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A Century of Leadership in Mathematics and its Teaching

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The Promise of Qualitative Metasynthesis: Mathematics Experiences of Black Learners

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The purpose of this article is to present the findings of a qualitative metasynthesis focused on Black learners negotiating their mathematics experiences in multiple settings (in school and out-of-school) and reflecting on experiences that contributed towards their mathematics identities over time. Five findings emerged from this qualitative metasynthesis to describe the ways Black learners negotiated their experiences in mathematics across time. The findings are: 1) Learners determined their values, which were influenced by others; 2) Learners defined success in life, in academics, and specifically in mathematics, based on their values; 3) Learners encountered issues of awareness and access along their experience pathways, which included opportunities to make academic choices and to experience high expectations in academics; 4) Learners developed self-images based on their values and a mosaic of images, which comprised their image-based criteria for negotiating experience pathways; and 5) Learners' development of agency depended on their understanding of the consequences of their encounters with issues of awareness and access as well as their image-based criteria for success.

Keywords: Qualitative Metasynthesis, Black learners, mathematics

Introduction

The use of qualitative research in mathematics education provides researchers with the methodological tools for examining issues of equity. In particular, qualitative research analyzes the mathematics experiences of Black learners by describing these learners' mathematics understandings and studying their perceptions, beliefs, values, and dispositions towards mathematics. Since the late 1980s, there has been significant growth in the use of qualitative research methodologies for examining the mathematical experiences of Black learners; however, little is known about how this body of work contributes toward providing evidence-based practices for supporting positive mathematics experiences for Black learners and creating equity in mathematics education (Berry, Pinter & McClain, in press). This body of research challenges the dominant discourse of deficit and failure and pushes the field of mathematics education to consider sociological, anthropological, and critical theories when conducting research with Black learners (Jett, 2011; Martin, 2006; Noble 2011; Stinson, 2010; Taylor, 2009; Thompson & Lewis, 2005). There is insufficient work on how to integrate or synthesize findings across qualitative studies related to equity and the mathematical experiences of Black learners. The purpose of this article is to present the findings of a qualitative metasynthesis focused on Black learners negotiating their mathematics experiences in multiple settings (in school and out-of-school) and reflecting on experiences that contributed towards their mathematics identities over time.

This article is organized as follows. We first describe qualitative metasynthesis by providing a definition and rationale for using qualitative metasynthesis. Second, we describe our theoretical framework. Third, we describe the methods for conducting a qualitative metasynthesis. Fourth, we describe our findings. Finally, we reflect on the findings as well as the promise of qualitative metasynthesis to address equity in mathematics education, by answering the following research question: In what ways, do Black learners negotiate their experiences with mathematics across time?

Definition and Rationale of Qualitative Metasynthesis

In order to define qualitative metasynthesis, it is important to draw distinctions among review of literature, meta-analysis, and metasynthesis. Researchers often describe a review of literature as a summary, synopsis, and critique of a particular area of research often including both quantitative and qualitative studies (Téllez & Waxman, 2006). A qualitative metasynthesis is an analysis and interpretation of the findings of a selected pool of studies. Researchers conducting qualitative metasynthesis use a deliberate process of selecting studies with the emphasis on

synthesizing, analyzing, and interpreting findings across the selected studies.

A meta-analysis summarizes, replicates findings, or determines cause and effect by using statistical procedures that aggregate and condense a body of quantitative research studies to a common standard metric, such as a mean effect size (Finlayson & Dixon, 2008). A qualitative metasynthesis seeks to interpret findings for deeper understanding of meaning across a pool of selected studies by integrating, comparing, and interpreting patterns and insights systematically across qualitative research studies while maintaining the integrity of the individual studies (Erwin, Brotherson, & Summers, 2011).

Qualitative metasynthesis allow researchers to present their work as evidence-based by synthesizing findings across a collective pool of selected research studies. In this milieu of evidence-based support, qualitative metasynthesis allows for a broader approach to evidence-based research, practice, and policy by expanding how knowledge can be generated and used. Qualitative metasynthesis can suggest action steps for addressing issues of equity. Qualitative metasynthesis responds to moving from knowledge generation to knowledge application by helping researchers make sense of a collective body of research, but also identify gaps and omissions in a given body of research (Erwin, Brotherson, & Summers, 2011). In our search of the literature, we were unable to identify a formal metasynthesis in mathematics education.

Theoretical Framework

Conceptualizing mathematics learning and participation as "*racialized forms of experience"* provides space for a research approach framing learning and participation as the intersection between race, identities, racism, and empowerment (Martin, 2009; p. 299). Identity and agency are central to understanding how students make sense of, and respond to, ways they learn and participate within their mathematical experiences. Côté and Schwartz (2002) conceptualized high agency as having a high degree of self-exploration that is associated with a high degree of self-direction in determining one's life course. Conversely, low agency is a low degree of self-exploration that is translated into a low level of control over one's life course, such that identities remain undifferentiated and undeveloped beyond default options available to the person. For Black learners, race, agency, and identity are three areas that are negotiated for participation in mathematics. Using *racialized forms of experience* as a framework allows researchers to use learner-centered and identity-related conceptions of race and participation (Martin, 2009). Researchers can focus on how learners exhibit agency to develop a sense of control for self-exploration; thus, learners are able to assert their own identities to consciously make decisions about ways to engage in forms of mathematics learning and participation. This qualitative metasynthesis synthesizes findings across a pool of selected studies to interpret new and/or deeper meaning of how Black learners negotiate their experiences with mathematics across time.

