SOURCES OF BELONGING FOR 7TH GRADE BLACK GIRLS IN THE MATH CLASSROOM: A PHENOMENOLOGICAL STUDY

By

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ABSTRACT

Belonging-centered academic environments have been positively associated with increased academic achievement, engagement, and persistence. Yet, belonging is a context-driven construct, indicating that there may be differences in what an individual construes as a belonging-supportive versus belonging-thwarting environment. Therefore, when considering what a belonging-supportive math classroom looks like for Black girls in middle school, it is important to create space for them to share how their perceptions and conceptualizations have been shaped by their learning context and personal experiences. Rooted in an Axiom of Black Brilliance and drawing on frameworks such as belonging, race-reimaging, intersectionality, and PVEST, this phenomenological study explores the lived experiences of ten 7th-grade Black girls as they share their conceptualizations and identified sources of belonging within the math classroom. Drawing from multiple data sources, including math autobiographies, semi-structured interviews, and classroom observations, the 7th-grade Black girls in this study added dimension to how belonging is understood by highlighting the construct's dynamic nature. Through a layered conceptualization, the participants named competence, teachers, peers, and academic support as sources of belonging within the math classroom. Yet, the identified role of the participants' ethnic-racial identity varied among the participants. This study takes a race-reimagined view of belonging and highlights where Black girls' views of belonging differ from the literature. Additionally, this study explores how the participants' experiences can lead educators to support their sense of belonging within the math classroom more effectively.

This dissertation is dedicated to my grandmothers, Ermadine Harris and Elizabeth Crouch, my mother, Rolanda Harris, and my sister, Brianna Harris. Their love has carried me, and their lives inspire me to be a woman of joy, determination, and faith.

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CHAPTER 1: INTRODUCTION

"You want to be there, and people want you to be there." – Vanessa, age 13

Broadening participation within science, technology, engineering, and mathematics (STEM) has continued to be an area of focus in the United States (Committee on Equal Opportunities in Science and Education (CEOSE) Annual Report, 2020). To help increase and diversify the STEM workforce, studying the experiences of underrepresented groups within STEM and identifying the reasons for these disparities has been prioritized (Envisioning the Future of NSF EPSCoR Final Report, 2022). Whether it is technical problems with automatic bathroom soap or water dispensers (Fussell, 2017) or digital assistants not recognizing women's voices (Palmiter Bajorek, 2019), problems arise when there is not an adequate representation of people of color and women at the metaphorical STEM "table." From an equity lens, a more inclusive STEM field has the potential to increase how STEM research and practice can address inequities, particularly among minoritized communities.

One promising approach to increasing participation within STEM is facilitating authentic opportunities to belong (Belanger et al., 2020; Master & Meltzoff, 2020). Literature on belonging continues to grow as studies demonstrate that the construct is essential for students' academic and personal well-being at school (Anderman, 2003; Juvonen, 2006; Matthews et al., 2014; Vargas-Madriz & Konishi, 2021). While it appears clear that students benefit from experiencing a sense of belonging at school, studies vary on how belonging is conceptualized (Baumeister & Leary, 1995; Faircloth & Hamm, 2005; Furrer & Skinner, 2003). What is lost with disparate definitions is cohesion regarding what elements make up the construct of belonging and how it should be fostered (Allen et al., 2022). Further, belonging is a highly contextualized psychological construct that is significantly impacted by the context in which it is

studied, the personal experiences of the individual, and their interpretation of both (Gray et al., 2018). Therefore, students' perception of belonging opportunities throughout the school day fluctuates as they enter various classrooms (Gray et al., 2022). There is a need to understand better how belonging is viewed from students' perspectives and evaluate the precision with which belonging is conceptualized in the literature.

Statement of the Problem

Facilitating opportunities to belong is particularly important for Black students who often experience racialized barriers within their STEM classes (Evans et al., 2011; Faircloth & Hamm, 2005; Matthews et al., 2014). For example, there has been an enduring view that the subject of math is "culture-free" or "colorblind" (Battey, 2013; Martin et al., 2010). However, many math standards and curricula "prioritize white values and contributions while neglecting those of Black and Latinx individuals and communities" (Martin, 2008, as cited in Matthews et al., 2022, p. 5). An assumption of colorblindness has historically excused math classes from the critical evaluation and reflection needed to make them more equitable and welcoming to all students. Belonging has been found to help thwart the adverse effects of negative racialized experiences and increase academic engagement (Brooms, 2019; Gray et al., 2022). However, researchers have understudied the nuances within the school-related experiences of Black children.

Prior research indicates that Black boys' and girls' experiences at school differ, which is also true regarding experiences within the math classroom (Else-Quest et al., 2013; McDaniel et al., 2011; Young et al., 2017). There is a dearth of research related to the educational experiences of Black girls, particularly within the context of mathematics (Joseph et al., 2020; Young et al., 2020), due to the practice of grouping Black girls' experiences with their Black boys or girl peers. However, studies have indicated that identifying with intersecting marginalized identities,

in this case being Black and a girl, often leads to unique experiences within the classrooms that are worthy of a closer examination (Else-Quest et al., 2013; McDaniel et al., 2011; Young et al., 2017).

Purpose

Beyond the important desire to see greater representation of Black women throughout the STEM field, learning about the belonging experiences of middle school Black girls can position educators to more immediately tend to the belonging vulnerabilities that Black girls often face throughout their schooling experiences (Hill et al., 2010; Ezikwelu, 2020; Gholson & Martin, 2014; Joseph & Alston, 2018) and create greater representation (Solórzano & Yosso, 2002) of Black girlhood that is centered around the language Black girls use to describe themselves and their experiences at school. This study creates space for 10 Black girls in middle school to share how they view the construct of belonging, what contextual factors contribute to their school-related experiences of belonging, and what role their ethnic-racial identity (ERI) play in their understanding of whether they belong within the math classroom. Further, this study invites Black girls to help re-examine the accuracy and effectiveness of current theoretical conceptualizations of belonging and illuminate a clearer path to supporting their belonging within the math classroom.

Positionality

The act of writing a positionality statement requires the researcher to "consider who they are in relation to the data and how their identity, experiences, and beliefs affect research question development, data collection, data analysis, and interpretation of results" (Hope et al., 2019, p. 66). Explicitly naming a researcher's positionality is an essential element in a study's overall

quality and transparency due to how it influences the overall research design and interpretation of the results (Milner, 2007).

As a Black woman educational psychologist, my decision to study the belonging experiences of Black girls in middle school stemmed from a combination of my identity and my work-related experiences as a middle school teacher. My upbringing created a buffer against negative stereotypes regarding my capabilities in mathematics, and I enjoyed the math courses I took throughout my education. Although I did not pursue a math-related career, I felt confident and passionate about my opportunities to teach math courses as a special educator in the K-12 setting. Hearing the consistent negative comments and the self-deprecating stance many students took towards their math identity and achievement gave me pause. It also ignited a curiosity to examine how Black students in particular see themselves as a "math person" or belonging within the subject.

As a fellow Black girl, I identify with the participants and the task of balancing learning new math content with other academic responsibilities at such a critical age. I am also familiar with the school where the study took place, which also helped the participants view me as an "insider." However, I attended a private, predominantly white institution throughout my schooling, differentiating the level of diversity present at the study's school. As a result, I recognized the limits of my perspective and experiences and was mindful not to assume I understood how their more diverse academic setting impacted the participants' sense of belonging. My primary desire in focusing specifically on Black girls in middle school is to see their knowledge and experiences expressed from an asset lens- acknowledging their humanity, dignity, and value in retelling their stories.

Having been trained within the field of motivation science, the concept of relatedness in Ryan and Deci's (2000) Self-Determination Theory and Baumeister and Leary's (1995) definition of belonging are foundational ideas used to help construct the framing for this study. Yet, the interrogative nature of DeCuir-Gunby and Schutz's (2014) race-reimaging framework grounds the critical lens with which these theories are viewed. The race-reimaging framework shaped this study's design and the research questions' formation. I believe that our understandings are significantly shaped by our past and present experiences and the interpretation of those experiences. Therefore, using the Phenomenological Variant of Ecological Systems Theory (PVEST) (Spencer, 2006) emphasizes this concept by providing a framework to organize how the participants use the whole of their ecology to understand what belonging means dynamically. Taking a critical lens to traditional educational psychology theories and constructs is an integral part of moving toward greater expressions of equity within the field, a significant value I hold as a scholar.

As a prior K-12 teacher, I have experienced firsthand how education systems have worked against Black students. Whether in the overrepresentation of Black students within special education services (Annamma et al., 2018; Gillborn, 2015) or the disproportionate rates of discipline Black girls receive at school (Annamma et al., 2019; Hines-Datiri & Carter Andrews, 2020), the roots of racism continue to impact students' schooling experiences. Therefore, moving beyond "achievement gap" language and examining how educational systems can be reimagined more equitably is imperative. These ideas help me resist a deficit framework as I work with the participants and use a research perspective that considers historical and cultural narratives to interpret results contextually.

Significance and Contributions

This study contributes to the belonging literature in two important ways. First, the theoretical definition of belonging and how it should be supported did not initially consider how ethnic-racial identity might contribute to one's experience or view of belonging. This study takes a race-reimagined view of belonging and highlights how Black girls' views of belonging may differ from their peers. Second, prior literature on belonging often takes an in-the-moment or decontextualized view of the construct. This study highlights the situatedness of belonging by connecting how prior and present experiences and interpretations of those experiences contribute to the participant's current view of belonging.

This study contributes to the literature on Black girls' academic experiences in math in three important ways. First, prior literature focused on the belonging experiences of Black students often looked at the combined experiences of Black girls and boys. By focusing on the experiences of Black girls specifically, this study examines the specific ways that Black girls in 7th grade view their belonging experiences in math. This knowledge can help distinguish what might differentially help Black girls from Black boys or other girls within math spaces. Second, this study adds to the literature by examining whether there are within-group differences in the way that Black girls view math and belonging in school. Noting differences among the participants is important because Black girls' educational experiences are not monolithic. Third, by drawing on participants' own words, suggestions, and stories, this study also has the potential to generate actionable strategies for educators teaching math to Black girls in middle school. Drawing from the participants directly is important because it prioritizes reimaging STEM education to be inclusive rather than asking the Black girls participating in this study to adapt or conform to norms within STEM education.

Summary and Organization

While broadening participation within STEM fields has been a long-standing priority within the United States, gaps in representation persist, particularly among people of color and women(NSF EPSCoR Final Report, 2022). Considering the historical and sociocultural experiences of the participants, along with their intersecting identity as Black girls, this study seeks to examine how belonging is fostered from the participants' viewpoint. In addition, this study specifically examines the role the participants' ERI plays in their conceptualization of belonging. Findings can illuminate practical steps educators can take to support the belonging experiences of Black girls in math and help further expand the theoretical definition of what belonging means within the math classroom.

This dissertation is organized as follows. Chapter One describes the problem driving the research questions for this study and provides a rationale for the importance of this study. Chapter Two reviews relevant literature related to Black girls' belonging experiences broadly and within the math classroom specifically; it also expounds on the theoretical and conceptual frameworks guiding the study. Chapter Three describes the study's method, pilot and study demographic and setting details, data collection specifics, and analytic strategy. Chapter Four reports the resulting themes from data collection, broken down by research question. And finally, Chapter Five discusses the interpretation of the findings, their implications and limitations, and future directions.

CHAPTER 2: LITERATURE REVIEW

Rooted in an axiom of Black brilliance (Gholson et al., 2012), I begin Chapter Two by discussing ethnic-racial identity development in adolescents, the sociopolitical nature of the math classroom, and an examination of the theoretical framework guiding this study. In discussing the framework of belonging, I define school belonging more specifically, make a case for race-reimaging the construct of belonging, and identify potential sources of belonging from the literature. I then present a review and critique of the literature related to the belonging experiences of Black girls in math classrooms, highlighting the dearth of research examining Black girls' experiences in math classrooms specifically and making a case for the value of this study. I conclude by presenting a literature review summary and an overview of the present study and research questions.

Axiom of Black Brilliance

Dr. Danny Martin encouraged math researchers "to engage in research and argumentation with the brilliance of Black children as axiomatic" (2011; as cited in Gholson et al., 2012, p. 2). "Axiomatic" is defined as "self-evident or unquestionable" (Oxford English Dictionary), resulting in a research orientation that is not focused on *proving* that Black children are brilliant but rather on analyzing and interpreting results in light of this fact (Gholson et al., 2012). An axiom of brilliance dismisses deficit ways of viewing and speaking about Black children, which has been particularly salient in math education research (Gutiérrez, 2008; 2011; Young et al., 2018). This viewpoint resists the pull to provide counterexamples of "successful Black youth" in mathematics and instead demands that the humanity and inherent value of Black children be enough to cause investment and equal treatment in schools and the math classroom specifically (Bullock, 2020). Therefore, this study begins with the belief that the participants are brilliant,

capable, and inherently valuable regardless of their demonstrated mathematical success. This value guided the decision to interview participants across multiple math achievement levels to create a complete picture of how best to support their success and sense of belonging within math classrooms.

Math as a Political Space

Math has long been viewed as a subject area that is apolitical and free of bias because of the numerical nature of the content, assuming that numbers are bias-free (Aguirre et al., 2017; Joseph et al., 2019). Holding to this sense of neutrality has historically excused the subject from taking a critical view of how race and racism impact the experience of learning math, leading to colorblind approaches to math curriculums and instruction (Gutierrez, 2013; Martin, 2009). Critical scholars have found the math classroom to be a space impacted by the political nature of race and gender, as demonstrated through harmful barriers such as low expectations, stereotype threat, and exclusion (Battey & Layva, 2016; Gholson, 2016; Steele, 1997). This historical context supports the need for examining the belonging experiences of Black girls in the math classroom through a critical framework to consider how race and gender contribute to their experiences accurately.

Ethnic Racial Identity Development in Adolescents

Umaña-Taylor and colleagues define Ethnic-Racial Identity (ERI) as "a multidimensional, psychological construct that reflects the beliefs and attitudes that individuals have about their ethnic–racial group memberships, as well as the processes by which these beliefs and attitudes develop over time" (2014, p. 23). Additionally, the authors state that context(s) plays a significant role in the ERI development of individuals and should be considered from a bioecological and/or temporal perspective (Umaña-Taylor et al., 2014). The

multidimensional nature of identity can include the following components: identification with their ethnic-racial group, public regard, private regard, ethnic-racial salience, ethnic-racial centrality, and the level of commitment to one's ethnic-racial group (Rivas-Drake et al., 2014; Sellers et al., 1998; Umaña-Taylor et al., 2004).

During adolescence, young people begin to explore and synthesize their personal identities (Erickson, 1968), which, for Black students, often includes their ERI. The development of one's ERI during adolescence builds upon the ethnic-racial self-identifications experienced during childhood and processes that promote further ERI exploration (Pahl & Way, 2006; Umaña-Taylor et al., 2014). The term *processes,* in this case, "reflects the mechanisms by which individuals explore, form, and maintain their ERI" (Umaña-Taylor et al., 2014, p. 24). This interaction between the developmental stage and context means each individual's ERI exploration and development happens at differing paces (Huang & Stormshak, 2011; Phinney, 1993).

The school context can have a significant impact on the ERI formation of adolescents (Kiang et al., 2010). During adolescents, students experience increased exposure to discrimination, interactions with different groups of people, and access to ethnic clubs/groups, which can contribute to the increased saliency and exploration of one's ERI (Phinney, 1990). In prior research, experiences of stereotype threat and other forms of discrimination spurred further ERI development and exploration for Black students (Mims & Williams, 2020; Way et al., 2013). This aligns with the view that identities develop in response to the interaction between the social context and the individual (Erickson, 1968). Therefore, I anticipate the saliency and centrality of the participants' ERI in general and specifically within their math classes to vary depending on factors such as their prior experiences, the ethnic-racial and gender construction of

the school and their math classes, and the way their ERI is talked about (or not) within their homes.

Theoretical Frameworks

Acknowledging the multifaceted nature of examining psychological constructs, this dissertation uses multiple theoretical frameworks to explore the belonging-related experiences of middle school Black girls at school, specifically within the math classroom. In the following sections, I expand on how this study draws upon the frameworks of *belonging* (Baumeister & Leary, 1995; Maslow, 1968) and *school belonging* (Goodenow & Grady, 1993; Gray et al., 2018), *intersectionality* (Cole, 2009; Crenshaw, 1993; Few-Demo, 2014) and *phenomenological variant of ecological systems theory* (PVEST) (Spencer et al., 1997; Velez & Spencer, 2018). Together, these theoretical frameworks consider how the participants' perceptions and experiences interact to create their conceptualization of belonging within the math classroom.

Belonging

Maslow (1968) included belonging in his hierarchy of human needs, emphasizing that all humans need to feel included in their community, have a sense of interdependence, and connect with family and friends in platonic and romantic relationships. His work highlights that a lack of belonging affects human growth and flourishing. Building upon this idea, Baumeister and Leary (1995) extended the view of belonging by putting forth a theory of belonging that humans need to experience frequent, positive interactions with others in a stable, affective, and socially interdependent context to satisfy their innate drive to belong (Baumeister & Leary, 1995). Their theory shows the way satisfaction or deprivation of a need to belong impacts cognitive processes, behavior, and overall motivation.

As the conceptual definition of belonging continued to evolve, Ryan and Deci's self-determination theory (SDT) further established relatedness, similar to belongingness, as a source of motivational influence. SDT defines relatedness as the need to feel belongingness and connectedness with others (Ryan & Deci, 2000). The authors argue that this psychological need significantly impacts internal motivation and the internalization of external motivation and that the deprivation of this need can lead to alienation and poor mental health outcomes.

The conceptualization of belonging in education has evolved, highlighting the construct's dynamic nature (for a review of terms, see Gray et al., 2018). Thus, examining belonging related to the school context is necessary to understand how students experience belonging. This study focuses specifically on school-related belonging, defined by Goodenow (1993) as the psychological perception of being accepted, respected, included, and supported at school. As it relates to education, not experiencing belonging can result in lower self-esteem, disengagement, and academic achievement (Goodenow & Grady, 1993; Sánchez et al., 2005). Students who experience a sense of belonging at school tend to have a higher level of engagement, academic performance, and self-efficacy (Anderman, 2003; Furrer & Skinner, 2003; Juvonen, 2006).

Race-reimaging of Belonging

The purpose of race-reimaging is to reexamine psychological constructs beyond a color-blind lens. DeCuir-Gunby and Schutz (2014) define race-reimaged constructs as constructs that have been "reconceptualized to include racially influenced, sociocultural (e.g., history, context, multiple identities, etc.) perspectives" (p. 244). Kumar and colleagues (2018) have also called for an increase in motivational research that thoughtfully considers the impact of culture and weaves together common motivational theories with critical approaches that consider the participants'

context and experiences. Not considering the effect of cultural contexts can lead to the perpetuation of harmful stereotypes and ineffective solutions.

For example, differences in educational experiences and academic outcomes between students of varying racial identities have caused an extreme case of "gap-gazing," which refers to a hyper-focus on the idea of a race-related "achievement gap" to the exclusion of other vital considerations or helpful solutions (Gutiérrez, 2008). The tendency to conduct research from a deficit perspective often accompanies research on the “achievement gap” and usually does not begin by acknowledging the “enoughness” or wealth of knowledge and value communities possess (Woodson & Love, 2019; Yosso, 2005). In this study, the humanity, value, and knowledge held by Black girls ground this study and inform what questions are being asked and how the questions are being asked. So doing, the study goes beyond gap-gazing by seeing the underrepresentation of Black girls within the field of mathematics as being centered within the subject classroom itself rather than innate to the students being studied. More, by centering on Black girls' experiences in middle school, this study attempts to add the knowledge of middle school Black girls in particular to the broader understanding of school belonging.

Potential Sources of Belonging

According to the literature, potential sources of belonging support or threats include students’ relationships with their peers, parents, and teachers, perceiving their racial group fitting into the academic community, self-efficacy in the academic subject, shared academic struggles, social similarity, and a sense of caring from their peers and teachers. The following studies look at various sources of school belonging among college, upper elementary, and 7th-grade students, focusing on belonging in engineering courses at a predominately white institution and school

globally. However, no prior research has examined specifically what Black girls in middle school view as sources of belonging within the math classroom.

Looking at sources of academic belonging, the flowing studies drew upon the experiences of 3rd - 7th-grade students. First, in a seminal study by Furrer and Skinner (2003), the researchers found a sense of relatedness as a factor in the academic engagement and performance of 641 3rd through 6th-grade students. Results indicated that the quality of relationships with peers, parents, and teachers (relatedness) impacted the participant's level of engagement (Furrer & Skinner, 2003). The relationship quality with the students' teachers had the most potent effect on students' engagement in the classroom, followed by peers, then parents (Furrer & Skinner, 2003). This study indicates that students' relationships with their teachers, peers, and parents are essential sources of increased or decreased belongingness.

Next, in a study by Murphy and Zirkel (2015), sources of academic belonging was examined among 7th-grade students (918 African American; 459 White; 51% female, 49% male). The authors found that Black students greatly benefited from peer friendships at school and were conceptualizing belonging "at school" in their immediate school and the broader academic community (Murphy & Zirkel, 2015). Perceiving that their racial group was a fit within the wider academic community increased their sense of belonging at the local school level (Murphy & Zirkel, 2015).

In a study conducted by Schar and collegues (2017), the authors focused specifically on the belonging experiences of college students. In the study, 83 engineering students were surveyed regarding their experiences and sources of classroom belonging. The authors conceptualize that classroom belonging is made up of academic and social belonging, which have their sources of strengthening, including self-efficacy and shared academic struggles for

academic belonging or social similarity and a sense of caring for social belonging. The authors identified the following as potential sources of belonging within the engineering classroom: social belonging, engineering self-efficacy, engineering identity, and closeness to others in the classroom (Schar et al., 2017). Based on students' survey results, it was found that social belonging and their engineering identity were most salient to their experience of classroom belonging.

Lastly, in a study examining the experience of school belonging among Black college students, Walton and Cohen (2007) found that the degree to which the students felt they had social connections or friendships with peers within their academic field impacted their sense of belonging, as well as the degree to which they experienced adversity within their educational context. Further, the student participants' sense of belonging was also impacted by their perception of whether they individually belonged and whether their group belonged (Cohen & Garcia, 2005).

Taken together, these studies help illustrate that common sources of belonging include access to meaningful relationships with peers and others within a particular space (i.e., teachers or counselors at school), perceiving that experienced adversity is common beyond a single racial group, and experiencing their racial group's fit within the academic community (i.e., academic identity). However, because no study has examined what Black girls in middle school view as sources of belonging within their school or their math classroom, whether these prior findings generalize to this population remains unclear. This proposed dissertation study addresses this void by providing space for Black girls in middle school to name these sources on their terms.

