Toward a Theory of Black Woman Math Pedagogy

Elzena McVicar

A dissertation

submitted in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

University of Washington

2024

Reading Committee:

Elham Kazemi, Chair

Julia Aguirre

Kara Jackson

Program Authorized to Offer Degree:

College of Education

University of Washington

Abstract

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Elzena McVicar

Chair of the Supervisory Committee:

Elham Kazemi

College of Education

Black women have a legacy of pedagogical expertise. However, Black women teachers' mathematics pedagogy remains woefully under-theorized and under-researched. This is to the detriment of Black and Brown mathematics students. Mathematics education in the U.S. mirrors our broader society, which continues to reinscribe patterns of intellectual and socioeconomic whiteness, elitism, and masculinity (Joseph et al., 2021). I bring together scholarship on Black women teacher knowledge, research on pedagogical content knowledge, and Black feminist theory to generate a theoretical framework to study Black women's pedagogical expertise in mathematics: *Black Woman Math Pedagogy*.

From a Black feminist perspective, Black Woman Math Pedagogy is the dialogical relationship between politically conscious Black women mathematics teachers' thoughts and actions about their day-to-day mathematics teaching. The first construct of my framework is *Black Woman Pedagogy*, which I identified by analyzing the scholarship of Black women

educators such as culturally relevant teaching (Ladson-Billings, 1994), culturally responsive teaching (Gay, 2000), culturally specific pedagogy in mathematics (Leonard, 2008, 2019), abolitionist teaching (Love, 2019), and culturally and historically responsive teaching (Muhammad, 2023). My second theoretical construct is *Black Feminist Math Pedagogical Content Knowledge* (Black Feminist Math PCK). This construct draws on critical mathematics pedagogy (i.e., Zavala & Aguirre, 2024), mathematics pedagogical content knowledge (Ball et al., 2008), and Black feminist epistemology which considers Black women's "alternative knowledge" about how racism, sexism, and power operate within society (Collins, 2000). Black Feminist Math PCK refers to the knowledge that politically conscious Black women mathematics teachers develop and use in their practice that enables them to attend to how power, identity, and knowledge production operate within the mathematics classroom.

My study used Black feminist methodology (Hamilton, 2020; Mullings, 2000), which combines qualitative study (Merriam & Tisdell, 2016) with Black feminist thought (Collins, 2000). To build my theoretical framework, I documented and analyzed the mathematics teaching of two politically conscious Black women in one academic year who teach in racially, ethnically, economically, and linguistically diverse mathematics classrooms. Through observations and interviews over 13 months in a kindergarten and fourth grade classroom, I examined how the teachers' racialized lived experiences produced asset-based alternative knowledge that shaped their mathematics teaching practice, attending specifically to their Black and Brown students.

Across both teacher cases, I found that the teachers enacted Black Woman Pedagogy through an ethic of care grounded in Black feminist epistemology, became identity workers that cultivated the racial, social, and academic identities of students, and used a Black cultural ethos within their mathematics practice. By studying Black Feminist Math PCK, I found that each

teacher drew on their lived racialized experiences in schools to cultivate a mathematics classroom that allowed students to exist in their beautiful humanity while participating in mathematics. Teachers leveraged their asset-based alternative knowledge to plan engaging mathematics learning opportunities for students while maintaining an affirming, nurturing, and supportive learning environment.

This study makes important contributions to understanding the liberatory work of politically conscious Black women mathematics teachers. In particular, it expands how we conceptualize pedagogical content knowledge by incorporating a critical perspective on mathematics pedagogical content knowledge that disrupts racialized practices within mathematics classrooms. I also discuss the theoretical, empirical, and professional learning implications of a new vision of thinking about Black women's mathematics teaching. My study sparks further dialog about how the field of mathematics education can conceptualize mathematics teaching that is in service of Black and Brown students. Understanding the reasons why and how critical mathematics pedagogies such as Black Woman Math Pedagogy are taken up is crucial for teaching mathematics for liberation.

Dedication

To my namesake,
my great-grandmother
Elzena Pinkins Johnson,
who only completed sixth grade
but ensured more for her children.

To my legacy,
Elysia Odile, Akiva Selchen, and Asa Edi McVicar.
Mommy loves you.
I am so proud of you three.

Acknowledgements

I want to acknowledge my ancestors who lived along the Mississippi River and bayous of southern Louisiana: the Johnsons, Pinkins, Juliens, Marchands, and those names lost to history. I know I stand on your shoulders and would not be where I am today because of your love and sacrifice for your children. Thank you Odile Johnson Huey, Claudia Johnson Celestine, and Edith Johnson for being with me in spirit during my doctoral studies. I often thought about your legacies as teachers, principals, and school board members while writing this dissertation.