Methods

Six discrete steps were followed for this qualitative metasynthesis: 1) identify a specific research question; 2) conduct a comprehensive search; 3) select initial relevant studies; 4) appraise the quality of initially selected studies; 5) synthesize findings of selected studies; and 6) present findings across the studies. In our research question, we make the distinction of using the language "across time" to differentiate between research that is focused on a narrow period of time and research that focuses on a broad period of time. We define "across time" as studies in which learners reflect on their experiences spanning periods of time such as describing how experiences from early time periods contributed to their current position with mathematics. This is in contrast to studies focusing on a finite period of time such as a grade level or time spent in a mathematics club. Studies with in-school and out-of-school settings were included for this qualitative metasynthesis. This qualitative metasynthesis is a subset of a larger study in which the research articles were categorized across two domains: temporal and settings. Table 1 provides a summary of 26 qualitative studies included for the larger qualitative metasynthesis, organized across the four categories. The 12 articles in category one were used for this qualitative metasynthesis.

Sample: Conducting a Comprehensive Search

We used EBSCO to simultaneously search the following databases for peer-reviewed journal articles: a) Academic Search Complete, b) Education Research Complete, c) ERIC, d) Teacher Reference Center, and e) OmniFile Full Text Mega (H.W. Wilson). We conducted subject term searches within the selected databases with this protocol: mathematics in SU Subject Terms; AND (Black or "African American") in SU Subject Terms; NOT ("black holes") in SU Subject Terms. We also conducted a search using the Sociological Abstracts database with this protocol: mathematics in All field (no full text) – ALL; AND (Black or "African American") in All field (no full text) – ALL. Previous work suggested that qualitative research on Black learners has increased since the mid to late 1990s (Berry, Pinter, & McClain, in press); thus, we limited the dates of the search from January 2000 to May 2012. The following special limiters were used:

- Academic Search Complete database, Publication Type: Periodical and Document Type: Article.

- ERIC database, Journal or Document: Journal Articles (EJ) and Publication Type: Journal Articles.
- Education Research Complete database, Publication Type: Academic Journal and Document Type: Article.
- OmniFile Full Text Mega (H.W. Wilson) database, Publication Type: Academic Journal and Document Type: Article.
- Sociological Abstracts database, Source Type: Scholarly Journals and Document Type: Journal Article

Our initial search using the five EBSCO databases produced 391 documents, and the Sociological Abstracts database produced 310 documents. The inclusion/exclusion protocol from Figure 1 was used to determine which documents met the criteria to be used to investigate the research question. After reviewing and subjecting each document to the inclusion/exclusion protocol, 56 peer-reviewed articles were identified.

Inclusion Criteria	**Exclusion Criteria**
• Empirical qualitative research • PreK–12 • Mathematics (STEM) • Black and/or African American • Setting/Context United States **Additional permissible inclusion criteria** • Longitudinal qualitative with learners older than PreK–12 is included but the article had relevance to PreK–12 educational experiences (i.e. reflections). • While a study focused on learners other than learners (i.e. parents and teachers), the research had to be central to in-school and out-of-school experiences of learners. • Studies focused on additional learning opportunities and out-of-school programs • Most of the learners are identified as Black in cases with non-Black learners.	• Quantitative Methods • Mixed Methods • Review of literature or Summaries of research • Policy documents • Calls for research • Book reviews • Op-Ed pieces • Not United States Setting/ Context • Pedagogical/practitioners articles describing implementation of teaching, tools, and/or practice with learners • Multiple publications using the same data

Figure 1. Inclusion and Exclusion Criteria

We recognize that qualitative research cannot be treated as a unified field due to the plurality of methodological approaches (Dixon-Woods, Shaw, Agarwal & Smith 2004); however, qualitative research studies should include basic criteria of quality for methodological aspects, such as research problem/purpose/question, data collection techniques, data analysis, report of findings, and implications/conclusions. To appraise the quality of the 56 studies, we adapted an appraisal checklist reported by Erwin, Brotherson, and Summers (2011). Figure 2 represents the adapted checklist providing points for each indicator with a maximum of 15 points. We selected the 26 articles listed on Table 1 that scored in the high range (11 to 15 points). The 12 articles in column one on Table 1 were used for this qualitative metasynthesis.