Intersectionality

Critical scholars have used an intersectional lens to understand the multidimensional experiences of marginalized populations. Intersectionality was first widely used as a framework within critical legal studies by Dr. Crenshaw (1991; 1993) to examine the impact of multiple marginalized identities differentially impacting the experiences of individuals. Intersectionality is concerned with addressing inequities by identifying how multiple social categories, such as gender, ethnicity, race, age, and socioeconomic status, interact within a broader social and historical context (Crenshaw, 1991; Few-Demo, 2014). This interaction of social identities significantly shapes individuals' understanding of themselves, others, and what future plans are available to them. For example, the saliency of intersecting identities among women of color is a critical factor in their persistence in STEM fields (Sosnowski, 2002; Wilkins-Yel et al., 2019).

Intersectionality helps to provide a framework for why studying the specific math experiences of Black girls is valuable, as there is likely to be a difference in the experience of Black girls compared to their peers. Individuals with multiple marginalized identities often have different experiences of oppression than those with a single marginalized identity relative to the learning context (Purdie-Vaughns & Eibach, 2008). Therefore, studying the specific math-related experiences of Black girls has the potential to provide unique insights into how best to support their sense of belonging.

There is empirical support for the idea that students have differing school occurrences related to experiences such as belonging, achievement, aspirations, and perception of effort, partly based on their gender, race, and the intersection of the two. For example, in researching possible gender and racial/ethnic differences in the role that self-concept, enjoyment, and achievement may play for eighth-grade students, the study found no single narrative applied to

all girls across racial/ethnic identities as it related to their science aspirations (Riegle-Crumb et al., 2011). In another qualitative investigation of the belonging experiences of college students in STEM fields, Rainey and colleagues (2018) also found that White males were likelier to report a sense of belonging than their peers of color and White women. In the same study, the interviews revealed that representation within one's field of science was associated with a sense of belonging for women scholars but not white men.

Research examining the school-related experiences of girls and women from different racial backgrounds demonstrates how intersecting identities relate to varied experiences. For example, Black and White girls in gifted courses achieved a higher level than their peers not receiving gifted instruction, but the effects of access to gifted courses were nearly twice as large for Black girls than White girls in math classes (Young et al., 2017). In another study, researchers examining feelings of racial identity threat on college campuses found that Black women reported feeling more racial identity than their White and other women of color peers (Leath & Chavous, 2018).

The concept of intersectionality and associated research suggest that the intersection of gender and racial identities might be associated with differences in experiences of belonging and motivation. This dissertation study explores this possibility by examining Black girls separately from their Black boy and girl peers while making space not to assume but ask what contributors to a sense of belonging within math matter most to the participants. Acknowledging that math is not a culturally neutral space, there is reason to examine how Black girls, during a developmentally vulnerable time, experience or do not experience a sense of belonging.

Phenomenological Variant Ecological Systems Theory

Phenomenological Variant Ecological Systems Theory (PVEST) is a theory that examines how an individual's lived experiences interact with their context (Spencer, 2006). PVEST is rooted in a phenomenological, ecological, and critical perspective as it pertains to identity formation (Morton, 2021; Spencer, 2006) and focuses on capturing an individual's perspective regarding "societal expectations, stereotypes, and biases– even those that they endorse or fulfill" (Spencer, 2006, p. 818). Additionally, PVEST is concerned with how identity formation processes interact with "structures, cultural influences, and individual perceptions of oneself, significant others, life experiences, and the environments in which one lives and copes" (Valez & Spencer, 2018, p. 79). Many factors influence the meaning-making process throughout each developmental stage, and PVEST, expanding on Bronfenbrenner's bioecological systems theory (Bronfenbrenner, 1977), creates a framework to examine how developmental stage, social contexts, sociopolitical and historical background, and the individual's interpretation of their life experiences come together (Valez & Spencer, 2018).

PVEST has been used as a theoretical framework to help understand the experiences of Black college students (McClain et al., 2016; Morton, 2021) and Black adolescents (Hope & Spencer, 2017; McGee & Pearman, 2014; Spencer et al., 1997). Utilizing a critical perspective, PVEST acknowledges the ongoing influence of racism and oppressive systems that impact marginalized populations' identity development and engagement (Spencer, 2006). For this study, PVEST will guide the inquiry into how Black girls in middle school, differentially from their peers, perceive their environment and identity development. As the literature reviewed below highlights, there are many environmental and contextual aspects Black girls in middle school may consider as influencing their conceptualization of belonging and experience of belonging

within a math classroom. By acknowledging the participants as knowledge holders, insight can be gained as to how the participants are weaving together meaning from their perceived sources of belonging and their experiences at school.

Literature Review

In the following section, I present literature on the broader connection between belonging and ethnic/racial identity (ERI) before moving to the narrower context of Black girls' belonging experiences within the math classroom. To begin, I examine what is known about how a sense of belonging interacts with the ERI development of Black students, followed by a review of the literature connected to Black girls and their sense of belonging at school. Next, the math-related experiences of Black girls are reviewed before focusing on what is known about Black girls' sense of belonging within the math classroom and how this study fills essential gaps in the literature.

Adolescent Ethnic-Racial Identity Development and Belonging

Adolescence is an important time in the development of one's ethnic and racial identity (ERI), defined as "a multidimensional, psychological construct that reflects the beliefs and attitudes that individuals have about their ethnic-racial group memberships, as well as the processes by which these beliefs and attitudes develop over time" (Umaña-Taylor et al., 2014, p. 23). In the following sections, I highlight a few studies that examine Black students' experiences of academic belonging and the role of ethnic and racial development.

It is during early adolescence that children start to identify, give language to, and categorize themselves and others based on ethnic or racial identifiers; therefore, the influence of how a student views their own ERI and their surrounding environment is likely to influence their perception of where they do and do not belong. (Umaña-Taylor et al., 2014). There is still much

unknown about the interplay between ERI development and a sense of belonging, particularly to one's ethnic-racial group (Williams et al., 2020). In turn, it is unclear how the varying developmental stages of an individual's ERI might influence their perception of belonging within particular spaces, such as at school or a math classroom.

Research suggests that the perception of one's ERI is influenced by the social context in which the development occurs. For example, in a qualitative study examining the ERI development of 11 Black girls in middle school in a Southern state, Mims and Williams (2020) found that the participants were making meaning of their ERI within the complex social context of stereotype threats and biased messaging from teachers, history classes and textbooks, and peers. The participants' interview answers indicated that school had a significant catalyst in their exploration of their racial identity, and school peers were found to be the second most influential group on Black girls' perceptions of their ERI (Mims & Williams, 2020). Specifically, the participants reported having negative experiences within their classroom surrounding conversations about slavery, race, and racism, and the participants experienced racist bullying by peers (Mims & Williams, 2020). These social experiences within the learning context seemed to influence how the participants viewed and articulated their own ERI and their place within the school and class setting (Mims & Williams, 2020). Mims and Williams (2020) state that their findings cannot be generalized to other settings but indicate that other middle school girls may also be feeling the tension of experiencing negative racialized instances at school while developing their ERI. Building off these findings, this dissertation study will examine the extent to which participants perceive that the social experiences influencing their ERI also affects their sense of belonging in the mathematics classroom school.

Based on a quantitative study that included 733 Black girls (Mage = 14.49, SD = 1.62) from a more extensive longitudinal study examining racial identity and school climate, the results indicated that a sense of belonging was positively associated with academic persistence over time for Black girls (Butler-Barnes et al., 2018). Additionally, the study found that a positive orientation toward one's racial identity may have provided a grounding for African American girls to deal with stereotype threats regarding their achievement (Butler-Barnes et al., 2018). The results suggested an interaction between positive racial identity and academic outcomes, including a sense of belonging within the school space. While there are benefits associated with large survey design studies, it is often not possible to gain greater insight into the participants' specific experiences and their particular meaning-making processes as related to the construct of, in this case, belonging.

Looking specifically at post-secondary belonging, Hunter and colleagues (2019) conducted a study examining how 13 Black college students' racial identities were associated with their sense of belonging within same-race peer groups while attending a predominately white institution. Findings suggest that Black college students worked to negotiate their sense of belonging within their same racial group by authenticating or proving their Blackness, negotiating what parts of themselves to diminish or hold on to in response to their predominately white institution's setting, and connecting with other Black community members at the university (Hunter et al., 2019). These findings suggest that their identity and sense of belonging were likely impacted by how the students were perceived by their same-race peers, the academic setting, and their ability to build personal relationships with same-race peers (Hunter et al., 2019).

While there is some information about the interaction between ERI and belonging specifically for middle school Black girls based on the studies by Butler-Barnes and colleagues (2018) and Mims and Williams (2020), Black girls,' more information is needed to understand the role of specific experiences within their setting. As noted above, there is also much to gain by hearing from middle school Black girls themselves. This study will therefore examine to what extent middle school Black girls negotiate their sense of belonging in school.

Ethnic-Racial Identity and Black Women in STEM

In looking at studies examining Black women and how their ERI may have impacted their belonging experiences within the academic context, there are insights to be gained that may preview how the participants in this study feel when asked similar questions. In a phenomenological study by Dortch and Patel (2017), the three Black women participants talked about experiencing microaggressions directly tied to their ERI as Black women. They were explicit about the impact being a Black woman had on their academic experiences being a STEM major in their undergraduate degree program. In two studies by Johnson and colleagues (2019), 366 Black women (Study 1) and 205 Black women (Study 2) STEM majors in college participated in an experiment to examine how their sense of belonging was impacted by the presence of a Black man or woman professor vs. a white man or woman professor at a hypothetical institution. The results indicated that the participants viewed same-race professors, the Black woman profile, $t(347) = 2.78$, $p = .006$, d = .44, and the Black man profile, $t(347) = 2.50$, $p = .012$, d = .39 as a signal of safety leading to predicted greater sense of belonging (Johnson et al., 2019). Additionally, in the second study, when the participants perceived that Black women role models valued other Black women's success in STEM, it increased the participants' sense of belonging in STEM, $r(131) = .19$, $p = .029$, and sense of belonging in the

institution, $r(131) = .29$, $p = .001$ (Johnson et al., 2019). It was clear that the Black women in this study viewed their ERI as an important component of their understanding and experience of belonging within their STEM academic field. Lastly, in a review of the P-20 math experience of Black girls and women, Joesph and colleagues (2017) found that high-achieving Black girls and women reported feeling isolated and having a low sense of belonging. The participants in the studies reviewed often credited this reality to the intersections of racism and sexism (Joesph et al., 2017).

These three studies make a case that Black women have seen their ERI being of consequence to their experience of belonging within STEM spaces. These studies help make a case that the participants in this study may also view their ERI as contributing to the presence or absence of a sense of belonging within their math classes. Yet, no prior studies have examined whether Black girls in middle school see their ERI and academic context as influential on their sense of belonging at school and within the math classroom. Although prior studies indicate that possible sources of belonging can include relationships with peers and teachers and feeling as though one's identity group is accepted or fits into the academic space, it is unclear what Black girls in middle school will view as sources of belonging with their math classrooms.

Sense of Belonging for Black Women and Girls

Belonging has been shown to impact Black students' academic engagement (Gray et al., 2020), academic achievement (Booker, 2004; Matthews et al., 2014), and perceived competence (Graham & Morales-Chicas, 2015). However, few studies have examined the belonging experiences of Black girls separately from Black boys, often because the sample sizes are too small to have the appropriate statistical power (Young et al., 2017). Research suggests that Black boys and Black girls have differentiated experiences within the school setting, such as Black

girls demonstrating higher achievement in math (Young et al., 2017; McDaniel et al., 2011) and Black boys holding a higher self-concept and expectations for themselves as compared to their Black girl peers (Else-Quest et al., 2013). Though differences were identified, there is still a lack of clarity regarding why these differences are occurring. Taking the time to examine the experiences of Black girls will give needed insight into the psychological processing of Black girls' schooling experiences.

To date, only a few studies have focused specifically on the belonging experiences of Black girls or women specifically. While some of these studies examine the belonging experiences of Black women in college, only two focused on Black girls' belonging in middle school math classrooms. Beginning with the work on Black women in college, three qualitative studies examining the belonging experience of Black women in higher education (Booker, 2016; Dortch & Patel, 2017; McKoy, 2019) found that positive relationships and experiences of support by faculty members were both likely associated with participants' sense of belonging. Additionally, participants reported that building connections and a sense of solidarity with same-race peers on campus was a source of support and increased a sense of belonging.

More specifically, Dortch and Patel (2017) conducted a phenomenological study with three Black women that had received a STEM undergraduate degree. This study found that negative racialized experiences may be more associated with the participants' sense of belonging than positive experiences. In McKoy's (2019) phenomenological study, seven women who identified as African American undergraduate engineering students at a southeastern HBCU also brought up the positive experience of the university, intentionally connecting them to resources and other tangible supports was seen as an indication of the university's commitment to their success. This helped reiterate the Black women's fit within the department and increased their

sense of belonging (McKoy, 2019). Lastly, the six Black women undergraduate participants in Booker's (2016) qualitative study also pointed to the positive impact on their sense of belonging that seemed to stem from experiencing authentic instruction that was relevant to their lives. As far as factors that may have a negative impact on their sense of belonging, the Black women in these studies pointed to the pressure to represent their culture or be a spokesperson for Black women that can be implicitly or explicitly communicated (Booker, 2016; Dortch & Patel, 2017; McKoy, 2019).

These studies provide some insights into the belonging experiences of Black women and demonstrate the value of studying a construct such as belonging through a qualitative, phenomenological lens due to the nuances that can be detected through the participants' own words. For example, the pressure that results from being viewed as a token or spokesperson for your race/gender is a threat to belonging that may not have been drawn out if the participants were grouped together with other women. Or the way that fitting into the department seemed to be of great importance to the Black women in the study, which may differentially be prioritized by Black men or men in STEM generally. Nonetheless, these studies do not answer whether these findings translate to a younger population. This dissertation study will draw upon the experience of seventh-grade Black girls, which will provide insight as to where these themes intersect and diverge, as well as point to how these processes might change in relation to one's developmental stage.

Black Girls' Math Experiences

The following six studies were identified as having investigated Black girls' belonging in math classrooms in grades 3 - 9 (see Table 1 for an overview).

Based on qualitative interviews with participants, Jones (2003) and Joseph and colleagues (2019) found that it was essential for adolescent Black girls to work collaboratively with their peers in the math classroom. They also found that working in groups provided an opportunity to connect with their peers and receive informal, low-stakes help, which supported increasing Black girls' participation in the math classroom (Gholson & Martin, 2014; Joseph et al., 2019).

Table 1

Overview of Literature Related to Adolescent Black Girls' Math Experiences

Authors, Year	**Sample**	**Sample Size**	**Methodology**
Bowe et al., 2017	6th Grade Black Boys and Girls	77	Mixed-Methods
Gholson & Martin, 2014	3rd Grade Black Girls	2	Qualitative
Jones, 2003	3rd Grade Black Girl	1	Qualitative
Joseph et al., 2019	6th – 9th Grade Black Girls	10	Qualitative
Lim, 2008	6th Grade Black Girls	2	Qualitative
Young et al., 2017	4th Grade Black Girls	15,520	Quantitative

Based on interviews with two middle school Black girls (Gholson & Martin, 2014) and a large sample (*N*= 15,520) taken from NAEP data (Young et al., 2017), results indicated that teachers have a significant influence on Black girls' math identity development, experience within the classroom. Lim's (2008) interview study likewise found significant incompatibility between the expectations in the math classroom, which included working individually, speaking formally, and sitting still, and the natural disposition of the two 6th-grade Black girls in his study. Lastly, Bowe et al. (2017) and Young et al. (2017) both found that Black girls continually

reported a high sense of self-efficacy regarding their math abilities and also demonstrated growth and achievement on math assessments.

These themes highlight the need for intersectionally informed efforts to signal to Black girls that there is a place for them in the math classroom (Gholson & Martin, 2019) and math spaces outside of the math classroom (Jones, 2003). These studies provide some insights into influential factors associated with the math experiences of Black girls, such as their teachers, the learning environment within the math classroom, and the nature of their relationships with their peers. However, further studies are needed to understand if and how belonging impacts Black girls' experience with working collaboratively, their relationships with their teachers and peers, and what is construed as a supportive learning environment. These themes also highlight the social dynamics in the math classroom between Black girls, their peers, and their teachers. What remains missing from these studies is examining whether belonging plays a supportive role within the math classroom and how educators might create a sense of belonging in their math classrooms that resonate with Black girls in middle school. This dissertation study will examine the degree to which the presence or absence of relationships affects the way Black girls perceive their sense of belonging within the math classroom. Focusing on the construct of belonging creates an opportunity to be more specific in practitioner recommendations to support Black girls' positive math experiences.

Black Girls' Sense of Belonging in Math

In two prior studies examining the belonging-related experiences of Black girls in middle school math classrooms, it was found that teacher-student and peer-to-peer relationships were associated with a belonging-supportive math classroom. Moreover, the participants in Booker and Lim's (2018) study also indicated the importance of making the math content relevant to

their lives, while the participants in Harris-Thomas' (2022) study highlighted the critical role math competence played in feeling a sense of belonging within the math classroom. Although both studies provide insight into how the participants in their math classrooms experienced math-related belonging, an explicit discussion of what role, if any, the participants' ERI played was not made clear. There is also a lack of clarity regarding what additional sources of belonging the Black girls within these studies may have considered when negotiating their sense of belonging within the math classroom. The following sections will provide a detailed account of these studies and indicate why an additional examination is warranted.

Booker and Lim (2018) studied math-related belonging experiences of eight high-achieving Black girls and their three white math teachers. The participants attended diverse middle schools, one of which was in a small city, with approximately 800 students, including 58% White, 29% Black, 11% Latinx, and 2% Asian. The other middle school was located in a rural area with approximately 700 students, including 54% White, 23% Black, 22% Latinx, and <1% Asian. In-depth interviews were the primary data collection method, aimed at answering the following two research questions:

> "Research Question 1: How do African American middle school girls describe their instructional and personal relationship with their math teachers?
>
> Research Question 2: In what ways do teachers facilitate belongingness among this sample of students?" (Booker & Lim, 2018, p. 1038).

These research questions emphasize the teacher-student relationship and the teachers' pedagogical strategies to facilitate belonging within the math classroom. A thematic analysis approach guided the coding of the data, and the findings indicated the following two major themes: the importance of personal connections between both the teacher and the student and

between the students as peers and the importance of creating experiences related to the math content that is relevant to the students and their life experiences. The participants and their teachers indicated these factors as necessary for increasing Black girls' sense of belonging in the math classroom. Booker and Lim's (2018) study sheds important light on this specific source of belonging for Black girls and the nuances of student-teacher relationships within the math classroom.

Previously, I conducted a study examining how 4 Black girls in middle school conceptualized the construct of belonging and whether they experienced a sense of belonging within their math classrooms. The participants attended two middle schools that served predominantly Black and Latinx students within a Southern state. The study found that the Black girls in the study conceptualized belonging as being able to be themselves, fitting in with their peers, and receiving emotional support from the surrounding community (Harris-Thomas, 2022). When asked specifically what it means to belong within the math classroom, the participants described needing first to be able to understand the math content, followed by receiving support from the math teacher and finally being able to receive help from peers and being able to help peers (Harris-Thomas, 2022). Although the study provided greater insight into how the participants understood belonging, the role that the academic context, their own ERI, and gender identity may have played in their experience of belonging within and outside of the math classroom was not clear. The influence of the participants' context on their belonging experience at school remains an empirical question that this dissertation study is focused on addressing by explicitly centering on the ERI of the participants in our discussion of belonging.

The Present Study

The present study examines how contextualized experiences within the school setting influence the way Black girls in middle school perceive the construct of belonging, sources of belonging, and whether they perceive their ERI as impacting their belonging experiences within their math classrooms. Using a phenomenological approach, the multiple data sources will work together to create a detailed description of the participants' lived experiences from their perspectives.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

This study focuses on the belonging-related experiences of Black girls in middle school math classrooms to determine the sources of feeling a sense of belonging and the sources of belonging thwarting experiences. As identified in the literature review, Black girls' academic experiences are often combined with the experiences of all girls in general or with their Black boy peers (Purdie-Vaughns & Eibach, 2008). However, at the intersection of being a Black girl are experiences distinct from both peer groups, particularly salient in math classrooms where girls and Black students often feel marginalized (Joseph et al., 2020). There is a need to interrogate current theoretical conceptualizations of belonging and determine whether that definition and understanding align with or diverge from how Black girls in middle school conceptualize the construct. In the following chapter, I present the research worldview, methodology, design, analysis, and ethical considerations, while highlighting how these decisions connect to the research purpose and questions.

This study used a qualitative, phenomenological approach to capture the lived experiences and understandings of the participants and how their intersecting identities impacted their experiences of belonging in the math classroom. This approach created space for the participants to draw from their experiences within the classroom broadly and within their prior math classrooms to create a contextualized story of how their perception of belonging (or not) within the math classroom was derived. To this end, the following questions guided this study:

- RQ 1: How do Black girls in middle school describe the construct of belonging?
- RQ 2: What do Black girls in middle school view as sources of belonging within the math classroom?

- RQ 3: To what extent do Black girls in middle school see their ERI impacting their experience of belonging in the math classroom?
- RQ 4: To what extent do Black girls in middle school see their general school experiences impacting their experience of belonging in the math classroom?

Transformative Worldview

Creswell (2018) encourages researchers to explicitly name the philosophical worldview(s) that influence the research decision-making process. In this case, *worldview* is defined as "a basic set of beliefs that guide action" (Guba, 1990, p. 17) and "a general philosophical orientation about the world and the nature of research that a researcher brings to a study" (Creswell, 2018, p. 44). I use a qualitative, phenomenological approach within a transformative philosophical worldview in this study. Transformative worldview, also called the transformative paradigm (Mertens, 2007), is defined by its prioritization of justice efforts in relation to the participants and topic being examined. Mertens (2010) defines the transformative paradigm as "a framework of belief systems that directly engage members of culturally diverse groups with a focus on increased social justice" (p. 3). The decision to use a transformative worldview was made in response to my positionality, the participants' identities, and the study's overall purpose being rooted in centering the voices of Black girls in math spaces.

Transformative research works to intentionally consider the power dynamics at play between participants and researchers and create a co-equal space in which the participants are seen as knowledge holders (Mertens, 2010). At the core of this worldview is the marked decision to view often marginalized communities through an asset lens instead of a deficit lens and to prioritize the cultural capital present within the participants (Mertens, 2010).