I want to express gratitude and appreciation to my reading committee for supporting me throughout this scholarly work. Thank you Dr. Elham Kazemi for being my committee chair and advisor. Thank you for nurturing me for all these years, first as a pre-service elementary teacher and now as a mathematics teacher educator researcher Thank you for demystifying academia and pushing me to where I needed to go, even before I realized it. To my mentor Dr. Julia Aguirre, thank you for your wisdom. Thank you for our long conversations, your openness as a mother and scholar of color, and for pouring faith in me to become an agent of change. Thank you Dr. Kara Jackson for your wonderful guidance over the years as I crafted my research. I also wish to thank Dr. Shaneé Washington for serving on my committee and sharing her expertise on critical pedagogies.

I am deeply grateful to my two research participants for allowing me to tell your stories. Teaching is such an isolating profession, and sharing our ideologies and teaching practices can be a very vulnerable experience. Thank you for opening up your classrooms and sharing your mathematics teaching expertise. As a fellow Black woman mathematics teacher, I tell your stories with great pride.

Thanks to my Math Education Research Group, my MERG peeps: Taylor Stafford, Saraswati Noel, Drew Nucci, Dawit Alemayehu, Puja Patel, Rodney Perez, and James King. Thank you for letting me workshop my many iterations of this work with you all. Special thanks to my academic twin, Starlie Chinen. You have helped me grow more than you know. Thanks for sharing your perspectives and encouragement as we took on this academic journey together. Thank you Dr. Katie Lewis for your wonderful feedback and guidance as I started crafting this work years ago as my first Qualitative Methods teacher, along with your advice on organization and time management. Thank you Dr. Teddi-Beam Conroy for our impromptu office chats. Thanks to Cristina Betancourt who was my any place, any time academic mamma writing buddy. After many long days at libraries, evenings at coffee shops, and late night zoom sessions, we finally made it to the end of our journey!

Last, to my husband Nathaniel McVicar, thank you for your love. You tag-teamed parenthood with me for all these years while I drove off in the early mornings to collect data and hid away in the evenings to write. You then cared for me when I ran myself weary. Thank you for believing in me and encouraging me to reach as far as I could.

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Chapter 1: Introduction

Black women teachers are pedagogues. They always have been pedagogues. From the days of emancipation (Anderson, 1988) through de jure and de facto school segregation (Walker, 1996, 2018) to today's Millennial teaching force (Dilworth, 2018), Black women have been on the front lines of educating children in U.S. schools. As these schools have become more diverse, and educational justice for Black and Brown students have remained elusive in white teacher-led classrooms, scholars have turned to documenting the expertise of Black women teachers. Typically, research on Black teachers has focused on the *demographic imperative*, the belief that Black teachers are needed to successfully teach Black students. However, a second *democratic imperative* (Achinstein & Ogawa, 2011; Frank et al., 2018) has emerged, that Black women teachers' pedagogical expertise benefits *all* students across *all* subjects (Blazar, 2022; Gershenson et al., 2017).

Black women have a legacy of pedagogical expertise. Black women's pedagogical innovations that have critically influenced K-12 education include culturally relevant pedagogy (Ladson-Billings, 1994), culturally responsive teaching (Gay, 2000), culturally specific mathematics pedagogy (Leonard, 2008, 2019), abolitionist teaching (Love, 2019), and culturally and historically responsive teaching (Muhammad, 2023). These Black women researchers identified Black women's pedagogies through careful observations of teaching practice, and reflections on researcher positionality related to lived experiences grounded in Black girl and womanhood. Other scholars have researched Black women teachers' pedagogical stances that benefit Black students, including community uplift (Dixson & Dingus, 2008; King, 1993), political activism (Beauboeuf-Lafontant, 2005; Dixson, 2003), and protecting Black children (McKinney de Royston et al., 2020). Collectively, Black women's pedagogies are practices of

freedom, allowing both teachers and students to engage in democratic classroom practices, build critical consciousness, and become self-actualized (hooks, 1994). Black women's liberatory pedagogies are rooted in Black feminist epistemology, political consciousness regarding the sociopolitical education context for Black and Brown people in America, and the need to advocate for the next generation of Black and Brown students.

Past research about Black women's liberatory pedagogies has largely gravitated toward disciplines outside mathematics teaching and learning, generally drawing examples from language arts and social studies. Few authors of these liberatory pedagogies write from a mathematics background or study Black women teaching mathematics. This trend has persisted to the detriment of Black and Brown students. Mathematics education in America mirrors our broader society, which continues to reinscribe patterns of intellectual and socioeconomic elitism, whiteness, and masculinity (Joseph et al., 2021). Mathematics classrooms are sites of anti-Black violence, where racial scripts typically dictate learning opportunities and treatment of Black and Brown children in mathematics (Gholson & Wilkes, 2017; Martin et al., 2019). Anti-Black violence includes "othering" Black and Brown students by constantly comparing them to white students via achievement gap rhetoric and classifying them as remedial (Bullock, 2019; Gutiérrez, 2008). Mathematics education needs the voices of Black women teachers able to counter anti-Black violence in mathematics through humanizing, liberatory mathematics pedagogies.