Table 1. Qualitative research studies organized by temporal and setting categories (January 2000–May 2012)

Across time and in-school and out-of-school	**Finite time and in-school and out-of-school**	**In-school**
1. Berry III, R. Q., Thunder, K., & McClain, O. L. (2011).	1. Jackson, K. (2011).	1. Brand, B. R., Glasson, G. E., & Green, A. M. (2006).
2. Berry III, R. Q. (2008).	2. Jones, S. (2003).	2. Corey, D. L., & Bower, B. L. (2005).
3. Berry III, R. Q. (2005).	3. Keck-Staley, T. (2010).	3. Davis, H. A., Gabelman, M. M., & Wingfield, R. D. (2011).
4. Ellington, R. M., & Frederick, R. (2010).	4. Lim, J. H. (2008).	4. Martin, B. K., Pourdavood, R. G., & Carignan, N. (2005).
5. Jett, C. C. (2010).	5. Nasir, N. S., & Hand, V. (2008).	5. Moody, V. R. (2004).
6. Jett, C. C. (2011).		6. Parks, A. (2010).
7. Martin, D. B. (2006).	**Finite time and out-of-school**	7. Sheppard, P. (2006).
8. McGee, E. O., & Martin, D. B. (2011).	1. Nasir, N. S. (2000).	
9. McGee, E., & Martin, D. B. (2011).	2. Taylor, E. V. (2009).	
10. Noble, R (2011).		
11. Stinson, D. W. (2008).		
12. Thompson, L. R., & Lewis, B. F. (2005).		

Criteria	Possible Points	Points Given
1. Research Problem, Purpose, and/or Question	2	
a) Problem is stated clearly and related to the research literature		
b) There is a clear statement of research purpose and/or question		
2. Method: Data Collection and analysis	6	
a) Study is methodology qualitative		
i) Sample plan and data collection are appropriate to the question		
ii) Data analysis plan is consistent with design and purpose		
b) Described the learners of the study and how they were selected		
c) Researcher showed an awareness of their influence on the study and its learners (describe experiences and/0r assumptions with which the researcher entered the research)		
d) Data collection procedures are fully described		
e) Steps/process of the data analysis is clear with examples		
f) Techniques for credibility and trustworthiness are described and used correctly		
3. Findings	5	
a) Interpretations of data are plausible and/or substantiated with data		
b) Overall findings address the purpose of the study		
c) Ideas (themes, categories, concepts, etc.) are precise, well developed, and linked to each other		
d) Results offer new information about or insights into the targeted phenomenon		
e) Quotes provide support/evidence for each theme/concept presented		
4. Discussion and Implications	2	
a) Return to the research questions/purpose proposed at the beginning and discuss interpretation and significant findings		
b) Recommendations for intended audience and future research issues		
Total Points	15	

- Highly overall standards of quality and credibility = 11–15 points
- Moderate overall standards of quality and credibility = 6–10 points
- Low overall standards of quality and credibility = 0–5 points

Figure 2. Appraisal Criteria for Assessing Quality of Qualitative Research Process

Data Analysis

The findings from each article were treated analogously as informants for this qualitative metasynthesis; consequently, the findings were extracted into a single document to be coded. A grounded theory approach was used to code, categorize and constantly compare data to develop a general theory (Strauss and Corbin 1997). The researchers open coded the findings independently then negotiated our independent open coding to reach a shared set of initial codes and definitions to be used consistently throughout the analysis of data. The initial codes were then categorized. We reread and re-coded to refine and verify coding and to assure consistency. After this, we sorted the data by codes and reread looking for themes within each code to see if there were dimensions that required the data to be further discriminated. Through this process, themes emerged from the data. From this categorization and classification of the data, we provide and describe visual data displays.

Findings

Five findings emerged to describe the ways Black learners negotiated their experiences in mathematics across time. Table 2 presents the five findings. These findings are not mutually exclusive and describe defining qualities of the complex, nonlinear experience pathways unique to the learners across the studies. Table 3 presents a sampling of data across the nine studies (12 articles) to support the findings from the metasynthesis. The findings and the representativeness of this data are detailed in the sections that follow.

Values

Learners determined their values, which were influenced by others. Learners identified and embraced particular values early in their experiences with mathematics and ongoing throughout their lives. Learners were influenced by the values of others with whom they interacted, including family, neighbors, church members, coaches, teammates, teachers, club members, and peers. Table 4 summarizes the five central values of learners and the sources of these values. The quotes in Table 2 are typical of the ways learners described their values. Learners valued caring for (financially) and about (affectively) their faith and church involvement, their community, and their family. For example, Roger valued the role of God in his life and following God's will. Cordell's, Karen's, and Nathaniel's family members modeled the importance of caring for and about each other as a family. Learners also valued knowledge as a means for improving or maintaining their financial situation (like Nathaniel) and for earning the reverence and admiration of others (like Corey, Malik, and the majority of participants in the McGee & Martin (2011a, 2011b) studies). Valuing knowledge led to a value of future options, including mathematics-related careers, and access to additional studies.