The transformative worldview necessitates theoretical and methodological choices that align with the prioritization of furthering equity, in this case, within the math classroom (Creswell, 2018). Therefore, critical theories such as tenants of critical race theory and PVEST were chosen to address the role inequity and injustice have played in how the participants experience belonging within their school. Practically, the transformative approach also influenced how I recruited participants, where we conducted the interviews, the decision to conduct member-checking to evaluate the emerging themes, and how the results were disseminated alongside the participants for their prioritized stakeholders. In alignment with the purpose of transformative research, the study further emphasizes the strengths Black girls in middle school possess, the variety with which they experience belonging, and insights into how educators can create a more welcoming, affirming space as their scholarly identities continue to develop.

Research Methodology

A qualitative methodology was chosen to investigate the phenomena of belonging within a math classroom as a Black middle school girl. Qualitative modes of inquiry are often marked by the researcher's immersion into the participants' world and focused on understanding the participants' perceptions, experiences, and meaning-making processes (Creswell, 2018). Qualitative methodologies are well suited for capturing the nuances of examining tacit (intuitive and felt) knowledge (Lincoln & Guba, 1985), particularly when examining specific phenomena.

Phenomenology

Phenomenology is a research design "in which the researcher describes the lived experiences of individuals about a phenomenon as described by participants" (Creswell, 2018, p. 50). By focusing on the lived experiences of multiple individuals around the same phenomenon,

phenomenologists work to describe the essence of these collective experiences (Moustakas, 1994; van Manen, 1990). There are two primary approaches within phenomenology, transcendental/descriptive and hermeneutical/interpretive. Transcendental or descriptive phenomenology centers on describing the participants' experiences around the phenomena of focus and uses strategies such as *bracketing* to extract the research's biases, perspectives, and experiences from their understanding of the expressed description of the participants (Moustakas, 1994). In contrast, hermeneutical or interpretive phenomenology views phenomenology as an interpretive process intended to mediate and interpret the essence of multiple lived experiences (van Manen, 1990; Creswell, 2009). Hermeneutic phenomenology acknowledges the effect of a researcher's experiences on the interpretation process and encourages researchers to be explicit regarding how their understandings impact the study (Creswell, 2009).

I have chosen to conduct a qualitative, hermeneutic phenomenological study because of how my identity interacts with the identity of the participants. As a Black woman studying the belonging experiences of Black girls, it would be difficult to remove or bracket my experiences in school from the interpretation processes, necessitating an explicit description of my positionality, which be found in my reflexivity statement in Chapter One of this dissertation. In addition, choosing to examine the phenomena of belonging in a math classroom from a critical lens, a hermeneutical phenomenology creates space, methodologically, to consider the impact of sociohistorical and sociopolitical factors within the interpretation of the participants' described experiences.

Research Methods

A phenomenology methodological approach offers the possibility of shedding light on new contexts or understandings of a phenomenon (Dyson & Genishi, 2005; Emery & Anderman,

2020). This study focused on understanding the lived experiences and perceptions of belonging within the math classroom for Black girls in middle school. Observation and interview research methods were chosen to capture these experiences and perceptions.

Observation as a research method has been a primary source of data collection for qualitative researchers intending to "understand the culture, the setting, or social phenomenon being studied from the perspectives of the participants" (Hatch, 2002, p. 72). There are various roles an observer can take on within an observation, ranging from complete participant to complete observer (Creswell, 2016). For this study, I chose the role of *participant observer* for my initial observation and the role of a *nonparticipant/observer as a participant* for my follow-up observation. Being a participant observer initially allowed me to make connections and build rapport with the teacher and students and gain insights through participation in the class activities (Jones & Somekh, 2005). Upon completing the interviews, I returned to the classroom as a nonparticipant/observer as participant, allowing me to foreground my presence as a researcher as I watched and took notes from a distance. It should be noted that although I did not participate in activities during the second observation, I acknowledge that my presence within the classroom does have an impact (Jones & Somekh, 2005).

The research method of interviewing, defined as a conversation with a specific intention, is often used to gather the participants' thoughts, feelings, and motivations regarding a topic (Seidman, 2019). Three common types of interviews are structured, semi-structured, and unstructured. A semi-structured interview was chosen for this study to allow for a more dynamic flow between the researcher and the participants. In a semi-structured interview, the researcher creates an interview protocol with several predetermined questions but also has the leeway to probe, ask clarifying questions, and digress where deemed helpful throughout the interview

(Lune & Berg, 2017). After the data was analyzed, the participants were given the opportunity to give feedback in member-checking interviews (Lincoln & Guba, 1985).

Research Design

Research Context

This research study took place at a public junior high school for 7th and 8th-grade students in a small city in the Midwest. The city has a population of about 28,000 people. The city's racial demographics are approximately 73.5% White, 14.8% Black or African American, 7% Latinx, 4.13% Multiracial, 1.3% Asian, 0.3% Native American, and 0.2% Native Hawaiian or Pacific Islander. The school's enrollment is just over 500 students, with students of color making up 55% of the student enrollment (20.6% Black, 17% of two or more races, 16.5% Latinx, and .9% Asian). This junior high school would be considered an *urban characteristic* school, defined by Milner (2012) as schools that may be located in a suburban or rural area but experience challenges commonly associated with larger, urban schools. The school is classified as Title 1 because 74% of students are eligible to receive free or reduced lunch. Lastly, the junior high is known for its award-winning music programs and high student involvement in afterschool programs, clubs, and sports, including a winning girls' coding club.

Seventh-grade students are in a transition year, coming to the junior high school from the 5th and 6th-grade building. They are getting used to rotating with each class period and the increased workload. Seventh graders are enrolled in either the traditional 7th-grade math class, the honor's 7th-grade math class, or the advanced 7th-grade algebra math class, depending on the following three factors: state-level test math scores, teacher recommendations, and parental/guardian input.

Pilot Study

Before the main study, the interview protocol and observation protocols were piloted with Black girls in 8th grade at the same school as the participants in the main study. After obtaining IRB approval, the pilot participants were recruited in September 2022 through math teacher nominations. Two students volunteered, one of whom was in the 8th-grade honors class, and the other student was in the traditional 8th-grade math class. I met with both pilot participants, explained the study, and provided them with paper and digital parent permission forms. Upon returning their parental consent and student assent forms, the semi-structured interviews were conducted at the local library and the middle school during non-instructional times.

The pilot interviews revealed a need to simplify and clarify the language used in the interview questions and refine questions that were viewed as repetitive. The interviews were transcribed and coded to determine whether the interview protocol aligned well with the research questions. To evaluate the effectiveness of the observation protocol, I conducted two observations in an 8th-grade math classroom. The goal was to determine the ease of note-taking, the structure of the observation protocol, and where to make any additional adjustments as needed. After the pilot observations, it was determined that a digital version of the observation protocol would be easier to use across multiple classes. Doing so on an iPad allowed the researcher to draw the classroom structure into the field notes.

Setting the Scene: Ms. Belman's Class

For the main study, I worked with a 7th-grade math teacher, Ms. Belman (pseudonym), who teaches 7th-grade math, 7th-grade honors math, and 7th-grade algebra. Ms. Belman, a white woman in her thirties who has been teaching for eight years and has worked at this middle school

for the past three years, is warm and welcoming as she greets her students at the door. Her classroom is next to other 7th-grade classes, resulting from the school placing 7th-grade and 8th-grade core classes on different levels. Once inside, motivational posters and student work hang on the walls, and students are seated at individual desks in rows. Large windows span the left wall of the classroom while the fluorescent lights beam from above. Ms. Belman has positioned her desk at the back of the classroom, which has now become a preferred spot for students who ask to sit in her seat since she is typically either at the board or circulating through the room. Students begin to do their bell work as I make my way to the back of the class and set up. “Who are you? Why are you here?” are questions I am asked as I sit down. This school is a familiar place, having worked there four years prior as a special education teacher. I introduce myself and say that I am here to learn about what happens in Ms. Belmna’s math classes. My answer temporarily satisfies the curious student.

For most classes, it takes a while to settle the class down to begin reviewing the work as students finish up conversations about the latest basketball game, a song they have been playing on repeat, or voicing their frustration with someone in the class that will not leave them alone. Once pencils are handed out and sharpened and attendance is taken, Ms. Belman covers the day's lesson, reminding students of the skills they are building on from prior weeks or last year. As a few participants pointed out later, the difficulty is that their last two years of math instruction have been quite disruptive. Between engaging in e-learning math classes as a result of the COVID-19 pandemic (fifth grade) to a teacher leaving midway through the year and being taught by a sub (sixth grade), some students feel behind and need a refresher. Yet, other students are grasping the concepts and ready to work ahead, as evidenced by one student asking a question

about an equation two or three problems ahead. Ms. Belman talked about the challenges of meeting the wide-ranging academic needs of her classes.

After the lesson is taught, Ms. Belman encourages students to work in groups to complete the practice worksheet as she walks around and helps answer students' questions. In some classes, the Black girls participating in this study group up with their friends as they laugh and talk about their math work and other non-school related topics. When asked why Aubriella likes working in groups during math, she said it was because "We talk about other stuff" (Interview 1). In other classes, a few participants choose to work alone. One participant later revealed that she does "wanna work with other people. But, I feel like I don't know anybody well enough to like to say anything or like I'm too nervous. Like what if they say no? Or like what if they like look at me weird or they're not like talking or nothing like that?" (Stephanie, Interview 1).

As Ms. Belman walks around, she hands out tickets for good behavior and correct answers on the math worksheet. Students can write their names on the tickets which will be collected, and a winner will be randomly drawn at the end of class to receive a prize. Many of the participants call out to Ms. Belman for help and also ask their partners for help. Nearing the end of the class, Ms. Belman shouts a few last-minute instructions about the homework, asks students to put their desks back into rows, and picks a winner (someone who "*always* gets picked" won). As the bell rings, Ms. Belman reminds students that she dismisses the class, not the bell. She waits until the class is quiet and then allows them to head on to their next class as she positions herself by the door and welcomes the next group of learners into her room.

Participants

For a phenomenological study, 5 to 25 participants are recommended to analyze multiple perspectives on a phenomenon but with a level of depth that becomes difficult to do with more

than 25 participants (Polkinghorne, 1989). To recruit students, I was given a list of students who identified as Black girls based on their school registration and spent time speaking to small groups of girls about the study during lunch. From a list of 17 girls, ten returned all their forms and agreed to participate in the study. The participants ranged from 12 to 14 years old and were enrolled in one of Ms. Belman's 7th-grade math classes (Table 2).

Table 2

Research Study Participants

Name	Age	Math Class	Hour
Aubriella	13	Honors Math	7th
Dannie	13	General Math	4th
Duckie	12	Honors Math	7th
Imani	12	Honors Math	8th
Jackie	13	Honors Math	8th
Jaylynn	12	General Math	8th
Naomi	13	Algebra	3rd
Shantel	13	Honors Math	7th
Stephanie	12	Honors Math	8th
Vanessa	13	Algebra	3rd

Note. All names are pseudonyms.

Participant Self Descriptions

The following descriptions of the participants were taken from their interviews, where they were asked to describe themselves, and from their math autobiographies, where they shared how they feel about math in general and other helpful information about their schooling experiences.

Dannie is a 13-year-old student who describes herself as "a good friend," someone who "tries to stay positive" and is sometimes shy. She has been a student in this school system throughout her school career. Dannie has math in the middle of her school day during 4th period and shared that math is her favorite subject. When she was in first grade, she would ask her math teacher for more work, and even now, she says that when she "walks into her math class, I am always ready to learn" (Math Autobiography). Dannie shared that she is very confident in her math abilities and always willing to try her best.

Duckie is a 13-year-old student and describes herself as someone who "likes to be on my own" and "can be serious, but at the same time, [I] can be goofy." She appreciates calm, chill environments and, above all, loves to sleep. Duckie has moved around schools and though she does not mind being back, she thinks the students in this school are mean. Duckie has math near the end of her day during 7th period and math is her favorite subject at school. Duckie also shared that she likes to be challenged in her math class and feels "lucky to be good at math because I will need it for the rest of my life" (Math Autobiography).

Imani is a 12-year-old student who describes herself as "nice, bossy, helpful, and smart" and enjoys her friends, playing in the school band, and singing in the school choir. She has been a student in this school system throughout her school career. Imani has math at the end of the day and views math as her favorite subject ever since her dad started helping her with her math homework. She shared, "My dad really helped and then that made me really feel good about myself because I started getting better at math. And so now I'm pretty good at it. So now math is my favorite subject" (Math Autobiography).

Jackie is a 13-year-old student who describes herself as "very athletic, pretty smart, and funny". She spends a lot of her time playing on her traveling sport teams. She has been a student

in this school system throughout her school career. Jackie has a complicated view of math which she expressed in the following statement: “Math used to be my favorite, but now, I don't know. I like solving actual math problems. I just don't like all the work that we do in that class because I have probably- Math is probably one of the classes I have the most work in. So it's like… but I like actually doing math” (Interview 1).

Jaylynn is a 12-year-old student who describes herself as “kind and nice to some people. Depends on who [they] are.” She “gets along with people [she] just met” and likes to write and make up stories. She has been a student in this school system throughout her school career. Jaylynn also has math as her last class of the day and does not like math overall. She used to like math, but in the sixth grade, it became harder, which decreased her math enjoyment (Interview 1). Jaylynn transferred to this middle school a couple of months into the school year but enjoyed her prior school more than her new school.

Naomi is a 13-year-old student who describes herself as funny, and if she gets comfortable around you, she “will act really weird around you.” But, if she is uncomfortable with someone, she prefers to keep interactions short. She has been a student in this school system throughout her school career. Naomi has math during 3rd hour and shared, "Something that I always have been good at is math. I love math, and it’s usually really easy” (Math Autobiography). Naomi told me that she has experienced some bullying, which has made it a difficult year so far. But she expressed thankfulness for the close friends she has at school.

Shantel is a 13-year-old student who likes to “draw, listen to music, and play basketball”. She describes herself as having a “social battery” that eventually runs out, and then she “doesn’t like being around people.” She has been a student in this school system throughout her school career. Shantel has math near the end of her day during 7th period, and “math has always been a

subject I liked" (Math Autobiography). As the math content has become more challenging, Shantel shared that she has "started to get distracted and drawn away from the learning. As of right now, I'm trying to get back on track. I want to do better because I know I can. I've always loved math and I want to love it again" (Math Autobiography).

Stephanie is a 12-year-old student who describes herself as "artistic, creative, kind of athletic, and kind of funny," a side of herself she only shares if she gets to know you. Stephanie ends her school day in math class and has a neutral to negative view of math. "I kind of feel neutral. Last year, I didn't like it [math class] at all 'cause I didn't know how to really understand it. But this year, I feel neutral" (Math Autobiography). This is Stephanie's first year at this middle school, and she has had difficulty making friends as a newcomer. She met a friend at her church who also goes to her school and has been helpful.

Vanessa is a 13-year-old student who describes herself as "a very outgoing person" who loves being around people. She loves being the center of attention and having other people admire her. She has been a student in this school system throughout her school career. Vanessa has math 3rd hour, and she began to really enjoy math when she was in the 5th grade. Throughout Vanessa's Math Autobiography, she shared stories of her positive experiences with many of her previous math teachers. Vanessa expresses a positive sense of self as demonstrated in the following quote "Yeah. I feel like people want me there [in math class] cuz I make every class fun I'm in. People just love me being in class. I make it fun" (Interview 2).

Aubriella is a 13-year-old student who describes herself as shy and "quiet around people I don't feel comfortable with." Once she gets to know someone, she likes to joke around. She has been a student in this school system throughout her school career. Aubriella has math near the end of her day during 7th hour and shared that math has been her favorite subject ever since the

3rd grade. Aubriella is in math class with a few of her closest friends. Although she enjoys it, she feels they distract her from doing her work (Math Autobiography). The teacher recently moved their desks around and Aubriella feels hopeful the change will help them all focus and improve their grades.

Procedure

This study used the participant's math autobiographies, semi-structured individual interviews, and classroom observations to examine the research questions. Upon receiving IRB approval and obtaining guardian consent and student assent to participate, the students were given directions to write their math autobiography. Initial classroom observations were conducted across the four math classes the participants were enrolled, and math autobiographies were collected before interviews were conducted. Collecting the math autobiographies and conducting the observation before the interviews provided time to read the math autobiographies and review observation notes to incorporate additional questions into the semi-structured interview protocol. Interviews were held after school on campus or at a public location of the participants choosing. Following the interviews, another round of classroom observations was conducted across the four classrooms. Finally, individual member-checking interviews were conducted in the spring of 2023.

Data Sources. Data collection occurred during the fall of 2022. Recommended forms of data collection for phenomenological studies include participant observations, interviews, and formally written responses, which are among the five sources of data utilized for this study (Creswell, 2007; Van Manen, 1990). Further, this study aims to situate or contextualize the belonging experiences of the participants. Nolan and colleagues (2015) note the benefit of drawing from multiple forms of data to help confirm the accuracy of identified descriptors and

themes, specifically noting observations, interviews, and other self-report methods as examples. These sources of data provide multiple viewpoints regarding the lived experiences of the participants: observations captured the participants' current math context and engagement, semi-structured interviews captured the real-time responses of the participants with space to ask for clarification and elaboration, math autobiographies captured the historical perspective of the participants in their own words and how it informs their current views. The following sections detail the procedure for each data source:

Math Autobiography (Appendix A). Participants began the study by writing a math autobiography highlighting their most salient math experiences dating back to their earliest memories of being in a math classroom. Students could respond to a few open-ended prompts (i.e., What is your earliest memory of doing math? Who was your favorite math teacher and why?) to help them craft a narrative of their prior math experiences. If desired, the participants could also share their memories more freely. To avoid privileging writing over other forms of communication, participants were given the option to video record, audio record, write or type their math autobiographies. Of the ten participants, only one student chose to audio record her math autobiography, while the other nine students wrote their math autobiographies on notebook paper.

Classroom Observations (Appendix B). Before conducting the semi-structured interviews, a classroom observation was completed in each of the four classrooms. The first classroom observation aimed to gain context regarding the participants' current math experience and build rapport. Therefore, a *participant observer* approach was used, allowing for engagement in the classroom (i.e., answering math-related questions during small group time) while taking notes (Creswell, 2016; Jones & Somekh, 2005). During the interview, notes from

the initial observation were used to ask clarifying questions regarding what was observed (i.e., I noticed that during class, you all worked in small groups a lot. How do you decide whom to work with? What do you like or dislike about working in small groups?). A second classroom observation was conducted after the ten interviews were completed. The second classroom observation aimed to identify how the participants responded to the presence or absence of sources of belonging identified in the interviews (i.e., working with friends, the pacing of the lesson, and opportunities to ask for help in private). Therefore, an observer-as-participant approach was used because I did not engage with the class directly but observed and took notes (Creswell, 2016; Jones & Somekh, 2005). During both observations, an iPad was used to take digital notes and to draw renderings of the classroom setup and the location and movement of the participants throughout the class period. After observations, field notes were taken to record reactions, questions, impressions, and factual information about the observation process.

Semi-Structured Interviews (Appendix C). The particpiants participated in two semi-structured interviews. Upon turning in their math autobiographies and completion of the initial classroom observations, the first semi-structured interviews were conducted with each participant. The interview protocols included questions regarding the participant's prior experiences in school, their conceptualization of belonging, sources of belonging within the academic setting, and the role of ERI in their understanding of belonging in the math classroom. The interview protocol also included a section asking for clarification and elaboration regarding their math autobiographies and notable moments from the classroom observation. The interviews took place primarily at the participants' school and lasted about an hour each. A second round of interviews was conducted and lasted about a half hour each and focused specifically on hearing how the participants viewed their ERI and its potential influence on their sense of belonging in

math. The interviews were audio-recorded, and a professional service was used for transcription. Upon receiving the transcripts, they were checked for accuracy by relistening to the audio interviews and making any corrections. This resulted in

Field Notes. Field notes were taken throughout the recruitment and data collection process to support creating thick, rich descriptions of the study's overall context (Patton, 2002; Phillippi & Lauderdale, 2017). Field notes included comments about the settings where data collection took place, conversations with teachers, coaches, and administrators at participating school, and nonverbal communication from the participants during interviews and observations. Hand-written field notes were transcribed into an ongoing digital document.

Memos. Memos were taken throughout the research study to document the decision-making process, map research activities, and capture thoughts and impressions during data analysis (Birks et al., 2008). Glaser (1978) stresses the importance of memoing to the overall trustworthiness of a qualitative studying. Keeping track of thoughts and conceptions that inform the data analysis process through memoing aids in the transparency of how conclusions or themes are drawn (Birks et al., 2008).

Member-checking. Member checking aims to "illuminate a better representation of the lived experience of the participants being studied" (Cho & Trent, 2006, p. 332) by asking for feedback concerning the credibility of the research analysis and findings (Creswell, 1997; Lincoln & Guba, 1985). After creating the final themes, participants engaged in a member-checking meeting to ensure the outcomes accurately represented their experiences and perspectives (Lincoln & Guba, 1985). During these meetings at the participating school, students provided feedback regarding the identified themes, adding nuance, clarity, and missing details.

Data Analysis

This study's findings draw heavily from the participant's math autobiographies and interview transcripts, while field notes and classroom observations added additional support to the autobiographies and interviews during data analysis.

Data analysis within qualitative research is an ongoing process that starts once data collection begins and builds throughout each iterative cycle of analysis (Miles & Huberman, 1994). In keeping with centering the experiences and perspectives of the participants, thematic analysis was chosen to analyze the data. Thematic analysis is a method to describe and interpret data by identifying patterns and themes (Braun & Clark, 2006). Braun and Clark (2006) highlight that thematic analysis can draw out similarities and differences across the data set, unearth new insights, and "allow for social as well as psychological interpretations of the data" (p. 97). Two typical coding processes take place within a thematic analysis, which are *inductive* coding and *deductive* coding. Inductive coding looks to the participant's words to derive the themes and has a descriptive and exploratory orientation. In contrast, deductive coding looks to theory or philosophical frameworks to derive themes and has a more confirmatory orientation (Braun & Clark, 2022; Fereday & Muir-Cochrane, 2006; Guest et al., 2014).

While traditionally presented as a binary choice, Braun and Clark (2022) state that inductive and deductive coding processes are not mutually exclusive and can be considered on a continuum. For example, Braun and Clark (2022) state that a researcher's orientation to the data can be either more inductive or more deductive. Following in the path of prior scholarship (Fereday & Muir-Cochrane, 2006; Proudfoot, 2022), I have chosen to take a more nuanced approach and would define my orientation to the data as "*More inductive:* where the analysis is located within, and coding and theme development are driven by the data content" (Braun &

Clark, 2022, p. 10). The reason for not selecting a pure inductive orientation to the data is due to the goal of race-reimaging the construct of belonging, necessitating an examination of how the emerging themes align or diverge from current conceptualizations of belonging within the current literature. Overall, the strengths found within thematic analysis align with this study's transformative paradigm and critical conceptual framing by providing opportunities to draw out needed nuances in how belonging has been conceptualized and to view the Black girls in this study through a dynamic rather than a monolithic lens.

