Cullingford's (2006) recollection research proved useful in understanding how a teacher's formed mathematics identity impacts the everyday experiences of learning mathematics for African American males. By utilizing an integrative framework of identity, I was able to understand the details of Linda's mathematics identity and how this is transmitted to her mathematics instruction and classroom environment. Linda's mathematics identity is embedded in natural ability, independence, and accountability. Linda's primary reason for entering the teaching profession, is to teach mathematics and not to teach how to be a "citizen". This supports Lortie's (1975) work that teachers teach the way they were taught, as Linda uses primarily direct instruction. However, it also problematizes Lortie's work in that Linda's mathematics identity informs the way she teaches and expects her students to understand mathematics.

Since educational research shows that African American students benefit from culturally relevant and responsive teaching that demonstrates care and building learning communities, Linda's mathematics instruction reinforces oppressive mathematics teaching and learning by placing accountability solely on the student as the "controller" of their own mathematics learning. In describing the collective identity of her three African American male students, Linda refers to her students as holding a certain viewpoint of mathematics which includes doing mathematics fast. Linda's mathematics teaching does nothing to challenge or disrupt this view of mathematics as she makes it evident that she does nothing instructionally different for her African American students outside of grading rationale.

Therefore, before Linda can undertake culturally relevant teaching which emphasizes academic success, cultural competence and challenging the status quo, Linda must first understand how her identity coupled with the deficit view of African American males in mathematics limits her ability to successfully teach mathematics to African American males. Therefore, I argue, that an integrative view of teacher identity provides an opportunity to understand how a mathematics teacher's identity can impact and shape mathematics instruction for African American males as they develop their mathematics identity in K-12 schooling.

Implications and Conclusion

Educational scholars have provided foundational and groundbreaking research on what good teaching looks like, in the areas of culturally relevant pedagogy, culturally relevant teaching, and culturally sustaining pedagogy (Gay, 2000; Ladson-Billings, 1995; Paris 2012). However, before culturally relevant teaching can occur, it is important to understand how a teacher's math identity within an integrative framework impacts mathematics instruction for African American students. I argue further research is needed utilizing an integrative framework of identity to understand how teacher mathematics identity impacts learners of mathematics in K-12 public schools. I believe additional research on teacher identity will help uncover the barriers African American males experience in obtaining a quality mathematics education, as well as address the reasons for their limited participation in STEM.

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EXPLORING AN INTEGRATIVE LENS OF IDENTITY

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EXPLORING AN INTEGRATIVE LENS OF IDENTITY

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EXPLORING AN INTEGRATIVE LENS OF IDENTITY

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