Black women's mathematics teaching remains woefully undertheorized. Emerging research on Black women mathematics teachers offers promising developments for understanding Black women's liberatory mathematics pedagogies. A small yet crucial group of studies focus on Black women's trajectories into the field, racialized experiences, beliefs, and

practices (Birky et al., 2013; Clark, Frank, et al., 2013; Frank et al., 2018, 2021; Frank, View, & Williams, 2019; Leavitt, 2010; McVicar, 2024). Few scholars, if any, examine Black women's pedagogical expertise through a Black feminist lens, study pedagogical content knowledge (PCK) from a critical Black feminist perspective, or situate Black women's teaching beyond teaching Black students. More empirical work is called for to identify liberatory mathematics pedagogies that resist and disrupt racism and racialization in diverse classrooms.

In response, this dissertation offers a conceptual exploration of *Black Woman Math Pedagogy,* exploring how politically conscious Black women mathematics teachers teach mathematics to racially and ethnically diverse learners. I take a Black feminist stance in my work, using Black feminist thought to theorize Black women's teaching of mathematics. I explore how Black women use their "outsider-within" perspective (Collins, 1989) when teaching mathematics in schools, which remain white institutional spaces. I develop a construct of *Black Feminist Math Pedagogical Content Knowledge* to study how Black women's lived racialized experiences generate knowledge that impacts their mathematics teaching. I enact a Black feminist methodological stance that entails co-constructing knowledge with Black women teachers by dialoging about teaching and making connections between Black women's identities and lived racialized experiences with teaching mathematics. I also draw on insights gathered in partnership with two Black women mathematics teachers in two racially, ethnically, linguistically, and economically diverse elementary schools in a city located in the Pacific Northwest. Questions that support my conceptual inquiry include the following:

1) How does Black women mathematics teachers' methods of teaching connect to pedagogies developed by Black women education scholars (i.e., culturally relevant,

culturally responsive, culturally specific, abolitionist, culturally and historically responsive)?

2) What pedagogical expertise of Black women mathematics teachers becomes apparent when teaching mathematics to racially and ethnically diverse learners?
3) How do Black women mathematics teachers' lived racialized experiences and ideas about power, criticality, and knowledge production shape their Black Feminist Math Pedagogical Content Knowledge (Black Feminist Math PCK)?
4) What commonalities and differences emerge in how Black Feminist Math PCK presents in Black women's mathematics classrooms?

Research Significance

Few have conceptualized teaching through the multiple lenses of Black feminist thought, critical pedagogical content knowledge, effective Black teacher literature, and Black women's liberatory pedagogies. This deep-dive into the elements of Black Woman Math Pedagogy will uncover pathways to dismantling racialized mathematics practices that negatively impact Black and Brown students. Empirical contributions include adding to the small but significant research about Black mathematics teachers (e.g., Chazan et al., 2013; Frank et al., 2019) by using a Black feminist lens and studying Black women's mathematics PCK specifically to link racialized lived experiences with how these women enact mathematics teaching.

My prior research (McVicar, 2024), along with Jacqueline Leonard's work on culturally specific mathematics pedagogy, applied a Black feminist lens to study aspects of Black women's mathematics pedagogies. Leonard's (2019) latest version of culturally specific mathematics pedagogy drew on Black feminist thought and critical race theory to craft mathematics lesson ideas that weaved together culture and mathematics. Leonard relied on her lived experiences as a

mathematics teacher educator to provide insights into teaching mathematics through Black culture and the cultures of marginalized students. My research complemented Leonard's work, drawing on a Black feminist perspective to understand the mathematics teaching beliefs and practices of five Black women elementary teachers (McVicar, 2024). I demonstrated a link between participants' racialized mathematics experiences, their beliefs about teaching mathematics, and their liberatory mathematics teaching practices. Study findings included shared liberatory stances of care, personal accountability, and a desire to serve as a role model for Black students and other students of color. These research connections indicated that Black women mathematics teachers often develop parallel liberatory perspectives about mathematics teaching and learning that arise from unique, yet predictable, lived racialized mathematics experiences. This dissertation comprises a continuation of my previous research.

As a Black woman mathematics educator and former public school elementary teacher myself, I know that our pedagogical expertise, both theoretically and empirically, has remained hidden for far too long. This new study provides expanded theoretical contributions by applying a combination of complex theoretical lenses in concert to focus on Black women teachers. Thus, my work centers Black women as clear and committed pedagogues and serves to stimulate innovation and advance teaching in mathematics.