Phases of Thematic Analysis. Braun and Clark (2006) propose six-step thematic analysis processes (Table 3). These steps were followed within the data analysis of this study. During *phase one*, I reread the math autobiographies, listened and read along with the transcripts from the two semi-structured interviews, including checking transcripts for accuracy, and reviewed my notes from the classroom observations and field notes.

Table 3

Braun and Clark's Six Phases of Thematic Analysis

Phase
Phase 1: Familiarizing yourself with the dataset
Phase 2: Coding
Phase 3: Generating Initial Themes
Phase 4: Developing and Reviewing Themes
Phase 5: Refining, Defining, and Naming Themes
Phase 6: Writing Up

Note. Taken from Braun and Clark's book *Thematic Analysis: A Practical Guide* (2022, pp. 9-10).

During *phase two*, I conducted an initial open, inductive coding analysis of the data in which the codes were derived from the data instead of from a priori codes or analytic

preconceptions (Braun & Clark, 2006). After the initial round of coding, which resulted in a large list of codes that captured a wide variety of information from the full data set, a second round of coding was conducted with the same full data set. This process created the full set of codes from which categories were established. Categories differ from codes because they are broad labels that simultaneously capture multiple codes. Further, these categories served as an organizing mechanism while uncovering the participants' meaning-making through a variety of data sources (Coffey & Atkinson, 1996).

Phases three, four, and five represent an iterative process in which the codes and categories were analyzed to combine, eliminate, and form overarching themes as the interpretation phase of data analysis was foregrounded. Patton (1990) describes this progression as moving from identifying descriptions to organizing the data in such a way as to highlight patterns in an attempt "to theorize the significance of the patterns and their broader meanings and implications, often in relation to previous literature" (Braun & Clark, 2006, p. 84). In addition to identifying confirming examples across the data set, counterexamples, points of tension, and anomalies were used to establish robust support for the identified themes (see Table 4).

In phenomenological studies, the researcher seeks to uncover the *essence* of how a phenomenon is experienced, drawing out textual and structural descriptions. The textural description focuses on what happened, and the structural description focuses on how the setting and context impacted the experience of the phenomena (Creswell, 2007). In phase six, examples in the participants' own words were extracted to portray how Black girls in 7th-grade experience a sense of belonging within their math classrooms and what they identified as sources of that belonging or lack thereof.

Table 4

Excerpt of Coded Data

Theme: Belonging Means Being Yourself			
Definition: The ability to express oneself authentically without having to hide parts of who they are			
Category	*Code*	*Quote*	*Source*
Conceptualization of Belonging - Internal	Familiarity creates space to be yourself	I used to go to therapy like last year, I think. Yeah. And with the therapist around and the other kids there, they like really understood me and stuff. And I thought like I belonged there because like they understood me and like some people and just made me feel better about myself.	*Naomi, Interview 1*
		Um, because like I feel like I could be more myself cause like I was in high ability last year. And I was literally in the same classroom with the same people for my whole life, so. So like it was easy to be myself in front of those people and they already knew how I was gonna be.	*Stephanie, Interview 1*
		I feel like I belong where my friends are comfortable at. And like you don't have to act like somebody else. And you can be yourself.	*Jaylynn, Interview 1*
	Feeling Comfortable	Being comfortable.	*Dannie, Interview 1*
		They feel comfortable. And they feel like they can like be welcomed.	*Duckie, Interview 1*

Table 4 (cont'd)

Theme: Belonging Means Fitting In			
Definition: Feeling a sense of place and understanding among a group of people or within a specific space			
Category	*Code*	*Quote*	*Source*
Conceptualization of Belonging - External	Fitting In	Feeling welcome. And feeling like you like fit in. Like you're supposed to be here instead of not feeling like you shouldn't.	*Imani, Interview 1*
		Yeah. When you fit in and like everybody has like an understanding, like, you know where you're supposed to be and stuff. They know that you're like- that you fit in with that area.	*Shantel, Interview 2*
		Like you feel like you fit in there.	*Aubriella, Interview 2*
		Fitting In	*Jackie, Interview 1*
Theme: Belonging Means Having Positive Social Connections			
Definition: Experiencing positive relationships and or consistent interactions with others, including peers, teachers, and friends.			
Category	*Code*	*Quote*	*Source*
Conceptualization of Belonging - External	Having Friends	Like having a lot of friends and knowing a lot of people.	*Stephanie, Interview 1*
		I'd probably say like being kinda like, like having a lot of friends and knowing a lot of people. And, being like likeable and stuff.	*Stephanie, Interview 2*
	Being liked by others	This is my family.	*Dannie, Interview 2*
		People want you, I feel like. They think you're like a great person. They just, you're a great and positive person. Everybody just likes you.	*Vanessa, Interview 2*

Table 4 (cont'd)

Theme: Belonging Means You Want To Be There			
Definition: Feeling an internal desire to be a part of a particular space, group of people, or thing			
Category	*Code*	*Quote*	*Source*
Conceptualization of Belonging - Internal	You want to be in that space	Because sometimes like people don't treat you good, but you still know you belong there and you feel like you belong there, so you're gonna stay. If you didn't want to be there. Like even if people were good to you, you still feel like you didn't want to be there or you don't like... you just don't.	*Imani, Interview 1*
		B: How would you define belonging? V: You want to be there, and people want you to be there.	*Vanessa, Interview 1*
	Personal enjoyment/Desire to learn math	Maybe that like, they enjoy math a lot and they feel like they wanna learn more about math and they want to help others with math and stuff like that.	*Naomi, Interview 1*
		Like, they really like, they like the learning environment and like they really understand. They really understand what they're doing.	*Shantel, Interview 1*

Note. Categories are listed in the left column, followed by the codes and example quotes. Finally, the source of the examples is provided in the right column.

Trustworthiness

Establishing trustworthiness, the degree of confidence readers have in a study's quality, is an essential step due to the interpretive nature of qualitative research (Creswell, 2018). Lincoln and Guba (1985) elaborated on the concept of trustworthiness by establishing criteria, *credibility,*

transferability, dependability, and confirmability, for evaluating the degree of trustworthiness in a qualitative study. Creswell (2018) recommends several steps to increase the trustworthiness of a qualitative study, including the following: triangulation, member checking, using rich, thick descriptions, clarifying researcher bias, using negative or counterexamples, prolonged time in the field, and peer debriefing. In the next section, I will address how I addressed Lincoln and Guba's (1985) four criteria, utilizing many of the steps they recommend along with recommendations by Creswell (2018).

Credibility refers to confidence in the accuracy of the findings and how well it represents what actually took place (Lincoln & Guba, 1985). I triangulated the participants' math autobiographies, classroom observations, interview transcripts, and field notes to establish credibility. I also conducted member-checking meetings with participants to ensure an accurate representation of their ideas and experiences. Next, I intentionally used the participants' words to describe their ideas and experiences whenever possible, prioritizing direct quotes to explain the themes. Finally, by conducting a classroom observation and reading the math autobiographies before conducting the interviews, the interviews provided a space to ask the participant to clarify further and elaborate on the stories and details they shared, which helps increase the credibility of the results.

Confirmability is the clarity with which readers can see how the data was interpreted and themes drawn out, and *dependability* is the clarity with which readers understand the steps and decisions made throughout the research process (Creswell, 2018; Lincoln & Guba, 1985). Both criteria were established similarly, beginning with detailed memos regarding decision-making processes throughout the study, data analysis and how themes were formed, and details from time in the field. Field notes were another way to establish confirmability and dependability

because of the detailed accounts of classroom observations, recruitment visits, and conversations with administrators, students, and teachers. Finally, developing a reflexivity statement provides further support for confirmability by clarifying the background, biases, and perspectives I bring to the interpretation of the findings.

Transferability is the clarity with which one can determine how similar the research context is to other contexts (Lincoln & Guba, 1985). The recommended way to establish transferability is to provide rich, detailed descriptions of the context, the participants, and the setting in which it took place (Creswell, 2018; Lincoln & Guba, 1985). In the results and conclusion sections, I have included detailed descriptions and provided contextual information to make clear the essence of the participants' experience and create a mental bridge for the reader to experience the research setting.

Research Ethics

Decisions concerning ethics abound throughout the research project, starting at the conceptualization through the dissemination of the findings. Ethics are "concerned with attempts to formulate the principles and codes of moral behavior. [Ethics] seeks to provide guidance in relation to what is morally right and wrong" (Thomas, 2013, p. 9). Within academic research, there is a need to focus on procedural ethics, ethics in practice, and relational ethics (Ellis, 2007; Guillemin & Gillam, 2004). Procedural ethics focus on the structural components of a study's design and implementation, including the participants' consent, privacy, and harm avoidance (Thomas, 2013). Institutional Review Board (IRB) approval was obtained for this study prior to beginning recruitment and data collection.

Ethics in practice focuses on the unpredictable moments that arise throughout the research process, such as decisions regarding the location of data collection, communicating with respect,

and consideration of participants' needs (Thomas, 2013). To prioritize the participants' personal and academic time, data was not collected during instructional times, participants were given clear pathways to opt out of participation, times of interviews were flexible to fit into the participants' schedules, and all communication was handled professionally with respect.

Finally, relational ethics focus on mutual respect and taking responsibility for how one's actions impact others (Ellis, 2007). In writing about ethical considerations within critical research studies, Thomas (2013) states, "The critical researcher has an ethical responsibility to assess his or her own values, beliefs, and prejudices, which can and do influence various aspects of the research process in a myriad of ways…" (p. 10). To be clear and forthright, the premise of this study is founded on the idea that Black girls in 7th grade are knowledge holders and can impart wisdom necessary for the improvement of teaching Black girls in math classes. From this asset-oriented lens, the research questions were derived, the theoretical and conceptual frameworks and data collection methods were chosen, and the dissemination plan was formed.

CHAPTER 4: FINDINGS

"I dreamed about a culture of belonging. I still dream that dream. I contemplate what our lives would be like if we knew how to cultivate awareness, to live mindfully, peacefully; if we learned habits of being that would bring us closer together, that would help us build a beloved community."

— bell hooks, Belonging: A Culture of Place

In this chapter, I present the findings of a reflexive thematic analysis (Braun & Clarke, 2022) regarding the research questions guiding this study. Reflexive Thematic Analysis is simultaneously engaging in "the practice of critical reflection on your role as a researcher and your research practice and process" while analyzing and interpreting patterns across a data set (Braun & Clarke, 2022, p. 5). I begin by discussing how the participants conceptualize the construct of belonging, followed by five sources of belonging the participants highlighted, and finally, an examination of the role the participants' ERI played in their experience of belonging in math. After multiple coding cycles, the findings are discussed through the lens of the participants and organized by research questions.

RQ 1: How Do Black Girls In Middle School Describe The Construct Of Belonging?

The first research question examines how the participants conceptualize the construct of belonging. Prior research on belonging has offered a variety of conceptions of belonging (for a review, see: Allen et al., 2018 and Gray et al., 2018). Therefore, before examining the participants' perceived sources of belonging, it was important to understand how they understood the construct explicitly. This allowed me to use their words and terminologies to ask about their experiences and conceptions throughout the remainder of the interview. The following four themes provide an overview of how the participants described belonging: 1. Belonging Means *Being Yourself*, 2. Belonging Means *Fitting In*, 3. Belonging Means *Having Positive Social Connections*, and 4. Belonging Means *You Want To Be There*.

Belonging Means Being Yourself

A repeated refrain in defining what belonging means was the idea that to belong means you can be yourself. This theme is defined as *the ability to express oneself authentically without having to hide parts of who they are.* One participant states this clearly when she said, "You don't feel like you have to hide anything. You can be yourself" (Duckie, Interview 2). While Jaylynn described it this way: "I feel like I belong where my friends are comfortable at. And like you don't have to act like somebody else. And you can be yourself" (Interview 1). Another way the participants deepened this idea of being able to show up as themselves was the idea of being understood and comfortable within the environment. Naomi described it this way:

> I used to go to therapy like last year, I think. Yeah. And with the therapist around and the other kids there, they like really understood me and stuff. And I thought like I belonged there because like they understood me and like some people and just made me feel better about myself (Interview 1).

From this quote, we see that Naomi not only feels like she can be herself, but she feels as though who she shows up as is understood, which deepens her sense of belonging in that space. She goes on to say, "I mean, like, if I think about it more, [you belong] if you feel yourself. Like if you're around the people that you know, you can feel yourself or like things like that" (Naomi, Interview 2).

When asked to share an example of a place where the participant felt a sense of belonging and why that space gave her that feeling, Stephanie described the math class she was in the previous year:

> Um, because like I feel like I could be more myself cause like I was in high ability last year. And I was literally in the same classroom with the same people for my

> whole life. So like it was easy to be myself in front of those people and they already knew how I was gonna be (Interview 1).

As I will discuss more in-depth later, the social interplay between individuals within a space significantly impacts the degree to which the participants felt they could be themselves. For example, Dannie talked about how she changes how she acts when she is in a classroom with a substitute or student teacher because she does not know them as well:

> Like, say that I would go in a class and like, I can be shy sometimes. So like, I'll go in a class and like, if there's a substitute in there then like I, my actions would probably change. [Her teacher], I've been around her the whole school year and I'm comfortable with her. But like, if there was a substitute in her class or the student teacher that's in her class, it's different (Interview 2).

Being able to show up in a space authentically without hiding or changing who you are is an important component of belonging. This aligns with prior literature on belonging, in which strategies for supporting belonging emphasize accepting, valuing, and including students' varied identities (i.e., culture, gender, disability, etc.) (Goodenow, 1993; Healey & Stroman, 2020).

Belonging Means Fitting In

Fitting in the environment was another way the participants described the construct of belonging. The term "fitting in" assumes a bounded or specific place or group to which this applies and highlights the contextualized nature of belonging (Gray et al., 2022). This theme is defined as *feeling a sense of place and understanding among a group or within a specific space*. In addition to multiple participants saying that belonging means "to fit in" (Aubriella, Jaylynn, and Jackie), Imani described belonging as "Feeling welcome. And feeling like you like fit in.

Like you're supposed to be here instead of not feeling like you shouldn't" (Interview 1). Adding to this idea of feeling like there is a place for you, Shantel defines belonging as "When you fit in and like everybody has like an understanding, like, you know where you're supposed to be and stuff. They know that you're like- that you fit in with that area" (Interview 2). Here Imani and Shantel emphasize the sense that in fitting in, there is a place for you where you are expected to take up space. They describe a mutual understanding between the individual and the people within that specific space. There is an understanding that their presence is not only welcomed but also expected. Being "included" or "not being left out" (Aubriella, Interview 1) and "feeling welcomed" (Imani, Interview 1) were also ways the participants described belonging as fitting in.

Belonging defined as "fitting in," connects to prior literature's conceptualization of the construct. Studies by Walton and colleagues (2012) described belonging as having perceived similarities or fitting in, while Gray (2017) examines belonging as a dynamic interplay between a desire to fit in and a simultaneous desire to stand out (Gray, 2017). In an article entitled "Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics", Lewis and colleagues (2016) compare and contrast belonging experiences through the ideas of fitting in or opting out of a physics class for students in high school.

Belonging Means Having Positive Social Connections

Next, belonging was conceptualized in terms of having positive social connections. This theme is defined as *experiencing positive relationships or consistent interactions with others, including peers, teachers, and friends.* When asked what belonging means, Stephanie shared, "Like having a lot of friends and knowing a lot of people. Like being able, maybe, I don't even

know a word, but like being able to make friends fast. (Interview 1). Vanessa emphasized that how her peers view her impacts how she understands belonging. She defines belonging as when "People want you, I feel like. They think you're like a great person. Everybody just likes you" (Interview 2). Or said differently, "Like if you're around the people that you know, you can feel yourself or like things like that" (Naomi, Interview 2).

As expounded upon in a later section, many of the participants' sources of belonging are interpersonal relationships. The participant's relationships with their teachers, friends, and peers play a significant role in fostering or thwarting their sense of belonging within the math class. Zooming out beyond the math class, participants cited their relationships with their librarian, coaches, and past teachers that they stay in contact with as additional places of belonging. This reiterates that belonging's conceptualization is deeply connected to interpersonal opportunities to belong (Gray et al., 2018).

Together, the girls' conceptualizations emphasize what prior literature has highlighted, the socially constructed nature of belonging and, therefore, the importance of interpersonal relationships (Booker, 2004; Ibourk et al., 2020; Lewis et al., 2016). In a study of African American high school students, Booker (2004) found that positive interpersonal relationships were particularly important in supporting a sense of belonging among African Americans in school.

Belonging Means You Want To Be There

The final component of the participants' conceptualization of belonging was unexpected and seems to put forward the idea of autonomous belonging. This theme is defined as *feeling an internal desire to be a part of a particular space, group of people, or thing.* The participants emphasized in various ways that their understanding of belonging goes beyond having a

responsive relationship to their environment. Rather, the individual's desire to belong within that space may supersede the experience of belonging supports or threats in that environment. Said differently, several participants defined or conceptualized belonging in such a way that emphasized the role their own interest/desire/willingness to show up and engage plays in whether they feel a sense of belonging in a space. Imani describes it as follows:

> Because sometimes like people don't treat you good, but you still know you belong there and you feel like you belong there, so you're gonna stay even if you didn't feel welcome. If you didn't want to be there, like even if people were good to you, you still feel like you didn't want to be there or you don't like... you just don't (Interview 1).

When asked what she thought someone means if they say they feel like they belong in math, Naomi replied, "Maybe that like, they enjoy math a lot and they feel like they wanna learn more about math and they want to help others with math and stuff like that." Vanessa defined belonging as "You want to be there, and people want you to be there."

In their explanations, Naomi and Vanessa emphasize the feelings and perspectives of the individual first. This contrasts the above idea, where belonging is defined in relation to the social connections within the environment. There is no evidence that these two ways of looking at belonging are mutually exclusive but rather likely build upon one another. Further research is needed to explore whether this concept of autonomous belonging is present in other settings or particular to this group of middle school Black girls.

Summary. The middle school Black girls in this study offer a dynamic and nuanced view of the construct of belonging. From the interplay between the participants

and their environment to the internal experiences and desires of the individual, belonging is defined as being able to be yourself while still fitting in and building positive social connections. The idea of autonomous belonging or prioritizing one's desire, or lack thereof, to belong in a specific space connects to the idea of *Personal Interest* in a study by Rainey and colleagues (2017) that examined how race and gender influenced students' decisions to major in a STEM field. *Personal Interest* focuses on interest in a specific STEM field, separate from how they view themselves (Rainey et al., 2018). For example, when a Black woman biology major was asked about her sense of belonging in her STEM field, she replied that "she belongs when she is interested in the material and does not feel she belongs when she is not interested" (Rainey et al., 2018, p. 9). Future research into the circumstances under which the participants tap into this definition of belonging would help clarify its conceptualization.

RQ 2: What do Black girls in middle school view as sources of belonging within the math classroom?

Recognizing that students will respond differently to potential sources of belonging or belonging supports, identifying what Black girls in middle school view as sources of belonging provides insight into how best to foster and tend to their sense of belonging within the math classroom. This research question was examined by reviewing how the participants answered questions such as "Where do you feel like you belong in school?", "Do you feel like you belong in your math classes? Why or why not?"; and "Who or what makes you feel like you belong in your math class?" The participants shared with me about their prior math classes and what they appreciated or did not appreciate about those experiences. The following four sources of belonging stood out as being well represented across the participants and data sources:

Competence as a source of belonging, *Teachers* as a source of belonging, *Peer Social Connection* as a source of belonging, with a section emphasizing specifically friendships, and finally *Academic Support* as a source of belonging.

Competence as a Source of Belonging

Competence is defined as students' belief about their own abilities and about whether they believe their efforts will result in success (Linnenbrink-Garcia et al., 2016). Throughout the data collection process, each participant referenced their math achievement and its impact on their sense of competence as a source of feeling like they belonged in math. This theme is defined as *considering the degree to which one feels confident in their skillsets and achievements regarding a particular academic concept as an indicator of belonging.* Jackie (Interview 2) stated directly that not being good at math was her reason for not feeling a sense of belonging in her math class:

Brooke: Do you feel like you belong in math?

Jackie: No.

Brooke: And why not?

Jackie: I'm just not really good at this.

Similarly, Aubriella (Interview 2) shared how she no longer feels like she belongs in math because she is not doing well in her math class academically.

Brooke: Do you feel like you belong in math?

Aubriella: Not anymore.

Brooke: Okay. Why not?

Aubriella: I don't know. It just don't feel right with me no more.

Brooke: When did that change happen, would you say?

Aubriella: This year.

Brooke: Like what do you think has made it not sit right with you?

Aubriella: I'm not as good at it as I was anymore, like, I can't focus like that no more. Like I would before.

Just as the participants found struggling academically or viewing themselves as not good at math as a source of threat to their sense of belonging, when math came easy to the participants, it increased their sense of belonging. An example, as stated clearly by Vanessa, read, "I love math because it comes so easy to me" (Math Autobiography). Ducke described being good at math as the reason for math being her favorite subject:

Duckie: I like math. That's my favorite subject actually.

Brooke: Okay. Why do you like It?

Duckie: Because I've always been good at it. And when I'm good at something I tend to like it more.

Having one's sense of competence impact their sense of belonging can create an ever-shifting sense of belonging. This can be seen in Shantel's (Interview 1) point:

Brooke: Do you feel that sense [of belonging] when you think about math?

Shantel: Kind of. It depends on, like, what in math we're doing. If it's like something really hard and stuff that it's like hard for me to understand, then no.

According to SDT, competence, autonomy, and relatedness or belonging are interrelated. As I examined the participants' comments regarding competence as a source of belonging, competence appears to be viewed as a prerequisite to belonging. This finding aligns with a similar finding in my previous study with a different group of Black girls in middle school (Harris-Thomas, 2022). In both studies, the Black girls look to

their academic achievement and overall ease of academic success as an indicator of their overall math competence and therefore, a determiner as to whether they belong in math.