Success

Learners defined success in life, in academics, and specifically in mathematics, based on their values. Table 5 presents the learners' negotiated definitions of success. Learners' definitions of success were based on the achievement of certain outcomes closely linked to their values. The quotes in Table 3 are representative of learners' negotiated definitions of success. Each of the learners in the Jett (2010 & 2011) study described success as keeping their faith and using God-given talents. Young learners in the midst of their elementary education, like Darrell, and adult learners reflecting back on their experiences, like those in the Stinson (2008) study, identified their successes as acquiring knowledge that enabled them to take care of their families. Anita, Malik, and Raheem defined success as meeting career goals in which they gave back to their community and became role models. In school, Alfred and the learners in the Berry (2005 & 2008) study negotiated success as outperforming peers through class participation, grades, and testing, being labeled as gifted, enrolling in advanced courses, and attending college. Although these outcome-based definitions of success permeated the data, the learners' definitions of success were not static. Rather, an individual's definition of success was always under negotiation across time.

Table 2. Findings from Data Analysis

First Finding	Learners determined their values, which were influenced by others.
Second Finding	Learners defined success in life, in academics, and specifically in mathematics, based on their values.
Third Finding	Learners encountered issues of awareness and access along their experience pathways, which included opportunities to make academic choices and to experience high expectations in academics.
Fourth Finding	Learners developed self-images based on their values and a mosaic of images, which comprised their image-based criteria for negotiating experience pathways.
Fifth Finding	Learners' development of agency depended on their understanding of the consequences of their encounters with issues of awareness and access as well as their image-based criteria for success.

Awareness and Access

Learners encountered issues of awareness and access along their experience pathways, which included opportunities to make academic choices and to experience high expectations in academics. Table 6 details these issues of access as well as the forms of aids and barriers that defined these encounters. As they reflected on their experiences, some learners realized critical points along their pathways that impacted opportunities. Often, awareness was fostered through reflection rather than in the midst of the encounter. Additionally, awareness did not imply access to opportunities; the presence of barriers sometimes restricted access despite awareness. The quotes in Table 3 characterize the types of encounters experienced by the learners across the nine studies. Cordell described his encounter with the issue of access to academic choice. With his mother as advocate, Cordell gained access to gifted identification despite gatekeepers. Malik also gained access to advanced mathematics courses by serving as his own advocate to alter course offerings. Raheem's story is representative of students who were misplaced or misidentified and unaware of the consequences of this action by gatekeepers; as a result, Raheem did not gain access. In a similar way, Roger was unaware of his encounters with issues of access until he engaged in reflection during the study. Alfred described peer support as his encounter with access to academic expectations. Karen and Tinesha presented opposite experiences with access to quality teaching: Karen's

Table 3. Metasynthesis Analysis of Findings Across Qualitative Studies

Finding	Berry, Thunder, & McClain (2011)	Berry (2005, 2008)	Ellington & Frederick (2010)
First Finding	Jamal: "What I like about math is it's kind of complicated...I want my work to be complicated so I can actually do better when I get to higher grades. And it feels like I finished something. It's like when it's hard, like when we were doing an engineering project, I feel like I finished something really good." (p. 17)	Cordell: "My grandmother and aunts help my mother by encouraging me to make good decisions and make sure that I stay on the right track. My grandmother and mother talk to me about doing well in school and make sure I do my work. My mother is always saying I better do well in school if I plan on going to school." (p. 473)	Karen: "My mom taught us how to count and everything like that. And every time we went someplace, oh, what's 1+2? And what's 2+2?…I know before [age] 5, I know I could add." (p. 67)
Second Finding	Derrell: "I realized I was good at math when my mom, brother, sister, or grandparents were doing bills or taxes and everyone asked me, 'How did you know this and that?' That made me feel very happy." (p. 16)	"Seven boys reported feeling successful in the elementary grades because they knew their multiplication tables before their peers, were grouped with the smart kids for mathematics, or were challenged during their pre-fourth-grade years with assignments that were above their grade level." (p. 477)	Anita: "There's the social obligation [to stay in the mathematics program]. Where, you know, you feel like, as a Black female in the program, one of few, that, if you don't stay in the program, then nobody else will. And what happens to the little Black girl who wants to be a math major, and doesn't see anyone who's one, and then she doesn't become one...And so that's something I feel has motivated me." (p. 74)
Third Finding	Wynn: "At my school really it matters what classes I'm in…I was the only African American who was in there the whole year…It's better in the gifted classes because personally I think the teachers are nicer." (p. 18)	Cordell: "My mother thought I was not being challenged enough and that that is why I got into trouble. The teacher and principal did not want me tested because they felt I was not gifted. My mother thinks the reason they did not want to test me was because I am Black. She stayed on the teachers and principals until I was tested. I did well enough to be placed in the AG program." (p. 473)	Karen: "Our teachers expected a lot out of us…I told my teacher I couldn't do it at first. I was like, no, I'm not smart enough to do it. She's like: *yes you are!* I'm like, *no, I'm really really not.* She's like, *yes you are.* So she made me do it and I did it. Yeah, it was no problem, but I didn't think I could at first." (p. 69)
Fourth Finding	Keeshawn: "I know that African American males...don't achieve too well in math and stuff. But I feel that just because like statistics show that African Americans don't do as well in math, don't achieve more, I still feel that we can do good...that kind of gives me a boost." (p. 19)	Phillip: "Unfortunately, many of the African American boys at my school set bad examples and make bad reputations for African American boys. I work hard to carry myself in a mature manner all day, everyday. My dad has talked to me and other African American boys at my church about the importance of being a positive role model for younger boys." (p. 476)	David: "To maintain [your scholarship], you must maintain a certain standard and it's very competitive...This is what I've been searching for all my life—I'm in a group now, I'm surrounded by a bunch of people just like me. So, now I'm not the outcast so to speak...Now I've found that niche where I'm surrounded by people who are just as competitive." (p. 70)
Fifth Finding	Tinashe: "I think [being Black] hasn't affected me because it doesn't really matter what color I am…I'm addicted to math." (p. 19)	Phillip: "I think God tells us to be achievers, so anything I set my mind to I can achieve. Church keeps me encouraged to do what is right, and my church has many positive Black Christian male role models." (p. 50)	David: "I had faith that I could get it [mathematics]. I wasn't going to quit, [be] cause I had a bad feeling when I dropped that computer science class and I switched majors. And it was very much a feeling that I didn't want again…I didn't feel like God brought me to my junior year to have me fail a class. I just had to ultimately say that everything was going to be okay, and that it was just only a matter of time. " (p. 73)