Organization of Chapters

Chapter 2 provides theoretical framing and relevant literature to conceptualize Black Woman Math Pedagogy. Using Black feminist theory and literature of effective Black women teachers, I construct *Black Woman Pedagogy* to interpret politically conscious Black women's teaching. To study the pedagogical knowledge of Black women in mathematics, I outline a Black Feminist Math PCK construct, which uses a Black feminist perspective on pedagogical content

knowledge to name how the asset-informed stances that Black women teachers have derived from their alternative knowledge influence their mathematics teaching practice. I end Chapter 2 with a model of Black Woman Math Pedagogy that encompasses studying Black women mathematics teachers' Black Woman Pedagogy and Black Feminist Math PCK to interpret their mathematics teaching. Chapter 3 discusses the Black feminist qualitative methodological considerations I used to interpret Black Woman Math Pedagogy for two Black women mathematics teachers. Chapters 4 and 5 provide two cases that investigate components of Black Woman Math Pedagogy in the mathematics classrooms of Leslie and Shawna. Chapter 6 offers a discussion of my findings, study implications, contributions to the fields of Black women mathematics teacher literature and pedagogical content knowledge for teaching mathematics, and finally considerations for future research.

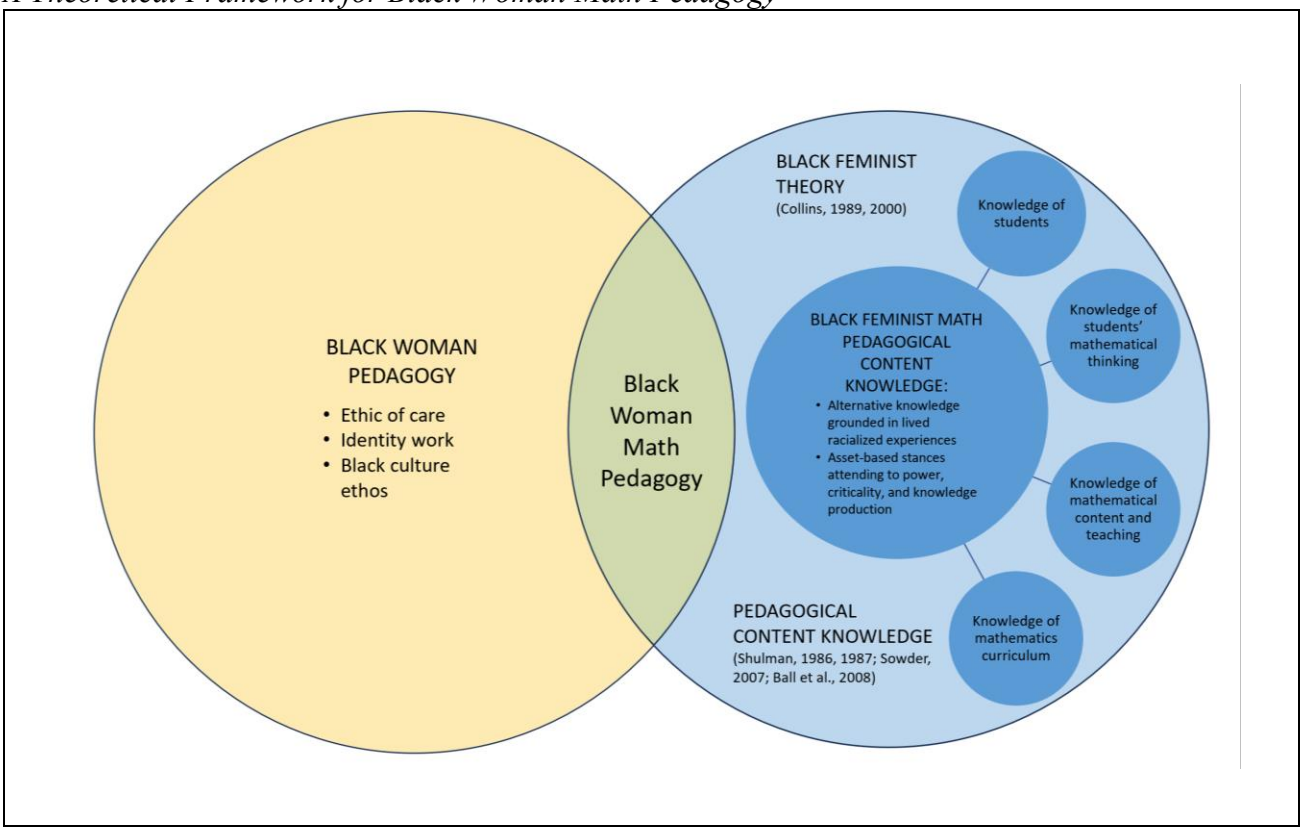
Chapter 2: Theoretical Framework and Literature Review

This literature review brings together Black women teacher knowledge, research on pedagogical content knowledge, and Black feminist theory to generate a theoretical framework to study Black women's pedagogical expertise in mathematics: *Black Woman Math Pedagogy*. The theoretical framework (Figure 1) draws on two constructs I identified based on these literature bases: *Black Woman Pedagogy* and *Black Feminist Math Pedagogical Content Knowledge*. Because Black teaching is predominantly a female endeavor, I analyze the scholarship of Black women educators using a Black feminist epistemology as the landscape for the theoretical framework of Black Woman Math Pedagogy. After laying the groundwork for use of a Black feminist lens in this work, I begin by discussing Black women teacher knowledge and progress to studying Black women teacher knowledge in mathematics, specifically.