There are few studies that look at how belonging and competence may interact with one another, particularly within a STEM setting. The following studies are related to belonging, STEM identity, and competency. In a study by Barbieri and Miller-Cotto (2021), an ethnically and racially diverse sample of middle school students' (*n*=206) sense of belonging in mathematics was examined. The authors found that "Belonging and identity may be related enough that their development may have similar contributors. In the current study, we find that student's sense of belonging is related to their performance, interest, importance, self-concept, and lack of entity view (Barbieri & Miller-Cotto, 2021, p. 7). While in a study with middle school boys, Berry and colleagues (2011) found that computational fluency by the third grade seemed to influence students' mathematics identity, noting that the speed and proficiency with which they gained the skills directly correlated to their level of identification with math.

Finally, in a study by Rainey and colleagues (2018), college students were asked how their race and gender influenced their decision to major in a STEM field. One finding from this study was that competence did influence the participants' sense of belonging or lack thereof. The participants described that as they were able to communicate their understanding and also obtain "good grades", their sense of belonging increased, yet if they struggled to grasp a concept, it was cited as a reason for not feeling a sense of belonging. This aligns with the view of the Black girls in this study.

These studies and the relatedness between the sense of belonging, academic performance, and self-concept begin to form a foundation to examine further whether the

role of competence in relation to a sense of belonging in math is unique to middle school Black girls or also found in other groups of peers.

Teachers as a Source of Belonging

Every participant in this study referenced at least one teacher as either supporting or thwarting their sense of belonging within the math classroom. Positive teacher-student relationships, characterized by respect, kindness, and connection, can increase students' sense of belonging. This theme is defined as *considering the relational strength between a student and their math teacher as an indicator of belonging.* The participants shared their examples of this dynamic. First, Stephanie (Interview 1) shared:

> I remember in like fifth, fourth, or fifth grade. I was, it was actually virtual zoom. And, I had got like a question right. And my teacher said I did a really good job. That made me feel kind of happy because I feel like I belonged, and it made me like happy cuz like she kind of was praising me.

Stephanie's teacher encouraged her, impacting her sense of belonging and enjoyment in math class. On the other hand, if the participants felt the teacher was ignoring them or not offering them the attention or help they needed, it negatively impacted their sense of belonging. Dannie shared a negative experience of the teacher not helping her in her math class. She stated, "Hmm. Like whenever I don't feel belonging in math classes. Like whenever I ask her [the teacher] a question and then like she goes straight over to another person, and she doesn't answer my question" (Interview 2).

In recent studies examining the motivation and value of mathematics, Black girls were found to value math and be motivated to learn math as their peers (Barbieri & Miller-Cotto, 2021; Allen et al., 2021). This desire to really learn the content was repeated by multiple

participants. For example, Dannie's math autobiography, she states, "I like my math teacher this year. She is really nice. When I walk in her class, I am already ready to learn. I am so glad to be signed up for this [the study]. Math makes me so happy for some reason." Naomi's comments exemplify this desire for her teachers to help her learn the material and not just give her answers:

> **Brooke**: Like what would you be looking for, looking to feel or have if you felt like you really belonged at school? How would you know?
>
> **Naomi**: Like just having a few friends that I know that care about me. And just like having teachers that I know they can like, help me with my work and because like back in sixth and fifth I think... Yeah. Sixth and fifth, like some of the teachers, they just came and told me the answers. So like, I asked my mom for help and I didn't really understand the stuff. So like, basically whenever I like come into school, I just hope there's teachers that'll like actually explain the stuff to me instead of just like giving answers.

Aubriella expresses a similar desire to be supported and not given the answer:

> **Brooke**: Anything else that you would want from your teacher
>
> **Aubriella**: To explain things better. Cause not everybody explains it well for you to understand.
>
> **Brooke**: Yeah. What about if you have questions and stuff, what would you want from your teacher?
>
> **Aubriella**: To help me. Not to give me the answer, but to help me with this so I can understand it.

It is evident from these comments that the participants view their teachers as essential sources of knowledge acquisition and desire the opportunity to gain an understanding of the math

content being taught. Prior literature emphasizes the tremendous impact that teachers can have on their student's sense of belonging in general and specifically within the math classroom. Whether studies are encouraging teachers to exhibit caring and culturally responsive approaches to structuring their classrooms (Maloney & Matthews, (2020) or laying out design principles or instructional practices that teachers can utilize to support students' opportunities to belong (Gray et al., 2022), the literature supports the enduring nature of teacher's influence on students' experiences within the math classroom.

Peer Social Connections as a Source of Belonging

This theme examines the relational dynamics within the math classroom between the participants and their peers. This theme is defined as *considering the presence and nature of peer relationships, including friendships, as an indicator of belonging* To begin, we look at general peer interactions, then we will look at dynamics among their friends. According to Stage-Environment Fit Theory (Eccles & Midgley 1989; Eccles et al, 1993), developmentally, adolescents seek more independence outside their homes. Their desire for their peer's approval also increases during this time, which helps frame why peer social connections are a salient source of belonging for adolescents in middle school. Who is present in the participants' math classes plays a large role in their comfort and sense of belonging in that class. Shantel puts it this way:

> **Brooke**: Who are the groups of people that make you, that help you feel like you belong at school?

> **Shantel**: Well, the people that I be with in math, I feel like I belong with them. And then it's just like, depends on the class. Depends on the people that are in there.

When the participants are in a class with people they enjoy and get along with, it helps make the learning environment fun and engaging. Since Duckie got along with her classmates, them being on the same team (meaning they go to all of their core classes together) helped her feel more comfortable as a whole:

> Because I had the same kids in my class all year. With every class. It was just funny. Because we always got- we all got along so well because we had to deal with each other all year. So then we made it funny (Interview, 1).

Experiences outside of the math classroom also impact students' overall sense of belonging that is carried with them into the classroom. Naomi shared her negative experiences with some of her peers:

> One thing that makes it like go down is like I said, the kids here that like really rude and disrespectful. So like whenever they say rude things in the hallway- so like a lot of people they don't like me so they like call me rude things or whatever, me and my friend. So that kind of just makes it [sense of belonging] go down (Interview 2).

Friends as a Source of Belonging. In specifically looking at what the participants had to say about their friends' influence on their sense of belonging, many girls reported that even simply seeing their friends briefly in the hallway, let alone being in class with them, helped increase their sense of belonging and overall enjoyment of being in math class.

> When it [sense of belonging] does change, it's usually when I see one of my friends in the hallways and stuff. Like, I'll say hi to her and stuff like that. It makes me feel like I belong more and I'll be like, I'll be more myself more around her because she knows- I've gotten close to her (Vanessa, Interview 1).

On another positive note, Naomi has class with a few of her friends, and it has been a source of belonging and joy:

> **Brooke**: Is there any other group of people or person that you think of when you think about feeling like a belonging at school?
>
> **Naomi**: I have these other three friends… and I think we have like maybe two or three classes together. It's just like every time we get around and we talk to each other, we all like have the same personality and like humor and stuff. Yeah. So it's like really fun around them and I'll like come to school to just to see them. It's like fun learning with them and stuff.

Being in class with friends seemed to create an environment where the participants feel like they are known, can be themselves, felt comfortable, and enjoy the connection and math content. The opposite also rang true for students without friends or acquaintances in their math classes. Jaylynn shared her thoughts on being in class with friends:

> **Brooke:** What do you think makes that first class a place that you do not feel like you belong?
>
> **Jaylynn**: Because it's quiet and I hate quiet <laugh> and I don't, I have like, like I don't have that much friends in here and we're not allowed to talk, so it's just like- I don't like it.

Imani expressed a parallel thought on not having friends in her class when she said, “I know like what it feels like cuz like, it's just some classes I have like there, I have like none of my friends in really and that's just so odd. Like, ugh, I just hate it” (Interview 2).

The opportunity to learn communally has been connected to increased student belonging, motivation, and overall engagement (Boykin, 1986; Gray et al., 2020). Being in class with friends and/or among peers that the participants get along with can create an environment where the learning occurs communally. Students often shared that they could work in groups in their math classes, and most viewed this strategy as a positive experience. Dannie shared in her math autobiography that one of her favorite parts of her previous math class was being able to do group activities. Jackie shared that she “also loved partner work and not having to work alone” (Math Autobiography). The one caveat was being able to choose their partners or groups. “I pick the people that actually do work and don't just sit there and then ask for the answers” (Duckie, Interview 1).

Prior research not only supports the idea that students’ social connections are important for their overall sense of belonging but also that friendships influence adolescents’ sense of belonging and motivation (Goodenow & Grady, 1993; Ham & Faircloth, 2005; Lim, 2008).

Academic Support as a Source of Belonging

Connecting back to the reality that Black girls are often eager to learn (Barbieri & Miller-Cotto, 2021; Allen et al., 2021), each participant placed a high and consistent priority on having access to academic help within their math classes. This theme is defined as *considering one’s access to academic support within a supportive environment from peers and teachers as an indicator of belonging.* Whether from the teacher or a trusted peer, the participants needed to feel

they had support when it came to their mathematics learning. Vanessa expresses this very clearly: "I felt like, ‘oh my gosh, I don't belong here. It's too hard’. But then it started getting easier when I tell [the teacher] and like she started like teaching us like one on one sometimes (Interview 1). In line with receiving academic support from the teacher, Jackie shared her positive experience:

> Some of my teachers try to help me as much as they can. I think that makes it easier for me at school. And some teachers are like, they have a mixture of fun and serious, so it like makes it more- it makes it like, we still get to learn but we also get to have a little bit more fun, so (Interview 1).

In another positive experience with their math teacher, Aubriella shares:

> So my 4th grade year was probably my favorite. I understood my work very well and thats where I met my best friend but anyway the only thing I struggled with was fractions. They were my worst enemy but with the help of my favorite math teacher, I easily learned how fractions work and you might be asking why was he your favorite math teacher. For me, he made math seem fun to where you actually wanna participate (Math Autobiography).

In contrast, if the teacher is busy or unable to help immediately, having a trusted, knowledgeable friend can make all the difference. Aubriella acknowledged the help she receives from her friend when she said:

> **Brooke**: Why does having friends in the math class make it better?
>
> **Aubriella**: People that I could talk to or in case the teacher's helping somebody else, I can ask them. They can help me

Naomi shared a very similar sentiment:

> Even like if the teachers don't help, I also like ask, I ask my friends for help or I help them, like I want to help out with them or they, I want them to help out with me (Naomi, Interview 1).

Naomi references an idea within belonging literature that there is a both/and that is helpful when present regarding giving and receiving help. Students want to feel like they are receiving support but also that they can contribute support to their micro math-class community (Booker & Lim, 2018; Gray et al., 2018; Harris-Thomas, 2022).

Lastly, Jaylynn brings up a final point regarding asking for help and receiving academic support in math class. Jaylynn says:

> **Brooke**: What do you think it means when someone says they feel like they belong in math class?
>
> **Jaylynn**: They fit in and they can ask questions without having like feeling like dumb or weird about it.

The instructional strategy of creating an environment where students are safe to be wrong (Matthews et al., 2022) is an important element of asking for and receiving academic support. Though the teacher may be facilitating such an environment, students and their ability to extend understanding and restraint when a peer messes up contribute greatly to a sense of safety to be wrong. This is a priority for the participants, as expressed by the following comments:

> Like, being able to know that like when the teacher says so and so, there's only a few people who got a 80 on the quiz and that being able to know like, oh yeah, I'm one of the people who got an 80 mm-hmm. <affirmative>. And then being able be like, raise your hand and when you don't get the question why nobody laughs or nothing like that (Stephanie, Interview 1).

> No, they're very accepting. If you get it wrong, like mm-hmm. <affirmative>, maybe a few kids are just doing it to be doing it. They'll laugh. Yeah. But like other people are like, oh well you'll get it next time. Or like, oh, I know I wasn't gonna get it, so I might as well not even laugh or just....I just keep it to myself. Yes. And a teacher will give you a second chance like, oh, well fix this and then try it again (Vanessa, Interview 1).
>
> And they can ask questions without having like feeling like dumb or weird about it. And if you feel like you are able to ask for help and you won't like, feel embarrassed about it. Yes. Or stuff like that. If you feel like you can ask for help and you'll get the help you need and you won't be embarrassed by asking for help. Yes. Or think you're just not smart enough (Jaylynn, Interview 1).

Summary. The four sources of belonging tap into the participants' academic achievement (competence and academic support) and their interpersonal relationships (teachers and social interactions). Although looking to teachers, peers, and the level of academic support were aligned with prior literatrure, the participants added in the perception of themselves as competent in math as an important consideration in their sense of belonging.

RQ 3: To what extent do Black girls in middle school see their ERI impacting their experience of belonging in the math classroom?

According to prior literature on ERI development across the lifespan, the salience of one's ethnic-racial identity will vary greatly during adolescence (Sellers et al., 1998; Umaña-Taylor et al., 2014; Williams et al., 2020). This variety in salience was evident when participants were invited to reflect on the impact they believed their ERI had on their experiences of belonging within their math classrooms. When asked directly, most participants (nine out of ten)

stated that they did not see their ERI impacting their sense of belonging in their math classes., Yet, as the interviews continued, half of the participants identified examples of when their ERI was highlighted (negatively) in their math classes, while the remaining participants shared examples of their ERI impacting their experiences at school more broadly. Therefore, the answer to this research question varies along a developmental continuum, the degree to which the participants have language to identify and express how their ERI affects their lives, the participants' prior experiences, the math classrooms' ethnic-racial setting, and the strength of the relationship between the teacher and themselves.

Two broad themes emerged in response to RQ3. The first theme centered on why the participants stated that their ERI did not impact their sense of belonging in math. The two reasons given were either their teacher was perceived as treating all students the same, or the participants were in a class with mostly Black students. The second theme centered on the participants' stories regarding how their ERI did in fact impact their sense of belonging in math. The two reasons given were either their teacher was not treating them and/or their same ethnic-race peers fairly, or they were only one of a few Black students (or the only Black student) in the math class. It was evident that when further probed, all participants considered their math experiences from a racialized lens and deemed their math classes to be either welcoming or unwelcoming based primarily on how their teacher interacted with them and others of the same ERI. This connects to prior literature, which found that Black college students' sense of belonging was affected by how they were treated individually and their perception of whether their same ethnic-racial group also belonged in a particular space (Walton & Cohen, 2007).

I Do Not Have to Think About My ERI in My Math Class…

Research on ERI development in adolescents states that the degree of saliency will vary, often depending on the quantity and nature of identity-relevant experiences the adolescent has had, such as discrimination or being a numerical minority within a setting (Umaña-Taylor et al., 2014; Williams et al., 2020). This theme is defined as *the feeling that one's ERI is not negatively centered within the math classroom.* In this study, the participants that did not have current or on-going discriminatory experiences within their math classes were likely not being prompted to think about their ERI within this particular space. It is important to note that saliency is context-bound, therefore while some participants' ERI was not salient in their math class, their ERI could be very salient in another context, such as a dance class where they are the only Black girl (Williams et al., 2020).

The following two sections examine how the teachers' actions and the class's ethnic-racial make-up impacted the participants' perception of their ERI's role on their sense of belonging in math.

Because the teacher treats everyone the same. "I feel like in my math class everybody is treated the same" (Jaylynn, Interview 2) was a sentiment expressed by multiple participants (Imani, Jackie, Jaylynn, Vanessa). When the participants perceived that their math teachers treated all students fairly, the mental space used to navigate whether their ERI is accepted and valued is freed up to be allocated elsewhere, such as learning. Vanessa expressed how being treated fairly gives room to focus on the purpose for being there, which is to learn: "It kind of feels like [everyone is treated] the same- like, we're all there for one reason, to just learn" (Vanessa, Interview 2). Jackie also makes a connection between experiencing a fair math environment with learning when she shared the following experience: "I haven't dealt with much

unfairness from math teachers in the past. I felt in the past, we learned so much, but it was still fun. We weren't piled with so much work and still had time to do stuff" (Jackie, Math Autobiography). During her second interview, Jackie goes on to say that she does not feel like being Black has impacted her sense of belonging in math: "No, I don't. Not for me. I feel like some people think teachers do it [treat students unfairly] cuz they're Black or so. But for me, I'm just like- no" (Jackie, Interview 2). The participants' responses align with the ERI developmental viewpoint that some environments do not activate or increase adolescents' racial salience (Sellers, 1998).

Because there are mostly Black students in the class. Another reason given for the participants not thinking about their ERI in their math class was due to the ethnic-racial makeup of the class. Perceiving that there is a critical mass of same-race peers seemed to create a sense of comfort for the participants (Benner & Crosnoe, 2011; Juvonen, 2017). Shantel spoke to this idea directly when she was asked whether her ERI impacted her math class: "Well, not for me, no. Because, a lot of the math classes I've been in, most of the kids in my class were the same color" (Interview 2). Jaylynn noted that being in class with other Black students created a math environment rich with friendships:

> **Brooke**: Now, as a black girl, do you ever feel like being Black plays any kind of role or impacts how you experience your math class? Thinking back over the years?
>
> **Jaylynn**: Not me, personally. I don't think… no. Because in all my classes, it's like a variety of Black people in there. So, it's just like we're all friends. Like everybody in my class, we're all friends. (Interview 1)

Further reiterating the point that negative racialized experiences often make individuals' ERI more salient within that context, Imani draws out the impact of racism and ERI, as well as the sense of safety that comes with not being a numerical minority within the math classroom:

> **Brooke**: Do you think that you being a Black girl makes any difference in your math experiences?
>
> **Imani**: Yes. If it's a racist teacher, but I don't think my teacher's racist. Most of the kids in her class are Black. (Interview 2)

Imani perceived a connection between the teacher not being racist and the number of Black students in her class. This aligns with prior research that found Black women utilizing same-race peer friendships and group connections as a buffer against racism in STEM programs at the collegiate level (Morton & Parsons, 2017).

I Do Have to Think About My ERI in My Math Class…

As mentioned above, experiencing negative racialized experiences often prompt adolescents to consider their ERI more concretely (Sellers et al., 1998; Umaña-Taylor et al., 2014; Williams et al., 2020). This theme is described as *the feeling that one's ERI is negatively centered within the math classroom.* A few participants shared that they only think about their ERI in connection to negative racialized experiences. For example, Shantel shared her thought process regarding the importance of her race and gender:

> **Brooke**: Do you think about your race and gender that much throughout your day?
>
> **Shantel**: Yeah.
>
> **Brooke**: Yes. Do those pieces matter to you?

Shantel: Well, they didn't really before, but like, as I got older and I got darker, like people used to like, comment on it. So like I started noticing it then, but I don't have a problem with it now like I used to.

Brooke: Okay.

Shantel: Yes. So, it used to be very important to me, but it's not really anymore (Interview 2).

Naomi said she only thinks about ERI when she remembers a prior experience as one of a few Black students in her class.

> I mean, I don't think about them [her ethnicity and gender] that much because I don't really have those problems anymore. But I do think about them like occasionally whenever going back to my past and things (Interview 2).

The stories and reasonings shared for moments when the participants were prompted to think about their ERI within their math classes centered around moments when 1) their teacher was not treating them and/or members of their race/ethnicity fairly or 2) they were the only one or one of a few Black students in the classroom.

Because the teacher treats me unfairly. The participants shared examples of times when they perceived their teacher not treating them fairly, implying this was racially motivated. For example, when a teacher did not help Duckie while she was completing her math retakes, she perceived unfair treatment as compared to her peers:

Brooke: Do you feel like being Black impacts your sense of belonging in math?

Duckie: Sometimes it feels like it

Brooke: Yeah. Tell me about it. Like, what do you mean?

Duckie: Well, one time we were taking retakes and I didn't know how to do this problem and she was like, ‘Well, that's the problem. You need to learn how to do it. You can't just always ask for help’. When I never really ask for help. It was like, one of the first times I've asked for help. And like, I didn't understand how to do it because the people in my class are loud. It's like I barely can hear her, and it was just like, okay, whatever. So I skipped that question.

Brooke: And so you felt like maybe her response could have been racially motivated?

Duckie: Kind of.

Brooke: Have you seen her reacting differently to other ethnicities, would you say?

Duckie: Sometimes. Maybe a little. (Interview 2)

In another example, Jaylynn shared that she had a teacher in elementary school that treated her unfairly and eventually moved out of that teacher’s class.

Brooke: In your math autobiography, you walked about your second-grade teacher. Was your second-grade teacher a good math teacher, would you say?

Jaylynn: Um, not to be rude, but I hated her.

Brooke: Oh. Why?

Jaylynn: I got suspended in second grade.

Brooke: Really? What did you get suspended for?

Jaylynn: I threw chairs around the classroom.

Brooke: So what did you not like about that teacher?

Jaylynn: I felt that she was racist. They moved me classes though.

Brooke: They did? And it got better?

Jaylynn: Yeah. (Interview 1)

In addition to the direct actions and words of the teacher towards the participants, the environment the teacher creates with the images, music, and examples she or he uses around the class can also create a belonging-thwarting environment. When asked whether being Black had impacted Stephanie's belonging in math, she shared the following story:

Stephanie: Maybe a little bit. Um, I don't have a specific time, but maybe a little bit.

Brooke: Okay. So, what do you think makes you kind of feel that way? Like, I know you said you don't have a specific time, but where do you think that thought is coming from?

Stephanie: Like, kind of my third-grade teacher. She had a picture of Donald Trump in her room, so it was kind of like a trigger, like she might be kind of…[trails off]. yeah. So, I feel like sometimes I raise my hand in class, and she wouldn't pick on me because of that, but yes. It's not like for sure. It just felt like it."

The image of President Trump being hung up in the classroom led Stephanie to assume a certain level of disregard for her identity as a Black girl within that space. When the teacher's actions were not affirming, Stephanie drew conclusions reiterating this assumption.

These negative racialized experiences created an experience that highlighted the participants' ERI within the math classroom, each in negative way. This study did not focus on the teachers' view of the participants' character and achievement, but it was clear that the environment math teachers create in their classrooms has a significant impact on Black girls'

opportunities to belong within math. This emphasis on teacher actions and support aligns with teachers an important source of belonging which was mentioned above.

Because I am only one or one of a few Black students in the class.

When discussing instances of noticing their ERI in their math classes, multiple participants mentioned their noticing in conjunction with being the only Black student or one of a few Black students in their math class. The response to this reality differed among the participants based on whether they were the only Black student in the class or if there were more than one other Black student in the class. For example, in an out-of-school experience, Imani shared a parallel story, "I was doing this one thing and it was like mostly white girls. I was like, 'Okay. But there was like a couple black girls. I was like, 'Okay, I'm good.'" (Interview 1). While Naomi, whose Algebra class had five Black students out of 26 students, found comfort in the fact that there were "like a handful of us in there so, I don't really feel weird about it" (Interview 1). In contrast, later in her interview, Naomi shared a story about being the only Black girl in her school.

Brooke: Do you think being Black plays any kind of role in how you feel about math or how you experience math?

Naomi: No, I mean like whenever I was in elementary school, I went to [a private school] for a few years.