Table 3 continues

Table 3 continued

Finding	Jett (2010, 2011)	McGee & Martin (2011a, 2011b)	Noble (2011)
First Finding	Roger: "But I see right now that's not in God's plans for me to do. So at that point in time I was kind of frustrated, but right now I'm glad that it didn't go through." (p. 1138)	"The majority of the students in this study admitted to gravitating toward mathematics and engineering to be perceived as smart. The respondents recognized that excelling in mathematics meant being the beneficiary of privileged status and having access to the educational opportunities they need to get ahead." (p. 26)	Corey: "I was recruited to participate with the math club due to my performance in class. As we competed against other schools, I stood out and began to form a real love for the subject...It was the only subject that I didn't fall asleep through in school...Math has always challenged me, and this is what keeps me drawn to it." (p. 198)
Second Finding	"A common internal characteristic among the chosen ones was that they were all spiritually grounded and their spirituality positively contributed to their mission to fulfill their academic goals." (p. 330)	Valerie: "My ultimate career goal is to become a professor in engineering... I'd rather be a role model, and show them like I said 'you could achieve this, you could become a professor.' I want to be a role model and help other younger people who are in engineering who need a face to put with that goal they are trying to achieve. That's my goal." (p. 30)	Alfred: "I always scored a perfect score in the math section…I took this as a sign that I was a pretty good mathematician in my younger years. As the years progressed I took these scores plus my many A's that I got in my math classes as something to be proud of." (p. 197)
Third Finding	Roger: "To be honest with you, I really haven't dealt with racism, but I have. It was just that it wasn't, it was more behind the scenes instead of out in the open. They did things behind my back." (p. 1137)	Tinesha: "I came to realize, like, these people [teachers and her peers] don't expect too much of me in this class... If you tell me that I can't do something, then I want to prove to you that I can. And so for the rest of the time in all my upper-level classes, that was my goal...I took that attitude from that point on in all my math classes." (p. 19)	Alfred: "When I have friends who I know are good at math, then a lot of times we'll work together. And so they help me learn more and become better." (p. 201)
Fourth Finding	Antonio: "These transformative, spiritually attentive approaches also helped to validate my own academic success in that they grounded me both spiritually and academically." (p. 328)	"The pressure of stereotypes, his love of mathematics, and parental expectations drove Rob to develop a strong mathematics identity. Rob has long seen himself as an excellent mathematics student—according to him 'one of the best.'" (p. 18)	Dexter: "I never really felt like somebody that's in the same class as me is smarter than me. I've never really felt that way. So, when they succeed, I feel like that shows me that I could have succeeded if I didn't succeed. I realize that I should have set the bar higher." (p. 201)
Fifth Finding	"Roger mentioned that he did not think that he would achieve so much as it pertains to school... He made reference to the fact that he was "lost" as it pertains to his educational goals... He was going thorough the motions as a football player, not contemplating the ramifications of his own education his life. He now, however, has a clear vision of his future in mathematics, one that includes attracting more African American male students to the mathematics pipeline." (p. 1140)	"In order to preserve his racial self-esteem, he dropped out of Science Tech and moved back to the safe haven of his childhood neighborhood, taking an entire year off from school…He has no regrets about leaving Science Tech because that year was critical to rebuilding his racial self-esteem. Rob eventually received three master's degrees...as well as his PhD in applied mathematics." (p. 56)	Elijah: "I've taken more math courses than I've actually had to, which is something I don't mind doing…I've taken some of the more difficult classes as electives, some of the classes that people generally try to stay away from." (p. 199)