In Part 1 of this chapter, I investigate five pedagogies—culturally relevant, culturally responsive, culturally specific, abolitionist, and culturally and historically responsive teaching. Of the various nomenclatures used to describe Black women's teaching, I have chosen the term *Black Woman Pedagogy* to encapsulate the methods Black women teachers use to effectively teach Black and Brown students. Taking on this task is analogous to Gloria-Ladson Billings' (1990) description of capturing pedagogical excellence: it is like trying to capture lightning in a bottle! Even as I write, new iterations of Black teacher pedagogies such as hip-hop pedagogy and critical race pedagogy are being developed in Black teachers' classroom practices. To bound my work, I ground it in the history of Black Woman Pedagogy. Therefore, I open with the insights of my academic foremothers such as Geneva Gay and Gloria Ladson-Billings whose work impacts not just Black teachers in schools and districts, but teacher education research and programs as well. I weave in Jacqueline Leonard's work in mathematics education as a starting point to

Figure 1

A Theoretical Framework for Black Woman Math Pedagogy



cultivate an understanding of Black women teaching mathematics. Because of their impact in the geographic area of my research, I also bring in Bettina Love's abolitionist teaching and Gholdy Muhammad's cultural and historically responsive teaching.

Prior to this investigation, I had read the works of Ladson-Billings, Gay, Leonard, Love, and Muhammad—creators of the above pedagogies. In this analysis, I reread them with a critical eye, employing Black feminist lenses to make sense of how each pedagogy was researched and conceptualized. I then analyze a range of historical literature—from Black teachers working in the post-Civil War era of segregated schools to contemporary times—locating themes across the literature. I then analyze these themes in light of the five seminal works of Black Woman Pedagogy. From this review, I identify three common elements across Black Woman Pedagogy:

1) Black women teachers use an ethic of care 2) Black women teachers are identity workers, and 3) Black women teachers use a Black cultural ethos. In this investigation, I also review the limited literature base focused specifically on Black women's mathematics teaching. This literature gap leads me to conclude Part 1 with a call for research on Black Woman *Math* Pedagogy.

In Part 2 of this chapter, I argue that to interpret Black Woman Math Pedagogy, one must understand politically conscious Black women's mathematical pedagogical content knowledge (PCK). Mathematics PCK (Ball et al., 2008; Grossman et al., 2005; Shulman, 1986; Shulman, 1987; Sowder, 2007) is the knowledge teachers need to effectively teach students mathematics. Conventional methods of studying PCK in mathematics fail to address how identity, power, and knowledge operate within the mathematics classroom. They also fail to consider the assets politically conscious Black women teachers bring into the mathematics classroom.

Taking a Black feminist perspective, I explain how politically conscious Black women mathematics teachers possess "alternative knowledge" (Collins, 2000) rooted in their lived racialized experiences, which strengthens their mathematics PCK. I refer to Black women's methods of teaching mathematics with such knowledge as *Black Feminist Math PCK*. Possessing alternative knowledge provides Black women mathematics teachers an "outsider-within" perspective (Collins, 1989) for teaching mathematics that attends to power, criticality, and knowledge production, thereby informing how politically conscious Black women teach mathematics while refusing and resisting anti-Black narratives about students. Among the few studies from Black women mathematics educators about pedagogies that draw from a Black feminist perspective in mathematics is Joseph's (2021) Black Feminist Mathematics Pedagogies, which attends to the academic success of Black girls in mathematics classrooms, and Leonard's

(2008, 2019) culturally specific pedagogy in mathematics that increases students' success and ability to make mathematics important by connecting it to students' cultural knowledge bases. However, the scarcity of knowledge regarding how Black women teach mathematics specifically indicates that further study of Black women's pedagogical knowledge in mathematics is much needed.

In Part 3, drawing on research from Part 1 and Part 2, I discuss how to study Black Woman Math Pedagogy. I bring together the constructs of Black Woman Pedagogy and Black Feminist Math PCK to situate my study of Black women's daily mathematics teaching.

Theoretical Underpinnings of Black Woman Math Pedagogy

The significance of using a Black feminist lens to interpret Black women's mathematics teaching is that it demands attention be paid to Black women, Black peoples, and our oppressed kin facing intersecting oppressions, also known as intersectionality (Collins, 2000; Crenshaw, 1991). Intersectionality explains how interlocking systems of oppression (e.g. racism and sexism), such as being Black and female in mathematics, operates in our society. Black feminism demands acknowledgement that mathematics education remains is a white-male-dominated space fueled by ideologies that ignore the intersections of mathematics and race, gender, power, and oppression. Our society, including its consensual framing of mathematics, was not built for Blackness to flourish.