Brooke: Oh yeah?

Naomi: Yeah. And I was like the only Black girl.

Brooke: Yes.

Naomi: So it was kind of like hard because they kind of made fun of my skin. But like, then I moved schools and it kind of got better because I was like more around people that look like me. (Interview 2)

For Naomi, having a "hand full of us [Black students] in there" as opposed to being the only Black girl in a classroom made a difference regarding her sense of belonging within the classroom.

When Jaylynn was asked if her ERI impacted her sense of belonging in math, she replied, "No, but it might impact other people. If you're like the only Black person in there, then that would like, it's weird" (Interview 2). Her perception was that being the only Black person in the class would likely create a more negative experience.

Duckie also shared that being in a school where there are not many Black students was a negative experience:

Duckie: Well, kind of my old school before I moved here.

Brooke: Okay. What was the situation?

Duckie: There wasn't a lot of mixed or Black kids there.

Brooke: Yeah.

Duckie: There just wasn't a lot of mixed or Black kids in that town.

Brooke: Okay. So it kind of made you feel like you stood out sometimes?

Duckie: Yeah.

Though the exact number appears to vary based on the setting, having a critical mass of same-race peers in the math classroom can be a buffer against negative racialized experiences and a source of friendship and belonging within the math classroom. It was

also clear that being the only or one of a couple of Black students seemed to create a more stressful, less belonging supportive environment.

Summary. The Black girls in this study held varied views of the role their ERI played regarding their sense of belonging in their math classes. The answer was primarily rooted in the social dynamic created within their math classroom, namely, the eway the teacher treated them and their peers and the ethnic-racial make up of the classroom. These factors appeard to either center or decenter their ERI in response to the degree to which the participants felt their ERI was threatened or safe.

RQ 4: To what extent do Black girls in middle school see their general school experiences impacting their experience of belonging in the math classroom?

In seeking to understand whether additional factors impacted the belonging experiences of Black girls in middle school, RQ4 remained quite open-ended for the participants to direct the outcome. A few students, Duckie and Aubriella, did not feel their sense of belonging and focus in their math class was influenced by outside factors. Yet, the remaining eight participants felt that things happening outside of the math classroom generally impact them inside the math classroom but did not coalesce around a particular set of factors that would rise to the salience of a theme. There was also not an explicit focus on how these factors impacted the participants' sense of belonging. The participants seemed more so to talk about these outside factors impacting their ability or desire to engage with the math content. Nonetheless, I present a snapshot of the factors the participants highlighted to support future research that might examine how these factors contribute to or detract from a sense of belonging and engagement within the math classroom for Black girls in middle school.

Social Experiences Before Math Class

Multiple participants talked about the fact that their relational dynamics and experiences sometimes impact their ability to focus in their math class. Additionally, if the participants engage in an interaction that frustrates them in the hallway before class, it can also impact their mood inside the math classroom. Naomi talked about this dynamic with the art class she has right before math:

> Sometimes. Not like all the time, but sometimes in the period right before math I have art and then there's like lots of kids and they don't get along with each other. And it like really stresses me. So whenever I go to math class it just feels stressed because like things that happen before that class (Interview 1).

The participants' experiences in the class before their math class can impact their mood or willingness to engage in the math class. "Like if I'm mad, I'm gonna be mad at every single class. Like when it's time I'm gonna in math and I'm not gonna listen. I'm just gonna go to sleep" (Jaylynn, Interview 1). Similarly, Naomi shared:

> Sometimes, not like all the time, but sometimes in the period right before math, I have art and then there's like lots of kids and they don't get along with each other. And it like really stresses me. So, whenever I go to math class, it just feels stressed because like things that happen before that class. You're just paying attention to everything else (Interview 1).

Finally, Imani added her perspective when she described her mood being impacted by someone making her mad before class. She stated, "Yeah, because like if you like make somebody mad before class, that's not good... that affects your mood inside math class" (Interview 1).

Timing of the Math Class

The time of day and the sequence in which the participants' classes are placed impacted some participants' willingness and ability to engage in the math content. Participants taking math earlier in the day seemed to notice fewer distractions that could impact their focus. In contrast, taking math near the end of the day was more likely to impact their focus negatively, and their attention has shifted to wanting to go home or whatever activities are coming up after school. Jackie described it like this:

> I think it's cuz like my math class is at the end of the day, so I kind of just like want to go home at that time. So I'm just, yeah, not really in the mood for it. Maybe if it was at a different time that [might] changed what I think about it, like if it was like first period or something (Interview 1).

Vanessa shared a similar sentiment when she was asked whether things happening outside of her math class impact her inside her math class. She answered: "Since I have math third period, not really, cuz I not much happens those first few periods. But I'll like walk into math like super happy, like I'll just be happy" (Interview 2).

Future studies may want to consider the impact the time of day the math class is taken has on students' sense of belonging and engagement. Additionally, Black girls in advanced classes offered during only particular hours may fall into a cohort, taking the same classes with the same peers throughout their school day. Depending on the social dynamic of that group, this rhythm could negatively or positively influence middle school Black girls' sense of belonging throughout their day.

School-Wide Events

The last factor mentioned were school wide events, both planned and unplanned, that capture the attention of most of the students in the school. The example given was a fight between students. Word of a fight travels quickly in this school and causes students to become distracted and focused on the details of the event. Shantel shared this example when she said,

> Like if there was like a fight or something, everybody in class says what everybody would be focused on in the classroom. Certain things like, like bigger things that happen at the school. If that happens outside the classroom, they talk about it in the classroom" (Interview 1).

Shantel was the only participant to talk about how a fight might impact their experience in their math class. Future research may want to consider how school assemblies, field trips, unplanned fire drills, etc., may also create a changed dynamic within the math classroom for a limited amount of time.

Summary. In prior studies looking at external influences on participants' sense of belonging, there were a variety of factors considered. In a study by Lewis and colleagues (2016), the participants were undergraduate students that identified social supports outside of their classroom, access to recourses, and social ties as additional sources of belonging. Further, Leaper (2014), in a review of women and girls' sense of belonging in STEM, found that beyond peer relationships, family members, romantic relationships, and role models in the media influenced women and girls' sense of belonging within the STEM space. These studies point to the wide and somewhat ambiguous effect "outside influences" have on a student's sense of belonging within the math classroom. Further research is needed to identify which factors are most important to Black girls and in what setting those factors are considered.

Conclusion

In a phenomenological study, the researcher aims to provide a sense of the participants' lived experiences regarding, in this case, their sense of belonging within their math classrooms. The results described above demonstrate the nuance and intragroup differences that make up a complex conceptualization of belonging within the math classroom according to this group of 7th-grade Black girls. From fitting in and being oneself to looking to teachers, peers, and academic support as sources of belonging, much of the prior research on belonging is supported. Yet, important new threads emerged, such as competence as a source of belonging and the role of one's own desire to belong. Though the ERI of the participants as Black girls certainly influence their experiences of belonging within their math class, the results reiterate that racial salience is on a developmental continuum that is affected by the nature and strength of racialized experiences within a specific setting. The results add a needed dimension and exposition to the belonging and schooling experiences of middle school Black girls within the math classroom.

CHAPTER 5: DISCUSSION & IMPLICATIONS

"Overall, I want to learn in math and get back on track. I want to learn and get my work done on time. I want to do better because ***I know I can. I've always loved math, and I want to love it again****" (Shantel, Math Autobiography).*

Rooted in an Axiom of Black Brilliance (Gholson et al., 2012), this dissertation examined how 10 Black girls in 7th grade viewed the construct of belonging, sources of belonging, and additional contributors to their overall sense of belonging within the math classroom. Considering the context-bound nature of belonging (Allen et al., 2021; Baumeister & Leary, 1995; Gray et al., 2022), using a PVEST and intersectional framework created opportunities to consider how the participants' multiple identities, past experiences, and current context contributed to their conceptualizations and experiences with belonging in the math classroom. Using a race-reimaged lens, this study also considered the accuracy of current conceptualizations of belonging and allowed the participants to add, subtract, or bring nuance to this psychological construct.

Understanding how Black girls in middle school understand and experience belonging is important because belonging is associated with many positive outcomes within the school setting, such as increased well-being, engagement, achievement, and persistence over time (Allen et al., 2018; Anderman, 2003; Goodenow & Grady, 1993; Juvonen, 2006; Matthews et al., 2014; Vargas-Madriz & Konishi, 2021). These positive outcomes can contribute to the persistence of Black women within STEM fields (Johnson et al., 2019), which is particularly important to the goal of broadening the participation of underrepresented individuals within STEM fields (Envisioning the Future of NSF EPSCoR Final Report, 2022). This final chapter will include a summary of the findings, subsequent implications for theory and practice, an examination of limitations, and directions for future research.

Discussion and Implications

Based on the results of this study, it was evident that the participants viewed the construct of belonging and its sources from a more nuanced lens compared to the way belonging is most often studied. The following section elaborates on where the results align with prior literature, where the Black girls in this study offered unique considerations and implications related to each specific research question.

RQ 1: How do Black girls in middle school describe the construct of belonging?

The participants saw belonging as both an internal and external experience and conceptualized the construct as *fitting in, being yourself, having positive social supports,* and *wanting to be there.* The majority of these conceptualizations align with how belonging has commonly been understood, which emphasizes being accepted, respected, included, supported, and having opportunities to contribute (Goodenow, 1993; Gray, 2017; Healey & Stroman, 2020; Walton et al., 2012). Internally, the participants describe belonging as having the psychological space to be yourself within a context of which you also want to be a part. Externally, belonging meant you fit in within that specific context and experience positive social connections. Further, the participants emphasized the importance of being authentically themselves and not feeling like they had to wear a mask to show up in their math classes.

The participants also emphasized the individual's role in determining whether they belong. This was an unexpected finding because prior literature does not highlight this internal examination as a contributor to students' sense of belonging. This finding suggests that there is an interaction between the individual's internal desire to belong resulting in two possible orientations towards belonging that would require different

types of support within the academic setting. Using the math classroom as an example, there could be a scenario in which a student's math class is welcoming and belonging-supportive, yet the student does not *want* to belong within that space. Or, there could be a scenario in which the students' math classroom is not welcoming and is actively working against their sense of belonging, but the students' internal drive to belong results in a continued effort to find belonging in the math class. The interventions to support these two students' sense of belonging within the math classroom would look very different depending on their internal positioning toward the class. Though belonging is considered a universal need (Maslow, 1968), this assumption has boundedness in that an individual will likely not want to belong within every space, subject, group, etc. Therefore, the idea that a desire to belong within a specific context may precede being able to feel a sense of belonging or capitalize on the opportunities to belong. The role of autonomy in establishing belonging will be discussed further as a theoretical implication.

The degree of alignment between the historical conceptualization of belonging and how the Black girls in this study conceptualized belonging reiterates the value of educators fostering a sense of belonging in the classroom for all students. Yet, it was important not to begin this study with the assumption that the participants and I shared the same conceptualization of belonging. By being curious about their ways of understanding belonging, an added dimension was highlighted which may not have been drawn out otherwise. Knowing how Black girls in 7th grade conceptualize belonging can allow for a more accurate examination of whether a particular learning space is set up to foster their belonging. Additionally, identifying the multiple terms or layers of belonging (i.e., fitting in, being yourself, feeling supported, and wanting to be there) could also give

language to how Black girls are or are not feeling a sense of belonging within their math classrooms.

RQ 2: What do Black girls in middle school view as sources of belonging within the math classroom?

In response to various questions aimed at identifying what the Black girls in this study viewed as sources of belonging, the participants reiterated *competence, teachers, peer social connections*, especially *friendships*, and *academic support* as their main determiners. Viewing teachers (Maloney & Matthews, 2020), peer social connections and friendships (Goodenow & Grady, 1993; Ham & Faircloth, 2005; Lim, 2008), and academic support (Booker & Lim, 2018; Harris-Thomas, 2022; Matthews et al., 2022) as sources of belonging support aligned with the literature on belonging supportive practices. Due to the socially constructed nature of belonging, it is not surprising that the participants would emphasize these social connections and interactions as having an influence on their sense of belonging (Booker, 2004; Ibourk et al., 2020; Lewis et al., 2016).

Looking specifically at academic support, the participants identified their teachers and friends as the primary people offering academic support. The benefit of drawing out academic support as a source of belonging rather than including it under the teacher and student themes is that it opens the door in the future to explore other sources of academic support that may be or become salient to the participants, whether that is a tutor, a coach, or a parent, for example. Additionally, looking at academic support from peers as a source of belonging highlights the fact that students' academic and social goals can be aligned in the classroom and that peer relationships should not be viewed solely as sources of distraction or as competing goals within

classrooms (Roseth et al., 2008). These ideas highlight the potential value of supporting and facilitating opportunities for students to work together within the math classroom.

A surprising theme from this research question was competence as a vital source of belonging. Each participant shared multiple examples of how their competence or lack thereof in the math classroom influenced their sense of belonging (i.e., test scores, how quickly concepts are understood, or doing better than their peers). This created an awareness that their sense of belonging seemed to fluctuate with the changing math content throughout the year. Shantel's answer to whether she feels like she belongs in math makes this process clear:

> **Brooke:** Do you feel that sense [of belonging] when you think about math?
>
> **Shantel**: Um, kind of. It depends on like what in math we're doing. If it's like something really hard, and stuff that it's like hard for me to understand, then no (Interview 2).

A few prior studies found belonging and competence to be associated with one another (Barbieri & Miller-Cotto, 2021; Berry et al., 2011; Rainey et al., 2018), but the nature or directionality of this association is unclear. These prior studies also do not answer whether this association between competence and belonging is more salient for any particular group of students. The results of this study indicated the importance of competence to the Black girls in this study, warranting further examination in the future.

Knowing what sources of belonging the Black girls in this study looked to in their estimation of their sense of belonging in their math classes is a guide for future research and teacher practices. Each source represents a lane or prompt for educators to consider in designing supports that foster belonging for Black girls. For example, asking self-reflective questions such as, "How can I foster a sense of belonging through my academic support?" or "How can I foster

a sense of belonging through opportunities for peers to engage with one another?" or "How can I foster peer connections as a support for my students' belonging?" or "How can I talk about my students' math competence in a way that fosters their sense of belonging?" can inform how lessons are structured, as an example. Further, these identified sources of belonging are not mutually exclusive. For example, if the student's relationship with their teacher is poor, this likely will negatively impact their perception of being able to receive academic support. Therefore, future research might consider examining how these sources interact with one another or how they could or could not compensate for one another if one source is particularly weak.

RQ 3: To what extent do Black girls in middle school see their ERI impacting their experience of belonging in the math classroom?

The participants indicated a nuanced answer to research question three. Some participants did not feel their ERI impacted their sense of belonging, while others expressed stories of times when their ERI did impact their sense of belonging in their math class. This ingroup variation aligns with prior literature on ERI development in adolescents, which indicates that the degree of saliency will vary across the lifespan and in conjunction with identity-relevant experiences (Umaña-Taylor et al., 2014; Williams et al., 2020). It is important to highlight that all 7th-grade Black girls do not think the same or have the same experiences. This leads to variations in how they view and think about their ERI broadly and specifically within the math classroom. Though the participants stated that many did not believe that their ERI impacted their experience of belonging within the math classroom, a theme indicating that their ERI did impact their math experience emerged through their examples and stories. It was important not to assume past the participants' own determinations but to take in the whole picture of what was being shared. Through consideration of the participants' math autobiographies and experiences, it was evident

that many of the Black girls in this study were both aware of being Black within the math classroom and considered the safety of the environment to determine whether their ERI needed their attention.

The first theme addressed times when the Black girls' ERI was not central in their math class, partly due to the perception that their teacher treated everyone fairly or that most students in that math class were Black. Being treated fairly and being amongst same-ERI peers seemed to create a sense of safety for the participants in which they no longer needed to negotiate their ERI within the classroom (Benner & Crosnoe, 2011; Juvonen, 2017). The second theme addressed times when the Black girls' ERI was central in their math class, directly in relation to the perception that their math teacher was not treating them fairly or being the only or one of a few Black students in their math class. The negative experiences are also called identity-relevant experiences (Umaña-Taylor et al., 2014) in which the participants' ERI is perceived to be at the crux of the interaction.

It is important to recognize that the participants appeared to interpret my use of the word "impact" as meaning their ERI having a *negative* impact on their belonging in math when I asked, "Do you think your ERI impacts your belonging experience in math?" The following participant responses evidenced this:

- "Well, not for me. No, because, a lot of the math classes I've been in, most of the kids in my class were the same color" (Shantel, Interview 2).
- "No, I don't. Not for me. I feel like some people think teachers do it cuz they're Black or so, but for me, I'm just like... no" (Jackie, Interview 2).
- "No, but it might impact other people. If like you're like the only Black person in there, then that would like, it's weird" (Jaylynn, Interview 2)

- “No, I mean like whenever I was in elementary school I went to the [small private school] for a few years, and I had like, I was like the only Black girl. So it was kind of like hard because they kind of made fun of my skin. But, like, then I moved schools, and it kind of got better because I was like more around people that look like me” (Naomi, Interview 2).

The reasons given for saying that their ERI did not impact their math experiences were tied to either not having or no longer having negative racialized experiences within their math classes. Future studies should consider how to word or structure such questions that communicate a more neutral positioning to determine how the participants may view their ERI, leaving more room for sharing ways it could positively impact their belonging experiences within their math classes.

Additionally, to capture a sense of how salient the participants’ ERI was to them in general, they were asked to describe the most important things about themselves and how often they think about their ERI and gender throughout their school days. The participants' answers (Table 5) demonstrate that their ERI was not particularly salient within the school setting. This aligns with many participants’ notion that their ERI did not impact their sense of belonging in math.

Knowing there is variation in how Black girls may view the role their ERI may play in their sense of belonging in the math classroom should encourage caution in assuming that Black girls are struggling with racialized barriers such as stereotype threats within their math classes. The diligence needs to be in structuring a class environment that is culturally competent, accepting, and affirming of their authentic selves, which inadvertently can help thwart racialized barriers without exceptionalizing Black girls as a group that struggles.

Table 5

ERI Salience Questions and Answers

Name	What are Some Important Parts of Your Identity?	How Often Do You Think about your ERI?
Aubriella	Parents, Personality, & Her Thoughts	Not at all
Dannie	Her race	I don't know
Duckie	Family, Friends, & Being a cat person	Sometimes
Imani	How you treat others and family, How you're doing in school, & How life is going.	A lot
Jackie	Being on sports teams & Liking to read	Not really
Jaylynn	Personality, Being funny, Cheering up a room, Being smart, & Being loved	Sometimes
Naomi	Grades in school, Being asked to help others with school work, & Being a teacher's kid	Not that much
Shantel	Running track, How I look, & Being artistic	It depends
Stephanie	Being funny, Being quiet, & Playing volleyball	Not much
Vanessa	Being social, Her perception by others, & Family	Not that much

Note. Students were not given a limit on how many identity traits they could name.

RQ 4: To what extent do Black girls in middle school see their general school experiences impacting their experience of belonging in the math classroom?

The final research question cast a wide net in search of additional factors that may impact the participants' sense of belonging in the math classroom. The participants did not converge on a particular set of themes in answering this question, which leaves a few loose threads to consider in future research. Consideration of the impact of the time of day in which the participants are taking their math classes, the social experiences that are being had outside of the math class, and school-wide events were mentioned as external factors possibly impacting the participants' willingness or ability to focus and engage with the math content. If the participants

have had a particularly negative relationship or interaction with a student who is also in their math class, this can also negatively impact their sense of belonging within that math class.

Prior research examining impacting factors on students' sense of belonging identified social supports outside of their classroom, access to recourses, social ties such as peer relationships, family members, romantic relationships, and role models in the media can influence women and girls' sense of belonging within the STEM space (Leaper, 2014; Lewis et al., 2016). Examining additional or outside factors that may influence a sense of belonging in math needed to be more bounded. For example, considering out-of-school or familial factors could have produced more specific themes. Due to the inconclusive answer to this research question, there are no specific implications but rather starting points for future research to consider.

Implications

A limited number of studies examine Black girls' belonging within educational spaces, and throughout this study, I have made the case that it is vital to create space to hear directly from the voice and perspectives of Black girls. In reviewing the results above and the implications below, it is clear that their ways of knowing have added scope to our understanding of belonging by considering their own role in establishing their sense of belonging. The voices of Black girls in this study reiterate the value of prioritizing intersectional work that centralizes their identities, not only for the variety of experiences within Black girls but also for the changes and dimensions that emerge across their development.

This study provides needed insight into the educational experiences of 7th-grade Black girls by focusing specifically on their stories. Intentionally avoiding deficit language, narratives, and framings, this study reiterates the importance of studying Black girls through an asset-

oriented lens (Gholson & Martin, 2019; Joseph et al., 2017; Young et al., 2017). In the following sections, I discuss implications for theory and practice, drawing from the participants' recommendations and perceptions.

Implications for Theory

A primary goal of this paper was to use a race-reimaging lens to consider whether current theoretical conceptualizations of belonging aligned or diverged from how Black girls themselves understand the construct of belonging. The participants provided a nuanced definition of belonging, highlighting the cyclical nature of looking outward and inward as one determines whether one belongs. This study contributes to the belonging literature by drawing out how the Black girls in this study conceptualized belonging in ways that aligned with how belonging is often understood (Goodenow & Grady, 1993, Gray et al., 2018). Answering this question of whom this conceptualization represents helps identify the degree of confidence we can have in how belonging is conceptualized and its ability to also represent, to a degree, the thinking of Black girls. As the field continues to work to synthesize the many definitions and conceptualizations of belonging, knowing how Black girls view the construct helps add depth to the field's evaluation of such definitions.

Next, this dissertation study emphasizes how the participants' context, identities, and prior math experiences contribute to their current understanding of belonging within their math classes. Establishing a contextualized view helps underscore the situatedness of belonging and contributes insights as to why the construct can fluctuate over time and from setting to setting (Gray et al., 2022). This study also contributes to the literature by drawing out within-group differences among Black girls in how they view their ERI's role and belonging within the math classroom. Creating room for gradation among the participant's responses can serve as a

reminder of the variety of the participant's experiences and the value of looking across participants within a single ethnic-racial and gender category. This study also allows differences to be established among Black boys and girls and how they prefer to be supported within their math classes.