Table 3 continues

Table 3 continued

Finding	Stinson (2008)	Thompson & Lewis (2005)	Martin (2006)
First Finding	Nathaniel: "I got a sense [from my parents] that learning was something important, it was something that… put food on our plate, and eventually led us to moving up in social standing." (p. 988)	"Malik's desire to be highly regarded as the best at whatever he does is a recurring theme throughout our interviews. It is his desire that drives him to seek admittance 'to the best colleges,' and to focus more on mathematics where he was 'dominant' and 'almost untouchable' as opposed to athletics." (p. 13)	Keith: "I honestly feel that through my struggles and working and living as long as I have so far, that math is an essential foundation for everything." (p. 221)
Second Finding	"No matter how participants conceptualized success, implicitly or explicitly stated throughout their conversations was the undisputed need for education, whether it was to pass knowledge on or to ensure that one could financially care for loved ones." (p. 988)	"The deep-seated goals that a career as a fighter pilot allow Malik to realize are: (a) to be highly regarded as the best at whatever he does; (b) to help people; and (c) to be physically active." (p. 13)	Raheem: "That's why I decided to become a teacher, because I want to help too... If I demonstrate to children that a Black person is intelligent and they know what they are talking about, that will help them have more confidence in themselves and their own people." (p. 218)
Third Finding	"Each of the participants had been tracked into honors programs early in his education, providing him with access to enriched schooling experiences and academic programs and access to the most credentialed and experienced teachers." (p. 996)	Malik: "I want to go to one of the best colleges. I want to be something...I was looking at the required classes [for college] and I realized that where I stand right now as a junior, I don't have what it takes to succeed at that type of college...I knew I had to try to find a way to better prepare myself. So I went to Mr. King and asked him if there's any way we could add more advanced math classes to the schedule." (p. 11)	Raheem: "I remember Ms. Berks at the end of the school year telling me that she made a mistake not putting me in the algebra class in the 8th grade. And I remember her telling me this and not realizing what algebra was and I was just, 'Oh well, no big deal to me.'…that's to me an example of the fact that Black children, even when you do well, your educational future is not planned out properly for you…I was bored as hell in that class…by the time I got to algebra in 9th grade, I had kinda lost interest in math." (p. 210–211)
Fourth Finding	Spencer: "I make sure that I raise my hand to answer the questions early…I try to prove my worth, show that I belong." (p. 994)	Malik: "When you're at Garvey High School, the competition may not be as great as maybe some of the other schools...you're on this false sense of confidence. But once you start to compare yourself to kids nationwide, you're like oh, 'I'm kinda weak compared to these guys'...so when I was going into my senior year I was like, 'I gotta do something now.'" (p. 7)	Raheem: "I didn't see Black people in positions of power, authority…I can count on one, just about one hand the Black teachers that I had. I look back and reflect on the way I thought, in the way I perceived things. That had an impact on the way I felt about my own people. I saw people that were not Black as my teachers. So that made me self-consciously come on with the thought that Black people are just not that smart." (p. 209–210)
Fifth Finding	Ethan: "I was always…willing to learn…what I needed to do to achieve, and if the core curriculum [which included mathematics] was what they needed me to do, I was willing to do it." (p. 990)	Malik: "I had always wanted to be part of the in crowd and do what was cool; and what was cool was to play sports. So I never really focused on the books…When I got to high school, I started to make a change. Math class really changed everything for me because I started seeing myself putting the kind of effort into the classroom that I put into the field and I was dominant... It made me realize that this is where I compete, this is my passion and it can be just as fun as sports. This is where I can make a difference." (p. 6–7)	Amber: "I knew it right away. They do that because they want to push them along and keep us back. A lot of minority students knew this but they accepted it. I hated it. Why should I accept this, just because I'm a Black person? This is not fair. You're advancing them and letting them advance...So that's why I said forget it. 'I hate this, I'm leaving.' I checked out, getting a GED and went ahead and did what I needed to do." (p.216)

teacher held high expectations and supported Karen to achieve while Tinesha used her teacher's low expectations to motivate her reaction to achieve in the face of barriers. Access to academic choice and high expectations worked in tandem, as evidenced by the stories of Wynn and the learners in Stinson's (2008) study. Through tracking, the learners gained access to quality teaching. Most significantly, in each encounter, the learners perceived that race played a role in garnering access to opportunities.

Table 4. Learners' Values and the Sources of Their Values

Learners' Values	Sources of Values
Caring about their faith and church involvement.	Community, church, and family members held high expectations for learners.
Caring for (financially) and about (affectively) their community	
Caring for (financially) and about (affectively) their family	
Being revered, esteemed, well-regarded, admired	Learners experienced the societal value of being revered and outperforming others through their involvement in athletics and through the media.
	Peers held high expectations for learners.
Mathematical knowledge	By engaging learners in early childhood education (in and out of the home), parents communicated the value of knowledge, especially mathematical knowledge.
	Teachers and school personnel held high expectations for learners.
	Learners held positive beliefs about the nature of mathematics.