And yet, Black women were braving the front lines of this battle for Black liberation and justice long before emancipation (Anderson, 1988; Givens, 2019), long before Jim Crow forced integration (Siddle Walker, 1996, 2018) and the mass dismissal of most of our Black women teaching force (Acosta et al., 2018), and long before "achievement gaps" were blamed on Black and Brown communities rather than on public schools systems that failed to serve them (Ladson-

Billings, 2006). Freire (1970) theorized that freedom must come from the work of the oppressed. Black people are far from new to the undertaking of liberating themselves from oppression. Emancipation arose from the courage of Black folks such as Harriet Tubman who, after freeing herself, risked re-entering the South to free literally hundreds of people. Significantly, Tubman used mathematics to read the world and the sky—consulting the starry skies as coordinate planes—to map routes to freedom. We carry alternative knowledge that our oppressors cannot—or choose not—to recognize.

Black women teachers' work has been rooted in a pedagogy of freedom from oppression. However, Black women teachers' mathematics pedagogy remains woefully under-theorized and under-researched. For example, in the compendium chapter on *Identity in Research on Mathematics Education* (Langer-Osuna & Esmonde, 2017), identity discussions about race and mathematics (Black mathematics identity) and gender and mathematics (female mathematics identity) are divorced as separate topics. While I find Langer-Osuna and Esmonde's chapter on identity helpful, the intersectionality of being Black *and* female in mathematics is essentially erased by omission. Other scholars have noted this omission of Black girls and women in mathematics literature (e.g., Joseph, 2017, 2021a; Joseph et al., 2019). Few scholars have taken a Black feminist lens to mathematics education (Joseph, 2021; Leonard, 2019). However, our sense of the world and our alternative knowledge about the ways identity, power, and knowledge production operate in mathematics are assets from which mathematics education can benefit. Using a Black feminist perspective to interpret Black Woman Math Pedagogy reveals how Black women, like Harriet Tubman, use alternative knowledge gained from living on the margins of dominant culture to teach Black and Brown students using liberatory pedagogies, counteracting white-dominant education systems that perpetuate inequality for Black and Brown students.

Nicole Joseph's (2021) Black Feminist Mathematics Pedagogies framework adopts a Black feminist perspective in combination with Black girlhood theories to support the development of Black girls in mathematics classrooms. She defines Black feminist mathematics pedagogies as "a response [through curriculum and pedagogy] to an unrelenting gendered antiblack mathematics education system and represents a re-imagined mathematics curriculum and pedagogical world steeped in the unapologetic celebration of Black girlhood" (p. 80). Her framework refuses and resists whiteness and gendered anti-Blackness in mathematics, attending instead to curriculum and pedagogy that function in service of Black girls in mathematics classrooms. Joseph's pedagogies draw on critical mathematics scholarship (e.g., Aguirre et al., 2017; Battey & Leyva, 2016; Gholson & Martin, 2014; Martin et al., 2019) that situates mathematics as a gendered, anti-Black environment lacking the conditions under which Black girls can thrive.

According to Joseph (2021), Black Feminist Mathematics Pedagogies consists of four dimensions: 1) Ambitious mathematics instruction with a rigorous mathematics curriculum that promotes ambitious learning; 2) Critical consciousness and reclamation from teachers about Black girlhood within mathematics classrooms that raises Black girls' critical consciousness and reclaims the mathematics space for Black girls; 3) Academic and social integration that humanizes learning experiences by blending academic and social dimension to allow Black girls' full humanity to exist within the mathematics classroom and "affords Black girls the freedom and liberation to just be" (p.90); 4) Robust mathematics identities 2.0, creating opportunities for Black girls to know themselves and be known by others as competent mathematics learners and doers. Joseph developed this 2.0 version following McGee (2015), "who defined a robust mathematics identity as the strength and agency that college students develop despite their

racialization to maintain self-motivated mathematics success" while incorporating the conditions that Black girls must learn to resist and critique traditional mathematics education systems that perpetuate inequities in mathematics classrooms and the world (as cited in Joseph, 2021, p. 90).

Black Feminist Math PCK and Joseph's Black feminist mathematics pedagogies are closely aligned in the critical mathematics sphere. However, whereas Joseph situates her pedagogies within the learning sphere of Black girls, I situate mine within Black women's teaching. Further, whereas Joseph built her pedagogy from critical mathematics education research and Black girlhood scholarship, my pedagogy begins with Black women researchers and educators and seeks a way to study Black women's mathematics teaching that aligns with the epistemologies of Black women teaching over time. Our theoretical beginnings are similar: we both start with Black feminism. But while Joseph draws from Black girlhood studies, I focus on how Black women report their own lived experiences in the extant literature. My work is grounded in examining how Black women teach mathematics by drawing on their lived experiences in mathematics classrooms and the world.