Self Determination Theory. The findings of this study highlighted the dynamic and contextualized nature of belonging, which has the potential to influence how the field views other motivational concepts and theories, such as SDT, interest, and expectancy value's cost construct. Looking specifically at SDT, Ryan and Deci (2000) theorize about the interconnected and supportive nature of autonomy, competence, and relatedness. The theory does not specify whether specific scenarios promote an ordering between the three components, including competence and relatedness. This study suggests that in an achievement-oriented setting, competence needed to be established prior to feeling a sense of belonging and that belonging would likely not flourish if the participants did not have the autonomy to bring their desire to belong (or not) to the math classroom. Another consideration, though less clear from the findings, is whether the participants' identity as Black girls within the math setting created a scenario in which their sense of competence was more salient because of racialized barriers such as stereotype threats (Steele, 1997). This leads to questions about whether belonging can be fostered apart from competence within an achievement setting, whether all Black girls feel a need to demonstrate competence before feeling a sense of belonging within math, and what might happen if a student chooses not to belong. The results, as well as prior literature on the context-bound nature of belonging (Gray et al., 2022), suggest that the answer to these questions tends to depend on the setting. This would be an area for future research to examine.

Considering the historical oppression faced by marginalized groups within the United States, there are some spaces and people Black girls may encounter that will negatively impact their well-being. As an act of protection or resistance, they may choose not to want to belong within that setting. There may be a need to have an expansive and critical view of belonging such that the act of not belonging can be considered supportive of the individual. Additionally, it would be imperative to consider addressing the negative barriers that are prompting a withdrawal from belonging to not inadvertently push Black girls out of settings that are presently hostile to their presence, furthering their marginalization. The participants seemed to be (re)claiming their role in determining their belonging, viewing it as equal or greater than the role others around them play.

Interest. When the Black girls in this study were asked how they would know they belonged in math, many talked about how their enjoyment or interest in the subject would indicate belonging. Hidi and Renninger define interest as "a motivational variable [that] refers to the psychological state of engaging or the predisposition to reengage with particular classes of objects, events, or ideas over time" (2006, p 112). Prior studies have examined how students' sense of belonging and level of interest in an academic subject area can be negatively impacted by experiences of stereotype threat, marginalization, or the setting in general, suggesting an association between the two constructs (Hazari et al, 2020; Hoffman et al., 2021; Master et al., 2016).

The question remains whether students can experience belonging within an academic setting in which they are not personally interested. Or, could experiencing a warm and welcoming environment that communicates a sense of belonging trigger their interest? According to Hidi and Renninger's Four-Phase Model of Interest Development (2006),

experiencing a belonging supportive setting could help maintain situational interest in such a way that individual interest could emerge. Future research would be needed to determine whether a bidirectional association exists between interest development and a sense of belonging. The result of this determination could create another pathway for educators to encourage students' sense of belonging through engagement of their personal interests.

Recommendations for Math Educators

The Black girls in this study suggest that their teachers, friends, sense of competence, and help-seeking contribute to their overall sense of belonging within the math classroom. This information provides insight to educators on how they might support a sense of belonging for Black girls within the 7th-grade math classroom. To begin, math teachers can prioritize working to establish personal, positive relationships with the Black girls in their classes and ensure they feel their care (Maloney & Matthews, 2020). Building upon these positive relationships, math teachers can provide multiple ways to receive academic support during and after math class. The participants noted that when teachers asked if anyone needed help, many students felt uncomfortable raising their hands for fear of looking incompetent. Therefore, being assisted in one on one or small group settings was preferred by the participants, in addition to slowing down the pace of the lesson if the content was particularly challenging.

The participants had many suggestions regarding the types of classroom instructional strategies that supported their sense of belonging. For example, to facilitate positive peer social interactions within the math class, the participants pointed to the value of using small groups, and group work generally was viewed positively by the Black girls in this study. Working in small groups created opportunities for communal learning (Boykin, 1986; Gray et al., 2020) and appeared to strengthen their sense of social connection within the math classroom. Next, in

response to the prevalence of competence markers (i.e., good grades, concepts coming "easy" for participants, or doing well on tests) as an indicator or source of the participants' sense of belonging, the methods of giving feedback, how grades are shared within the class, and the language used around math learning can be considered avenues to supporting or thwarting Black girls' competence within the math classroom.

Finally, taking time as educators to be self-reflective regarding the equitable, or lack thereof, treatment of marginalized students within the math classroom is key to communicating through action that Black girls are more than tolerated within the math classroom but are celebrated and do indeed belong. When the participants sensed inequity, favoritism, or unfairness, it created an unwelcoming environment in which cognitive resources had to be diverted from learning and refocused on identity-related safety (Johnson et al., 2021). A culturally responsive classroom environment can create space for the participants to direct their mental energy into deeper math content learning.

Delimitations and Limitations

A hallmark of qualitative research is the centering of the perspective and voice of the participants and the ability to consider multiple influences on the examined constructs. A limited number of students were selected to participate in the study to prioritize depth and richness in my exploration of belonging within the math classroom. All 10 participants attended the same middle school and were taught by the same math teacher in the four different class periods represented. This study tries to capture the perspectives and experiences of the 10 Black girl participants, yet, when speaking of the results, there is tension in trying not to homogenize the experiences of Black girls in general. The results are bound within this specific context while shedding light on potential connection points within similar settings. Another limitation was

having a limited understanding of the participants' ERI development experiences and racial salience outside of the math classroom and how that may influence their views and experiences in school. Due to the limited number of participants representing three types of math classes, the experience of being in an advanced math class was not explicitly considered. This context may present different belonging opportunities and challenges for the Black girls in those classes. Lastly, this phenomenological study does not allow for determinations of causality.

Future Directions

It is important to continue studying Black girls' and women's lived educational experiences, especially in mathematics, because of how their identities impact their learning experiences across their development. Capturing the unique contours of their understandings and experiences can help theories expand and chart a path toward a new theoretical understanding. Therefore, it would be valuable to examine at a larger scale the prevalence of the above-mentioned sources of belonging among Black girls in middle school through a mixed methods approach. A mixed methodological approach would provide the opportunity to continue to hear the voices of Black girls as they guide educators in supporting their sense of belonging best while also giving perspective and a sense of scale for the ideas uncovered and implications for theory.

In addition, future research should look at the possible ordering among SDT's components of belonging and competence. The current study identified competence as a precursor or indicator of belonging for Black girls in their math class. Is this phenomenon found among other middle school Black girls? Is it related to their gender, and would it also be found among other girls in math classes? Is it related to their ERI, and would it also be found among other Black boys in math classes? A quantitative examination of these questions could provide a

sense of how bounded or expansive these ideas are. Moreover, many questions arose concerning the role of autonomy in forming a sense of belonging. A quantitative examination that considers Black girls' desire to belong within the math space before utilizing a set of interventions could provide insight into how this initial disposition towards belonging impacts the effectiveness of belonging interventions within the classroom.

In considering how students' sense of belonging is context-bound, future belonging-focused research needs to consider how the participants' context and setting influence their sense of belonging. When asked what outside influences are impacting the belonging experiences of the participants in their math classes, the timing and order of their courses emerged as a possible contributor. Future research could examine whether engagement and belonging fluctuate as a function of the time Black girls take their math classes. Furthermore, it would also be valuable to understand better how placement in an advanced math class context affects middle school Black girls' belonging experiences within that math class. Each of these future directions can add to the dearth of information about the educational experiences of Black girls and adolescent Black girls specifically.

Conclusion

Black girls are poised to succeed in math classrooms when their humanity, skillsets, and desire to learn are cultivated and valued. Creating math classrooms rich with opportunities to belong can nurture the seeds of math interest already present in many Black girls. Positioned as knowledge holders, the participants named how they want to be supported within their math classrooms and what does not work well for them. Ultimately, the 7th-grade Black girls in this study added dimension to how belonging is currently understood and determined, which can help clarify the path to supporting their math-related endeavors. As an essential starting point, we, as

educators and researchers, must first believe in the humanity of Black girls (Joseph et al., 2019) before seeing them as underrepresented or a statistic. This value can then inform how we listen to their voices, enact meaningful change, and signal that their perspectives and ways of understanding carry weight because they matter both within and outside the math classroom.

REFERENCES

Aguirre, J., Herbel-Eisenmann, B., Celedón-Pattichis, S., Civil, M., Wilkerson, T., Stephan, M., Pape, S., & Clements, D. H. (2017). Equity within Mathematics Education Research as a political act: Moving from choice to intentional collective professional responsibility. *Journal for Research in Mathematics Education*, *48*(2), 124–147. https://doi.org/10.5951/jresematheduc.48.2.0124

Allen, K.-A., & Boyle, C. (2022). School belonging and student engagement: The critical overlaps, similarities, and implications for student outcomes. *Handbook of Research on Student Engagement*, 133–154. https://doi.org/10.1007/978-3-031-07853-8_7

Allen, K.-A., Slaten, C. D., Arslan, G., Roffey, S., Craig, H., & Vella-Brodrick, D. A. (2021). School belonging: The importance of student and teacher relationships. *The Palgrave Handbook of Positive Education*, 525–550. https://doi.org/10.1007/978-3-030-64537-3_21

Allen, K.-A., Vella-Brodrick, D., & Waters, L. (2018). Rethinking School belonging. *Pathways to Belonging*, 191–218. https://doi.org/10.1163/9789004386969_011

Anderman, L. H. (2003). Academic and social perceptions as predictors of change in middle school students' sense of school belonging. *The Journal of Experimental Education*, *72*(1), 5–22. https://doi.org/10.1080/00220970309600877

Annamma, S. A., Anyon, Y., Joseph, N. M., Farrar, J., Greer, E., Downing, B., & Simmons, J. (2016). Black girls and school discipline: The complexities of being overrepresented and understudied. *Urban Education*, *54*(2), 211–242. https://doi.org/10.1177/0042085916646610

Annamma, S. A., Ferri, B. A., & Connor, D. J. (2018). Disability critical race theory: Exploring the intersectional lineage, emergence, and potential futures of discrit in Education. *Review of Research in Education*, *42*(1), 46–71. https://doi.org/10.3102/0091732x18759041

Barbieri, C. A., & Miller-Cotto, D. (2021). The importance of adolescents' sense of belonging to mathematics for Algebra Learning. *Learning and Individual Differences*, *87*, 101993. https://doi.org/10.1016/j.lindif.2021.101993

Battey, D. (2012). "good" mathematics teaching for students of color and those in poverty: The importance of relational interactions within instruction. *Educational Studies in Mathematics*, *82*(1), 125–144. https://doi.org/10.1007/s10649-012-9412-z

Battey, D., & Leyva, L. A. (2016). A framework for understanding whiteness in mathematics education. *Journal of Urban Mathematics Education*, *9*(2). https://doi.org/10.21423/jume-v9i2a294

Belanger, A. L., Joshi, M. P., Fuesting, M. A., Weisgram, E. S., Claypool, H. M., & Diekman, A. B. (2020). Putting belonging in context: Communal affordances signal belonging in Stem. *Personality and Social Psychology Bulletin*, *46*(8), 1186–1204. https://doi.org/10.1177/0146167219897181

Benner, A. D., & Crosnoe, R. (2011). The racial/ethnic composition of elementary schools and young children's academic and socioemotional functioning. *American Educational Research Journal*, *48*(3), 621–646. https://doi.org/10.3102/0002831210384838

Booker, K. (2016). Connection and Commitment: How Sense of Belonging and Classroom Community Influence Degree Persistence for African American Undergraduate Women. *International Journal of Teaching and Learning in Higher Education*, *28*(2), 218–229. https://doi.org/https://eric.ed.gov/?id=EJ1111140

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE.

Butler-Barnes, S. T., Leath, S., Williams, A., Byrd, C., Carter, R., & Chavous, T. M. (2017). Promoting resilience among African American girls: Racial identity as a protective factor. *Child Development*, *89*(6). https://doi.org/10.1111/cdev.12995

Coffey, A., & Atkinson, P. (1996). Making sense of qualitative data: Complementary research strategies. Thousand Oaks, CA: Sage Publications, Inc.

Cole, E. R. (2009). Intersectionality and research in psychology. *American Psychologist, 64*(3), 170–180. https://doi.org/10.1037/a0014564

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Sage Publications, Inc.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Dahlberg, H., & Dahlberg, K. (2003). To not make definite what is indefinite: A phenomenological analysis of perception and its epistemological consequences in human science research. *The Humanistic Psychologist*, *31*(4), 34–50. https://doi.org/10.1080/08873267.2003.9986933

Eccles, J. S., & Midgley, C. (1989). Stage/Environment Fit: Developmentally Appropriate Classrooms for Early Adolescence. In R. E. Ames, & Ames, C. (Eds.), *Research on Motivation in Education* (Vol. 3, pp. 139-186). New York: Academic Press.

Ellis, C. (2007). Telling secrets, revealing lives: Relational ethics in research with intimate others. *Qualitative Inquiry, 13*(1), 3–29. https://doi.org/10.1177/1077800406294947

Emery, A., & Anderman, L. H. (2020). Using interpretive phenomenological analysis to advance theory and research in educational psychology. *Educational Psychologist*, *55*(4), 220–231. https://doi.org/10.1080/00461520.2020.1787170

Erikson, E.H. (1968). *Identity: youth and crisis.* Norton & Co.

Evans, A. B., Copping, K. E., Rowley, S. J., & Kurtz-Costes, B. (2011). Academic self-concept in black adolescents: Do race and gender stereotypes matter? *Self and Identity*, *10*(2), 263–277. https://doi.org/10.1080/15298868.2010.485358

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, *5*(1), 80–92. https://doi.org/10.1177/160940690600500107

Fussell, S. (2017). Why Can't This Soap Dispenser Identify Dark Skin? Retrieved from https://gizmodo.com/why-cant-this-soap-dispenser-identify-dark-skin-1797931773

Gholson, M. L., Bullock, E. C., & Alexander, N. N. (2012). On the brilliance of black children: A response to a clarion call. *Journal of Urban Mathematics Education*, *5*(1). https://doi.org/10.21423/jume-v5i1a180

Gholson, M.L. (2016). *Clean Corners and Algebra: A Critical Examination of the Constructed Invisibility of Black Girls and Women in Mathematics*. *Journal of Negro Education 85*(3), 290-301. https://www.muse.jhu.edu/article/802815.

Gillborn, D. (2015). Intersectionality, Critical Race Theory, and the Primacy of Racism: Race, Class, Gender, and Disability in Education. *Qualitative Inquiry*, *21*(3), 277–287. https://doi.org/10.1177/1077800414557827

Glaser, B. (1978) Theoretical sensitivity: Advances in the methodology of grounded theory. Sociology Press, Mill Valley.

Goodenow, C. (1993). The psychological sense of school membership among adolescents: Scale development and educational correlates. *Psychology in the Schools, 30*, 79-90. https://doi.org/10.1002/1520-6807(199301)30:1<79::AID-PITS2310300113>3.0.CO;2-X

Goodenow, C., & Grady, K. E. (1993). The relationship of school belonging and friends' values to academic motivation among urban adolescent students. *Journal of Experimental Education, 62*(1), 60–71. https://doi.org/10.1080/00220973.1993.9943831

Graham, S., & Morales-Chicas, J. (2017). The ethnic context and attitudes toward 9th Grade math. *International Journal of Educational Psychology, 4*, 1–32. https://doi.org/10.4471/ijep.2015.01

Gray, D. L. (2017). Is psychological membership in the classroom a function of standing out while fitting in? Implications for achievement motivation and emotions. *Journal of School Psychology, 61*, 103–121. https://doi.org/10.1016/j.jsp.2017.02.001

Gray, D. L., Harris-Thomas, B., Ali, J. N., Cummings, T. N., McElveen, T. L., & Jones, T. R. (2022). Urban Middle Schoolers' Opportunities to Belong Predict Fluctuations in Their Engagement Across the School Day. *Urban Education, 0*(0). https://doi.org/10.1177/00420859221117682

Gray, D. L., Hope, E. C., & Matthews, J. S. (2018). Black and belonging at school: A case for interpersonal, instructional, and institutional opportunity structures. *Educational Psychologist*, *53*(2), 97–113. https://doi.org/10.1080/00461520.2017.1421466

Gray, D., McElveen, T., Green, B., & Bryant, L. (2020). Engaging Black and Latinx students through communal learning opportunities: A relevance intervention for middle schoolers in STEM elective classrooms. *Contemporary Educational Psychology,* 60:101833. https://doi.org/10.1016/j.cedpsych.2019.101833

Guba, E. G. (Ed.). (1990). The paradigm dialog. Sage Publications, Inc.

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). Introduction to applied thematic analysis. Applied Thematic Analysis, 3–20. https://doi.org/10.4135/9781483384436.n1

Guillemin, M., & Gillam, L. (2004). Ethics, Reflexivity, and "Ethically Important Moments" in Research. *Qualitative Inquiry, 10*(2), 261–280. https://doi.org/10.1177/1077800403262360

Gutiérrez, R. (2008). A "gap-gazing" fetish in mathematics education? Problematizing research on the achievement gap. *Journal for Research in Mathematics Education,* 39, 357-364. https://www.jstor.org/stable/40539302

Gutiérrez, R. (2011). Context matters: How should we conceptualize equity in mathematics education? *Equity in Discourse for Mathematics Education*, 17–33. https://doi.org/10.1007/978-94-007-2813-4_2

Gutiérrez, R. (2013). Why (urban) mathematics teachers need political knowledge. *Journal of Urban Mathematics Education, 6*(2). https://doi.org/10.21423/jume-v6i2a223

Hamm, J. V., & Faircloth, B. S. (2005). The role of friendship in adolescents' sense of school belonging. *New Directions For Child And Adolescent Development*, (107), 61–78. https://doi.org/10.1002/cd.121

Hatch, J.A. (2002). *Doing Qualitative Research in Education Settings*. Albany: State University of New York Press.

Hazari, Z., Chari, D., Potvin, G., & Brewe, E. (2020). The context dependence of physics identity: Examining the role of Performance/competence, recognition, interest, and sense of belonging for Lower and Upper Female Physics undergraduates. *Journal of Research in Science Teaching, 57*(10), 1583–1607. https://doi.org/10.1002/tea.21644

Healey, K., & Stroman, C. (2020). Structures for belonging: A synthesis of research on belonging-supportive learning environments. *Student Experience Research Network*.

Hidi, S., & Renninger, K. A. (2006). The Four-Phase Model of Interest Development. *Educational Psychologist, 41*(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4

Hill, C., Corbett, C., & Rose, A. S. (2010). Why so few?: Women in Science, Technology, Engineering, and Mathematics. AAUW.

Hines-Datiri, D., & Carter Andrews, D. J. (2020). The Effects of Zero Tolerance Policies on Black Girls: Using Critical Race Feminism and Figured Worlds to Examine School Discipline. *Urban Education, 55*(10), 1419–1440. https://doi.org/10.1177/0042085917690204

Hoffman, A.J., McGuire, L., Rutland, A., Hartstone-Rose, A., Irvin, M. J., Winterbottom, M., Balkwill, F., Fields, G. E., & Mulvey, K.L. (2021). The Relations and Role of Social Competencies and Belonging with Math and Science Interest and Efficacy for Adolescents in Informal STEM Programs. *Journal of Youth Adolescence, 50*, 314–323. https://doi.org/10.1007/s10964-020-01302-1

Hope, E. C., & Spencer, M. B. (2017). Civic engagement as an adaptive coping response to conditions of inequality: An application of Phenomenological Variant of Ecological Systems Theory (PVEST). In N. J. Cabrera & B. Leyendecker (Eds.), *Handbook on positive development of minority children and youth* (pp. 421–435). Springer Science + Business Media. https://doi.org/10.1007/978-3-319-43645-6_25

Hope, E. C., Gugwor, R., Riddick, K. N., & Pender, K. N. (2019). Engaged against the machine: Institutional and cultural racial discrimination and racial identity as predictors of activism orientation among black youth. *American Journal of Community Psychology, 63*(1–2), 61–72. https://doi.org/10.1002/ajcp.12303

Huang, C. Y., & Stormshak, E. A. (2011). A longitudinal examination of early adolescence ethnic identity trajectories. *Cultural Diversity and Ethnic Minority Psychology, 17*(3), 261–270. https://doi.org/10.1037/a0023882

Hunter, C. D., Case, A. D., & Harvey, I. S. (2019). Black college students' sense of belonging and racial identity. *International Journal of Inclusive Education, 23*(9), 950–966. https://doi.org/10.1080/13603116.2019.1602363

Ibourk, A., Hughes, R., & Mathis, C. (2022). "It Is What It Is": Using storied-identity and intersectionality lenses to understand the trajectory of a young black woman's science and math identities. *Journal of Research in Science Teaching, 59*(7), 1099–1133. https://doi.org/10.1002/tea.21753

J. P. Bajorek, "Voice Recognition Still Has Significant Race and Gender Biases". *Harvard Business Review*, 2019, section: Technology. [Online]. https://hbr.org/2019/05/voice-recognition-still-has-significant-race-and-gender-biases

Johnson, D.G., Mattan, B.D., Flores, N. et al. (2022). Social-Cognitive and Affective Antecedents of Code Switching and the Consequences of Linguistic Racism for Black People and People of Color. *Affec Sci 3*, 5–13. https://doi.org/10.1007/s42761-021-00072-8

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. https://doi.org/10.1177/0361684319830926

Jones, L., & Somekh, B. (2005). Observation. 138-145. *Research Methods in the Social Sciences.*

Jones, S. (2003). Identities of Race, Class, and Gender inside and outside the Math Classroom: A Girls' Math Club as a Hybrid Possibility. *Feminist Teacher*, *14*(3), 220–233. http://www.jstor.org/stable/40545893

Joseph, N. M. (2020). *Understanding the intersections of race, gender, and gifted education: An anthology by and about talented black girls and women in STEM*. Information Age Publishing, Inc.

Joseph, N. M., & Alston, N. V. (2018). We fear no number: Humanizing mathematics teaching and learning for Black girls. Annual perspectives in mathematics, 51-62.

Joseph, N. M., Hailu, M., & Boston, D. (2017). Black women's and girls' persistence in the P–20 mathematics pipeline: Two decades of children, youth, and adult education research. *Review of Research in Education*, *41*(1), 203–227. https://doi.org/10.3102/0091732X16689045

Juvonen, J. (2006). Sense of Belonging, Social Bonds, and School Functioning. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of Educational Psychology* (pp. 655–674). Lawrence Erlbaum Associates Publishers.

Juvonen, J. (2007) Reforming Middle Schools: Focus on Continuity, Social Connectedness, and Engagement, *Educational Psychologist, 42*:4, 197-208, https://doi.org/10.1080/00461520701621046

Kiang, L., & Fuligni, A. J. (2009). Meaning in life as a mediator of ethnic identity and adjustment among adolescents from Latin, Asian, and European American backgrounds. *Journal of Youth and Adolescence*, *39*(11), 1253–1264. https://doi.org/10.1007/s10964-009-9475-z

Kumar, R., Zusho, A., & Bondie, R. (2018). Weaving cultural relevance and achievement motivation into inclusive classroom cultures. *Educational Psychologist, 53*(2), 78–96. https://doi.org/10.1080/00461520.2018.1432361

Leaper, C. (2015). Do I Belong?: Gender, Peer Groups, and STEM Achievement. *International Journal of Gender, Science, and Technology, 7*, 166-179.