Images

Learners developed self-images based on their values and a mosaic of images, which comprised their image-based criteria for negotiating experience pathways. In this metasynthesis, images are defined as learners' self-identities, learners' perceptions of others' identities, and learners' perceptions of how they themselves are perceived. Learners used image-based criteria in conjunction with their values to negotiate their experience pathways. This negotiation considered two categories of images: academic images and racialized forms of images; neither can be divorced from the role of race. Table 7 describes these two categories of images. Central to both categories are the learners' images of self and mathematicians, and the intersection of these images. There were cases that situated the image of Black learners of mathematics as an anomaly. Learners' identities were always under construction across time. Table 3 presents quotes illustrative of the mosaic of images that comprised learners' image-based criteria. Keeshawn, Rob, and Raheem looked to images of stereotypes, role models and non-role models, and a lack of models of mathematical doers to construct their identities as self and as mathematicians. Phillip, Dexter, and Malik compared their own identities to their perceptions of peers' identities and performance. Rob and Spencer negotiated their identities based on their perceptions of the ways others, such as family members and teachers, perceived themselves in combination with their previous academic performances. At the intersection of learners' images of self and mathematicians, Antonio looked within to his spiritual values while David described his relief to reconstruct his image and to reject the image of Black learners of mathematics as an anomaly.

Table 5. Learners' Negotiated De nitions of Success

Life Success	Academic and Mathematical Success
Keep the faith	Use God-given talents
Take care of family	Meet career goals
Give back to community	
Be a role model	
Acquire knowledge	Out perform peers in class participation, in grades, in testing
	Gifted label
	Enrollment in advanced courses
	College attendance

Agency

Learners' development of agency depended on their understanding of the consequences of their encounters with issues of awareness and access as well as their image-based criteria for success. As a result, learners either surrendered to or rejected generalized forms of participation in mathematics. When learners developed a low sense of agency, they followed the default pathway; for many Black learners, this meant being placed in low-tracked mathematics courses. When learners developed a high

Table 6. Issues of Academic Access

	Aids	Barriers
Access to Academic Choice	**Gifted identi cation** • Advanced courses	**Misidenti cation** • Lack of offering advanced courses • Lack of compatible schedules
	Tracking (within school and within class)	**Misplacement**
	Advocates • Parents, Family members, Teachers, School personnel	**Gatekeepers** • Teachers, School personnel
Access to Academic Expectations	**Quality Teaching** • Immediate feedback • Emphasis on collaboration • Pacing for understanding • Willingness to answer questions • Transparency of learning objectives • Challenge • Making connections to mathematics through real world applications	**Lack of Quality Teaching** • Pacing too fast • Student questions go unasked and unanswered
	Support • Caring teachers (advocacy, challenge, support) • Family support • Peer networks & study groups	**Lack of Support**
	Role Models • Black mathematical doers	**Lack of positive role models, particularly in mathematics**

sense of agency, they asserted their identities to consciously make decisions about their participation in mathematics. In other words, these learners chose a pathway based on their values and negotiated definitions of success. Phillip, Elijah, and Ethan's voices (see Table 3) are typical of learners with a high sense of agency. They explored and evaluated their choice of pathway based on their image criteria.

Learners with a high sense of agency chose to pursue their own pathways to success sustained by the work ethic of practice and persistence. At decision-markers across time, learners negotiated their paths or patterns of participation in varied settings. Malik and Roger (see Table 3) shared representative stories of such decision-markers along their paths; these served as moments when Malik and Roger enacted their high agency by choosing to change paths and patterns of participation.

Encounters with nonsuccess were defining markers along each learner's pathway. Learners with a high sense of agency demonstrated persistence and resiliency to transform these encounters with nonsuccess into opportunities to increase their awareness of options and opportunities, to reevaluate their choice of pathway, and to renegotiate their identities and definitions of success. David, Rob, and Amber's stories (see Table 3) are representative of the learners' descriptions of encounters with nonsuccess. Each of these learners was resilient and persisted in the face of nonsuccess. While David and Rob resolved to continue their chosen experience pathway, Amber refused to follow the default pathway being forced onto her. Instead, she chose a new pathway that was not in conflict with her negotiated identity and definition of success. These learners with a forward vision chose to continue on or redirect their experience pathways.

Table 7. Image-Based Criteria of Success

Racialized Forms of Images	Academic Images
Images of self and of self as mathematician	
Images of Black learners of mathematics as anomalies	Participants' performance relative to their own previous academic performances
Stereotypes from media	Perceptions of peers' academic performances
Role models and non-role models from community and family	Participants' performance relative to perceived learning objectives
Perceptions of peers' identities	Models of mathematical doers
Perceptions of self by others, including gate keepers, teachers, peers	

Figure 3 displays the defining qualities of the complex, nonlinear experience pathways that represent the ways Black learners negotiated their experiences in mathematics across time.