Black Feminist Epistemology

Since the work of U.S. Black teachers across history has been a predominantly female endeavor, and since I, too, am a Black woman educator and academic, I bring to this work a Black feminist lens to interpret the pedagogies of Black women teachers of the past, present, and future. As I explore how Black Woman Pedagogy was created and continues to unfold, I follow in the tradition of fellow Black women scholars who use Black feminist epistemology in their theoretical framing. As Dixson and Dingus (2008) state, a Black feminist framework "explains how we also 'do' our research and scholarship" (p. 812). I approach Black teacher literature with the following Black feminist epistemological stances:

1) Lived experience as a criterion of meaning. Our experiences contribute to our knowledge and wisdom
2) The use of dialog with ourselves and other Black women, whether in person, writing, film, etc.
3) An ethic of personal accountability to knowledge claims
4) An ethic of caring that specifically honors individual uniqueness and personal experiences, emotions that validate dialog, and the capacity for empathy (Collins, 2000, p. 266).

Given these four epistemological stances, I analyzed Black teacher literature to understand the following research concepts:

1) How Black women's lived experiences inform how they teach;

2) How Black women scholars dialog with other Black peoples through writing, literature reviews, or conversations about educating students;

3) How Black women teachers articulate personal accountability to their knowledge claims;

4) How Black women embody an ethic of care in the work of educating students.

My interpretations of Black Woman Pedagogy are guided by six distinguishing features of Black feminist thought (Collins, 2000) that guide my interpretation of Black women's standpoints. As Collins (2000) explains, Black women's standpoints are "a collective body of wisdom" (p. 24) that is "characterized by the tensions that accrue to different responses to common challenges" (p. 28). Black women's standpoints should not be interpreted as essentializing Black women or implying that all Black women share the same experiences. Rather, a shared standpoint serves as a starting point from which to interpret Black women's

experiences given a shared history with common challenges as racialized and gendered individuals in the U.S. A Black feminist standpoint articulates Black women's stories of survival, activism, and empowerment passed down through history. These standpoints represent an understanding shared by many Black women, even when we are unaware of it or how our actions are based on it. Even so, it is from these standpoints that Black women can make decisions and take action for change.

Distinguishing Features of Black Feminist Thought

Drawing on Collins's work, I interpret the following six distinguishing features through the context of Black women teachers: 1) Black women create a standpoint based on historical group knowledge about Black feminist teaching, passed down through conversations and continuously experiencing the same shared issues. For Black women teachers, this history may revolve around dealing with tensions between what to teach or choosing allies in the building. 2) Black women's teaching standpoints are generally shared because we share similar collective experiences. Though no "normal" experience for Black women teachers exists, we face common tensions and challenges. 3) Having a self-defined standpoint can stimulate resistance among Black women teachers. 4) Black women teachers should at times combine their efforts with those of Black women researchers and scholars as well as Black women outside the education community to think through our everyday, taken-for-granted knowledge and generate new theories and practices. 5) Black feminist thought is dynamic and changes over time and across schooling contexts. 6) Therefore, it is important to constantly seek out the ideas of other Black women teachers and likeminded people working towards social justice. While oppression operates differently across racial, ethnic, gender, and other intersecting identities, social justice-oriented Black women strive for liberation for all oppressed peoples.

Part 1: Black Woman Pedagogy

There are many definitions for the term *pedagogy*. From a Black feminist perspective, thought and action have a dialogical relationship with one another (Collins, 2000). Therefore, I define pedagogy as the dialogical relationship between thoughts and actions *in relation to* teaching. This dialog can be a dialog of one—a Black woman teacher consulting with herself and then acting—or a dialog with many—either other Black women, or the collective knowledge of Black women teachers' legacy. The dialogical relationship between thought and action informs how Black women make sense of a world that may not value their lived experiences, their interpretation of the world, and their quest for seeking justice for themselves or oppressed peoples. Though Black women in the U.S. may not share the same lived racialized experiences, they do share a common standpoint from living in the U.S. and similar experiences based on how intersecting oppression operates in society. For example, a common conception for many Black women is the idea of community uplift, to lift as we climb, because education in the eyes of many Black folk is central to our personal growth and success in U.S. society.

Politically conscious Black women teachers' theories are based on their lived racialized experiences, which inform their knowledge bases: what they know to be true about the world, and what they know to be true about teaching. Because of common standpoints, Black women teachers often enact similar pedagogies in their classrooms, making it possible to study Black women's pedagogies and identify commonalities in their thoughts and actions.