Leath, S., & Chavous, T. (2018). Black women's experiences of campus racial climate and stigma at predominantly white institutions: Insights from a comparative and within-group approach for STEM and non-STEM majors. *Journal of Negro Education, 87*(2), 125–139. https://doi.org/10.7709/jnegroeducation.87.2.0125

Lewis, K. L., Stout, J. G., Finkelstein, N. D., Pollock, S. J., Miyake, A., Cohen, G. L., & Ito, T. A. (2017). Fitting in to Move Forward: Belonging, Gender, and Persistence in the Physical Sciences, Technology, Engineering, and Mathematics (pSTEM). *Psychology of Women Quarterly*, *41*(4), 420–436. https://doi.org/10.1177/0361684317720186

Lewis, K. L., Stout, J. G., Pollock, S. J., Finkelstein, N. D., & Ito, T. A. (2016). Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics. *Physical Review Physics Education Research, 12*(2). https://doi.org/10.1103/PhysRevPhysEducRes.12.020110

Lim, S. (2008) Job Satisfaction of Information Technology Workers in Academic Libraries. *Library & Information Science Research, 30*, 115-121. http://dx.doi.org/10.1016/j.lisr.2007.10.002

Linnenbrink-Garcia, L., Patall, E. A., & Pekrun, R. (2016). Adaptive Motivation and Emotion in Education: Research and Principles for Instructional Design. *Policy Insights from the Behavioral and Brain Sciences*, *3*(2), 228-236. https://doi.org/10.1177/2372732216644450

Lune, H., & Berg, B. L. (2017). Qualitative Research Methods for the Social Science. Essex: Pearson Education Limited.

Martin, D. B. (2008). E(race)ing race from a national conversation on mathematics teaching and learning: The National Mathematics Advisory Panel as White institutional space. *The Mathematics Enthusiast, 5*(2), 387-398. https://scholarworks.umt.edu/tme/vol5/iss2/20?utm_source=scholarworks.umt.edu%2Ftme%2Fvol5%2Fiss2%2F 20&utm_medium=PDF&utm_campaign=PDFCoverPages

Martin, D. B. (2009). Researching Race in Mathematics Education. *Teachers College Record*, *111*(2), 295–338. https://doi.org/10.1177/016146810911100208

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). https://doi.org/10.21423/jume-v3i2a95

Maslow, A. H. (1968). *Toward a psychology of being*. New York: Van Nostrand.

Master, A., Cheryan, S., & Meltzoff, A. N. (2016). Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science. *Journal of Educational Psychology, 108*(3), 424–437. https://doi.org/10.1037/edu0000061

Master, A., & Meltzoff, A. N. (2020). Cultural Stereotypes and Sense of Belonging Contribute to Gender Gaps in STEM. *International Journal of Gender, Science and Technology*, *12*(1), 152–198. https://genderandset.open.ac.uk/index.php/genderandset/article/view/674

Matthews, J. S., Banerjee, M., & Lauermann, F. (2014). Academic identity formation and motivation among ethnic minority adolescents: The role of the "self" between internal

and external perceptions of identity. *Child Development, 85*, 2355–2373. https://doi.org/10.1111/cdev.12318

Matthews, J., Gray, D. L., Lachaud, Q., McElveen, T., Chen, X.-Y., Victor, T., Okai, E., Boomhower, K., Wu, J., & Cha, E. (2021). *Belonging-Centered Instruction: An Observational Approach toward Establishing Inclusive Mathematics Classrooms*. https://doi.org/10.31219/osf.io/n7bv2

McClain, S., Beasley, S. T., Jones, B., Awosogba, O., Jackson, S., & Cokley, K. (2016). An examination of the impact of racial and ethnic identity, impostor feelings, and minority status stress on the mental health of Black college students. *Journal of Multicultural Counseling and Development*, *44*(2). https://link.gale.com/apps/doc/A450903901/AONE?u=googlescholar&sid=googleScholar&xid=0a2ae23c

McDaniel, A., DiPrete, T. A., Buchmann, C., & Shwed, U. (2011). The black gender gap in educational attainment: historical trends and racial comparisons. *Demography*, *48*(3), 889–914. https://doi.org/10.1007/s13524-011-0037-0

McGee, E. O., & Pearman, F. A. (2014). Risk and Protective Factors in Mathematically Talented Black Male Students: Snapshots From Kindergarten Through Eighth Grade. *Urban Education*, *49*(4), 363–393. https://doi.org/10.1177/0042085914525791

McKoy T. L. (2019). *A qualitative study of African American female engineering college students' intersecting identities, sense of belonging, and intent to persist* [Doctoral Thesis, Tennessee State University].

Mertens, D. M. (2007). Transformative paradigm. Journal of Mixed Methods Research, 1(3), 212–225. https://doi.org/10.1177/1558689807302811

Mertens, D. M. (2010). Transformative mixed methods research. *Qualitative inquiry, 16*(6), 469-474. https://doi.org/10.1177/1077800410364612

Miles, M. B., & Huberman, M. A. (1994). Qualitative data analysis: An expanded sourcebook (2nd ed.). Thousand Oaks, CA: Sage.

Milner, H. R. (2007). Race, Culture, and Researcher Positionality: Working Through Dangers Seen, Unseen, and Unforeseen. *Educational Researcher, 36*(7), 388–400. https://doi.org/10.3102/0013189X07309471

Milner, H. R.I V. (2012). But what is urban education? Urban Education, 47(3), 556- 561. https://doi.org/10.1177/0042085912447516

Mims, L. C., & Williams, J. L. (2020). "They told me what I was before I could tell them what I was": Black girls' ethnic-racial identity development within multiple worlds. Journal of Adolescent Research, 35(6), 754–779. https://doi.org/10.1177/0743558420913483

Morton, T. R. (2021). A phenomenological and ecological perspective on the influence of undergraduate research experiences on Black Women's Persistence in STEM at an HBCU. *Journal of Diversity in Higher Education*, *14*(4), 530–543. https://doi.org/10.1037/dhe0000183

Morton, T. R., & Parsons, E. C. (2018). # BlackGirlMagic: The identity conceptualization of Black women in undergraduate STEM education. *Science Education, 102*(6), 1363–1393. https//doi.org/10.1002/sce.21477

Moustakas, C. E. (1994). *Phenomenological research methods.* Sage Publications, Inc.

Murphy, M. C., & Zirkel, S. (2015). Race and Belonging in School: How Anticipated and Experienced Belonging Affect Choice, Persistence, and Performance. *Teachers College Record*, *117*(12), 1–40. https://doi.org/10.1177/016146811511701204

National Science Foundation. (2022). Committee on the Future of NSF Established Program to Stimulate Competitive Research (EPSCoR. Retrieved June 20, 2022 (https://nsf-gov-resources.nsf.gov/2022-08/Envisioning-The-Future-of-EPSCoR-Report.pdf).

Nolen, S. B., Horn, I. S., & Ward, C. J. (2015). Situating motivation. *Educational Psychologist, 50*(3), 234–247. https://doi.org/10.1080/00461520.2015.1075399

Oxford Reference. Retrieved 28 March. 2023, from https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095437678.

Pahl, K., & Way, N. (2006). Longitudinal trajectories of ethnic identity among urban Black and Latino adolescents. *Child Development, 77*, 1403–1415. https://doi.org/10.1111/j. 1467-8624.2006.00943.x

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE Publications, inc.

Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work: Research and Practice, 1*(3), 261–283. https://doi.org/10.1177/1473325002001003636

Phillippi J, Lauderdale J. (2018). A Guide to Field Notes for Qualitative Research: Context and Conversation. *Qualitative Health Research*, *28*(3), 381-388. https://doi.org/10.1177/1049732317697102

Phinney, J. S. (1993). A three-stage model of ethnic identity development in adolescence In Bernal MEP & Knight GP (Eds.), *Ethnic identity: Formation and transmission among Hispanics and other minorities* (pp. 61–79). New York: State University of New York Press.

Phinney, J.S. (1990). Ethnic identity in adolescents and adults: Review of research. *Psychological Bulletin, 108 3*, 499-514. https://doi.org/10.1037/0033-2909.108.3.499

Proudfoot, K. (2022). Inductive/Deductive Hybrid Thematic Analysis in Mixed Methods Research. *Journal of Mixed Methods Research, 0*(0). https://doi.org/10.1177/15586898221126816

Purdie-Vaughns, V., & Eibach, R. P. (2008). Intersectional invisibility: The distinctive advantages and disadvantages of multiple subordinate-group identities. *Sex Roles*, *59*(5-6), 377–391. https://doi.org/10.1007/s11199-008-9424-4

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International Journal of STEM Education*, *5*(1). https://doi.org/10.1186/s40594-018-0115-6

Riegle-Crumb, C., Moore, C., & Ramos-Wada, A. (2011). Who wants to have a career in science or math? Exploring adolescents' future aspirations by gender and race/ethnicity. *Science Education, 95(*3), 458–476. https://doi.org/10.1002/sce.20431

Rivas-Drake, D., Seaton, E. K., Markstrom, C., Quintana, S., Syed, M., Lee, R. M., Schwartz, S. J., Umaña-Taylor, A. J., French, S., Yip, T., & Ethnic and Racial Identity in the 21st Century Study Group (2014). Ethnic and racial identity in adolescence: implications for psychosocial, academic, and health outcomes. *Child development*, *85*(1), 40–57. https://doi.org/10.1111/cdev.12200

Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents' achievement and peer relationships: the effects of cooperative, competitive, and individualistic goal structures. *Psychological bulletin, 134*(2), 223–246. https://doi.org/10.1037/0033-2909.134.2.223

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55, 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Sánchez, B., Colón, Y., & Esparza, P. (2005). The role of sense of school belonging and gender in the academic adjustment of Latino adolescents. Journal of Youth Adolescence 34, 619–628. https://doi.org/10.1007/s10964-005-8950-4

Schar, M., Gilmartin, S., Harris, A., Rieken, B., & Sheppard, S. (2017). Innovation Self-Efficacy: A Very Brief Measure for Engineering Students. Proceedings for the *American Society for Engineering Education Annual Conference*, June 25-28. Columbus, OH. https://par.nsf.gov/biblio/10043009.

Seidman, I. (2019). *Interviewing as qualitative research: A guide for researchers in education and the Social Sciences*. Teachers College Press.

Sellers, R. M., Chavous, T. M., & Cooke, D. Y. (1998). Racial Ideology and Racial Centrality as Predictors of African American College Students' Academic Performance. *Journal of Black Psychology, 24*(1), 8–27. https://doi.org/10.1177/00957984980241002

Solórzano, D. G., & Yosso, T. J. (2002). Critical Race Methodology: Counter-Storytelling as an Analytical Framework for Education Research. *Qualitative Inquiry, 8*(1), 23–44. https://doi.org/10.1177/107780040200800103

Sosnowski, N. H, (2002). Women of color staking a claim for cyber domain: Unpacking the racial/gender gap in science, mathematics, engineering and technology (SMET). *Doctoral Dissertations Available from Proquest*. https://scholarworks.umass.edu/dissertations/AAI3056282

Sosnowski, N. H. (2002). Women of color staking a claim for cyber domain: Unpacking the racial /gender gap in science, mathematics, engineering and technology (SMET). *Doctoral Dissertations Available from Proquest*. AAI3056282. https://scholarworks.umass.edu/dissertations/AAI3056282

Spencer, M. B. (2006). Phenomenological and ecological systems theory: Development of diverse groups. In R. M. Lerner (Ed.), *Handbook of child psychology* (6th ed., Vol. 1, pp. 829–893). Hoboken, NJ: Wiley

Spencer, M., Dupree, D., & Hartmann, T. (1997). A Phenomenological Variant of Ecological Systems Theory (PVEST): A self-organization perspective in context. *Development and Psychopathology, 9*(4), 817-833. https://doi.org/10.1017/S0954579497001454

Steele, C. (1997). A threat in the air: How stereotypes shape the intellectual identities and performance of women and African Americans. *American Psychologist*, *52*, 613–629.

Sundler, A. J., Lindberg, E., Nilsson, C., & Palmér, L. (2019). Qualitative thematic analysis based on descriptive phenomenology. *Nursing open*, *6*(3), 733–739. https://doi.org/10.1002/nop2.275

The triple quandary and the schooling of Afro-American children. (1968). *The School Achievement of Minority Children*, 57–92. https://doi.org/10.4324/9781315060187-3

Thomas, V. G. (2009). Critical race theory: Ethics and dimensions of diversity in research. *The Handbook of Social Research Ethics*, 54–68. https://doi.org/10.4135/9781483348971.n4

Umana-Taylor, A. & Yazedjian, A., & Bámaca-Colbert, M. (2004). Developing the Ethnic Identity Scale Using Eriksonian and Social Identity Perspectives. *Identity: An International Journal of Theory and Research, 4,* 9-38. https://doi.org/10.1207/S1532706XID0401_2

Umaña-Taylor, A. J., Quintana, S. M., Lee, R. M., Cross, W. E., Rivas-Drake, D., Schwartz, S. J., Syed, M., Yip, T., & Seaton, E. (2014). Ethnic and racial identity during adolescence and into young adulthood: An integrated conceptualization. *Child Development*, *85*(1), 21–39. https://doi.org/10.1111/cdev.12196

van Manen, M. (1990) *Researching lived experience: Human science for an action sensitive pedagogy*. State University of New York Press, Albany.

Velez, G., & Spencer, M. B. (2018). Phenomenology and intersectionality: Using PVEST as a frame for adolescent identity formation amid intersecting ecological systems of inequality. *New Directions for Child and Adolescent Development*, *2018*(161), 75–90. https://doi.org/10.1002/cad.20247

Velez, G., & Spencer, M. B. (2018). Phenomenology and intersectionality: Using PVEST as a frame for adolescent identity formation amid intersecting ecological systems of inequality. *New Directions for Child and Adolescent Development, 2018*(161), 75–90. https://doi.org/10.1002/cad.20247

Walton, G. M., & Cohen, G. L. (2007). A question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology, 92*(1), 82–96. https://doi.org/10.1037/0022-3514.92.1.82

Walton, G. M., Cohen, G. L., Cwir, D., & Spencer, S. J. (2012). Mere belonging: the power of social connections. Journal of personality and social psychology, 102(3), 513–532. https://doi.org/10.1037/a0025731

Way, N., Hernández, M. G., Rogers, L. O., & Hughes, D. L. (2013). "I'm not going to become no rapper": Stereotypes as a context of ethnic and racial identity development. *Journal of Adolescent Research, 28*(4), 407–430. https://doi.org/10.1177/0743558413480836

Wilkins-Yel, K. G., Hyman, J., & Zounlome, N. O. O. (2019). Linking intersectional invisibility and hypervisibility to experiences of microaggressions among graduate women of color in STEM. *Journal of Vocational Behavior*, *113*, 51–61. https://doi.org/10.1016/j.jvb.2018.10.018

Williams, C. D., Byrd, C. M., Quintana, S. M., Anicama, C., Kiang, L., Umaña-Taylor, A. J., Calzada, E. J., Pabón Gautier, M., Ejesi, K., Tuitt, N. R., Martinez-Fuentes, S., White, L., Marks, A., Rogers, L. O., & Whitesell, N. (2020). A lifespan model of ethnic-racial identity. *Research in Human Development*, *17*(2-3), 99–129. https://doi.org/10.1080/15427609.2020.1831882

Woodson, A. & Love, B. (2019). Outstanding: Centering Black Kids' Enoughness in Civic Education Research. *Multicultural Perspectives, 21*, 91-96. https://doi.org/10.1080/15210960.2019.1606631

Yosso, T. J. (2005) Whose culture has capital? A critical race theory discussion of community cultural wealth, *Race Ethnicity and Education, 8*:1, 69-91. https://doi.org/10.1080/1361332052000341006

Young, J. L., Young, J. R., & Ford, D. Y. (2017). Standing in the gaps: Examining the effects of early gifted education on Black girl achievement in STEM. *Journal of Advanced Academics*, *28*(4), 290–312. https://doi.org/10.1177/1932202x17730549

Young, J., & Cunningham, J. A. (2020). Repositioning Black girls in mathematics disposition research: New perspectives from quantcrit. *Investigations in Mathematics Learning*, 1–14. https://doi.org/10.1080/19477503.2020.1827664

Young, J.L., Young, J.R. & Capraro, R.M. Gazing Past the Gaps: A Growth-Based Assessment of the Mathematics Achievement of Black Girls. *Urban Rev* 50, 156–176 (2018). https://doi.org/10.1007/s11256-017-0434-9

APPENDIX A: MATH AUTOBIOGRAPHY PROTOCOL

Before we meet to do your interview, I would like to learn about your past experiences with math in general and in your math classes.

Intro & Directions:

A math autobiography is the retelling of your experiences with math, starting as far back as you can remember and all the way up to today. I would like for you to share with me important stories you remember having about learning or using math. To help you share your math autobiography, I've included a prompt you can choose to answer, and an example of a student biography is listed below.

Remember, an autobiography is you getting a chance to tell your story from your perspective. I would like for you to be as honest as you feel comfortable and share any experiences that come to mind. Please feel free to add any additional memories including what you did, how you felt, and who was there with you. Title your autobiography with whatever creative title you think fits best.

The Big Question:

Please tell me your story about learning math over the years. Please include any memories you have, and the people involved in your learning of math. What did your experiences make you feel about yourself? What did your experiences make you feel about math? Include as many details as you'd like.

Option 1: Record yourself talking and send me the video! My cell phone number is XXX-XXX-XXXX

Option 2: Record a voice memo on your phone and send me the voice memo! My cell phone number is XXX-XXX-XXXX.

Option 3: Write a paper answering the questions and you can turn it in to your teacher, Ms. Belman or the front office to Mrs. Heart or Mrs. Joy.

Option 4: Record a video on FlipGrid! Here is the link: LINK

Whichever way you choose is up to you! Please feel free to reach out to me if you have any questions. Your guardian has my email and phone number.
Thank YOU in advance for sharing with me!

APPENDIX B: MATH CLASSROOM OBSERVATION PROTOCOL

Interview Protocol

Classroom Teacher:
Time:
Class Period:
Date:

Classroom Observation Timeline:	**Post-Observation General Notes:**
Observed Notable Instances (general)	**Post-observation Instance Specific Notes:**

Draw out a picture of the classroom and where the participants are seated:

APPENDIX C: SEMI-STRUCTURED INTERVIEW PROTOCOL

Interview protocol

Thank you for agreeing to do this interview with me today. I am a researcher at Michigan State University, and I am asking you to participate in a research study. The purpose of the study is to understand your experiences at school and in your mathematics class. I will ask you to answer some questions. There are no costs associated with participating in this study. Your participation is voluntary and know that there are no right or wrong answers. If you do not want to answer any of the questions, please let me know. You can also ask me to stop at any time without consequence. If you have any questions after the interview, your parents have my email address and phone number. I will be recording the interview, but your name and any teachers or school name that you use will be given a different name to protect everyone's privacy. Do you have any questions?

Okay, lets' get started!

I had a chance to read your math autobiography. Thank you for sharing with me! I will ask you a few questions about it later on in the interview.

Introduction questions - Context

1. To start off, can you tell me about one of your earliest memories from school?
2. In general, how do you feel about school?
3. What do you enjoy about school?
4. What don't you enjoy about school?

Sense of belonging (RQ 1: How do Black girls in middle school describe the construct of belonging?)

5. When I say belonging or sense of belonging, what comes to your mind?
6. How would you define belonging in our own words?
7. What are other words or phrases would you use instead of the word "belonging"?
8. Can you share an example of a time when you felt like you belonged somewhere?
9. Can you share with me a time when you felt like you didn't really belong?
10. How would you go about making someone else feel like they belonged?

Mathematics experiences and sense of belonging (RQ 2: What do Black girls in middle school view as sources of belonging within the math classroom?)

11. Who are the people that make you feel like you belong at school?
12. What are things that make you feel like you belong at school?

13. How do you know (or how would you know) that you belong at school? What would make it clear?
14. Where in the school do you feel the most like you belong?
15. What advice would you give to Principals or administrators about how to make the school a place where you feel like you belong?
16. What relationships are important to you at school?
17. How would you describe your relationships within your math classes?
18. What would you want your relationship with your teacher to be like in your math classroom?
19. What would you want your relationship with your classmates to be like in your math classroom?

For this next set of questions, I'd like you to think about all the math classes you've taken – from elementary school up through now.

20. How do you feel about the subject of math? When did you start to feel that way?
21. Thinking back, has there been a time when you felt a sense of belonging during math class? Can you describe that time to me? (If not, move on to the next question)
22. Thinking back, has there been a time when you felt that you did not belong during math class? Can you describe that time to me?
23. What would have helped you feel like you belonged in that math class?
24. Who in the math class can (or does) help you feel like you belong?
25. What about the physical space – the actual classroom? Are there things that have been done or could be done to make the classroom itself welcoming to you?
26. What do teachers need to know about making the math classroom feel like a place where students can belong?

Mathematics experience and ERI (RQ3: How would Black girls in middle school describe their ERI's role in their experience of belonging in the math classroom?)

I am about to ask you a few questions about your race. And just to remind you, there are no wrong answers – this whole interview is about getting to know what you think because that's what's important to me.

27. How would you describe your race?
28. What does being _____<insert thteir term> mean to you?
29. How would you describe how others view _____<insert their term> at your school?
30. If you have an example, tell me about a time when you noticed your race at school.
31. How would you describe how others view _____<insert their term> students in your math classrooms (past and present)?
32. If you have an example, can you tell me about a time when you found yourself noticing your race in your math classroom?
33. Do you think Black girls and Black boys have the same experience within a math classroom? If so, can you explain in what ways? If not, how do you see their experiences being different?

Follow-Ups:

34. <insert question(s) from math autobiography> examples: In your autobiography, you talk about _____, can you tell me more about that? How did that experience make you feel?

35. <insert question(s) from the classroom observation – "I saw this happened – how did you interpret that?" "I saw this happen - How would you have responded? Or What would you have wanted the teacher/peer to say/do?"
36. <Insert question(s) specifically around the BCI sub-dimensions> examples: “I saw that the teacher shared a story about a time when she used this math concept while baking – What did you think about that story? Did that story make you feel more connected to her or the topic?” or “I saw that when a student got a question wrong, the teacher said, “How did you not get that right? We just did 3 examples on the board. You need to pay attention.” -What did you think about your teacher’s response to that student? How would you want your teacher to respond?