Conclusion

The research question that guided this metasynthesis was, "In what ways, do Black learners negotiate their experiences with mathematics across time?" The answer to this research question is found in the ways the learners enacted their sense of agency. For the learners, a sense of agency was not mutually exclusive from race and identity. These learners negotiated though self-exploration their values, their perceptions of success, their awareness of and access to opportunities, and forms of images to enact their sense of agency. This negotiation informed ways of participation with mathematics. Patterns of participation in mathematics are connected to learners' sense of agency. Learners with a high sense of agency were able to negotiate and interpret participation with mathematics as a means to access opportunities, fulfill social obligations, and understand the consequences of differential forms of participation. When we consider the resources of the learners' communities and families, we find strong contributions of value, faith, and support. It is these contributions that were foundational towards a high sense of agency that supported resiliency and agency.

The promise of qualitative metasynthesis for mathematics education lies in its shift from knowledge generation to knowledge application. The findings of this research study suggest action steps for addressing issues of equity in mathematics education. Each of the learners encountered issues of awareness and access along their experience pathways. Their encounters with lack of equity were defined by the presence of aids and barriers. Describing and analyzing these aids and barriers is an implication for equity already addressed in the original studies; however, this qualitative metasynthesis draws a broader picture, describing and analyzing the intersection of race, identity, and agency within these encounters. The findings of this qualitative metasynthesis connect patterns of participation with learners' sense of agency. Therefore,

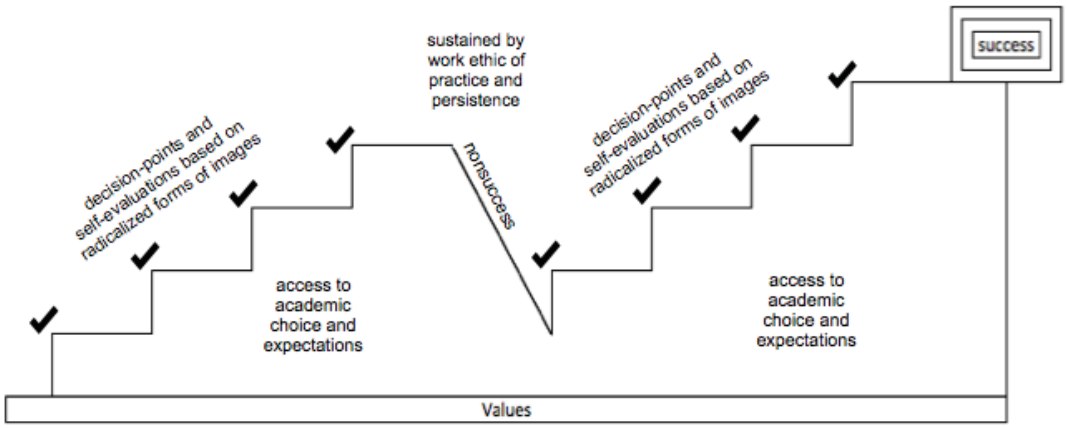

Figure 3. The Defining Qualities of Learners' Experience Pathways

developing learners' high sense of agency must become central to creating equity in mathematics education.

Within learners' experience pathways, a multitude of people contributed to their sense of agency: communities, families, educators, and peers. Each of these stakeholders must more purposefully and explicitly address agency development by engaging learners in examining images, by teaching learners about the consequences of awareness and access, and by instilling the work ethic of practice and persistence.

- Learners should be actively engaged in multiple contexts to explore, develop, and reflect on their images of self and of mathematicians as well as the intersection of these images. In this qualitative metasynthesis, learners determined their image-based criteria for success through mathematical autobiographies, reflective conversation, and interaction with people who embodied various images.
- Learners' understanding of the consequences of their encounters with issues of awareness and access held significant implications for their development of agency. Early in learners' mathematics educations, stakeholders should collaborate to teach various definitions and images of success as well as the experience pathways and opportunities that can lead to these outcomes. In particular, mathematics education researchers must inform educators, students, families, and communities about critical opportunities to make academic choices and to experience high expectations in academics. In turn, these opportunities must be available to all students.
- These same stakeholders served as rich sources of value, faith, and support. Instilling the work ethic of practice and persistence contributed to learners' resiliency when faced with lack of equity. This resiliency sustained learners with a high sense of agency and enabled them to choose to pursue their own pathways to success. In particular, educators can help learners develop this resiliency through positive means by holding high expectations in academics for all students.

As pressure increases toward evidence-based practices and policy implications in mathematics across diverse contexts, researchers in mathematics education face an increasing challenge to articulate and advocate for the role of qualitative research as evidence suitable for practice and policies. Researchers in mathematics education might be best served by taking full advantage of the evidence-based movement through qualitative metasynthesis. There is a wealth of qualitative research in mathematics education across a variety of topics and setting that can be applied to the rigor of qualitative metasynthesis.

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