Therefore, to define Black Woman Pedagogy, I began by rereading the scholarship of five major pedagogies from Black women educators: culturally relevant teaching, culturally responsive teaching, culturally specific teaching, abolitionist teaching, and culturally and historically responsive teaching. I chose these five pedagogies because they are firmly rooted in

scholarly work. Each scholar's book explores her pedagogy in-depth, from the pedagogy's origins to examples of implementation within classrooms. Three of the pedagogies' original texts—*Dreamkeepers* (1994) (culturally relevant), *Culturally Responsive Teaching* (2000), and *Culturally Specific Pedagogy* (2008)—have been published in more than one edition. Culturally and historically responsive teaching has two books on the subject in quick succession—*Culturally and Historically Responsive Teaching* (2020) and *Unearthing Joy* (2023). Abolitionist teaching is a single text—*We Want to do More than Survive* (2019)—yet has grown into the Abolitionist Teaching Network organization, featuring an online presence (*The Abolitionist Teaching Network*, n.d.). In sum, these pedagogies are well developed in teacher education scholarly and practitioner communities.

I read these texts during my teacher education training and early scholarly pursuits. Rereading them with a Black feminist lens allowed me to see in a new light each author's message about educating students. First, I noticed how present in their work each author was while writing about these pedagogies. There life's work of educating Black and Brown students was personal. Ladson-Billings (1994), Gay (2000), Leonard (2008, 2019), Love (2019), and Muhammad (2023) discussed not only their beliefs about teaching, but their own lived experiences and teaching experiences as well. As teacher educators, all five women reflected on the difficulties of preparing teachers to take up their pedagogies. Ladson-Billings and Love both reflect on their own school experiences as Black women and use that knowledge to make sense of what is possible when teaching Black and Brown students. Gay talks about her teacher educator practice and the knowledge she gained by talking with other educators and researchers. Leonard also describes her teacher educator experience in addition to offering a historical perspective of education in her own family, pointing out the generational strength and struggles

of Black folks advancing their own lineages to a place of achievement within inequitable school systems. Muhammad weaves in insights dating from childhood to her preservice program, and highlights conversations and questions she encountered as she built her pedagogy and shared it with others as a teacher educator. The authors' multiple insights through experiential knowledge in teaching, researching, and living life as Black women educators and scholars adds value to their pedagogies. Along with citing research, theory, and practice to articulate their pedagogies, each of these five authors engaged with Black feminist epistemology in some form to create a vision of how to teach students in general and Black children in particular.

Notably, as new pedagogies emerged, the authors considered how their pedagogies drew on earlier Black pedagogies and the pedagogies of our ancestors. Ladson-Billings synthesized the pedagogies developed by Black teacher scholars of the 1970s, '80s, and early '90s. Having observed predominantly Black teachers educate Black elementary children, she developed the culturally relevant pedagogy framework: academic achievement, cultural competence in your own culture plus at least fluency in one other, and building students' sociopolitical consciousness (Ladson-Billings, 1995). Gay (2000) draws from the field of multicultural education and previous cultural pedagogies from Black scholars—including Ladson-Billings' culturally relevant pedagogy—to construct culturally responsive teaching. She addresses how teachers can respond to students individually, given the idea that we cannot teach a student until we know the student's culture and cultural funds of knowledge. Culturally responsive teaching encompasses four components: care, communication with students in modalities that fit their cultural background, curriculum that fits a student's culture, and cultural congruency to teach with and through the student's culture. Gay grounds these components in empirical studies on teaching ethnically and linguistically diverse students. Many of the studies Gay cites makes no mention of

teachers' racial background and instead focus on that of the students. Gay also draws upon her personal teaching beliefs and practices as a Black woman educating high school social studies students and preservice teachers to illustrate culturally responsive teaching in her own practice.

Leonard (2008, 2019) recognizes the effectiveness of cultural pedagogies in supporting student learning. Importantly, Leonard points out that, though some differences appear among all cultural pedagogies—such as those of different ethnic and racial groups—all racialized students, particularly Black, Latinx, and Native American students, benefit when taught through culture. Leonard drew on culturally relevant pedagogy when creating culturally specific pedagogy for *mathematics* teaching. Thus, the goals of culturally specific pedagogy contain components of culturally relevant pedagogy, which include supporting students' academic success, building cultural competency, and developing sociopolitical consciousness. Leonard adds to Ladson-Billings' pedagogy by moving students beyond sociopolitical consciousness to taking action via mathematics, naming culturally specific pedagogy as part of social justice pedagogies that "expose unjust practices and empower students to challenge the status quo" (2019, p. 2). Leonard also encourages students to cultivate their own cultural competency as well as "develop their identity (e.g., racial, ethnic, gender, etc.) within the learning community" (Leonard, 2019, p. 2). Teaching through culture attends to these goals of culturally specific pedagogy in mathematics.

In her book, Leonard observes teachers of various racial identities to study their mathematics and science teaching implementation of innovative, culturally specific pedagogy lessons that Leonard and colleagues designed independently. For example, she highlights two women elementary teachers, one Asian-American and one white, who taught a unit about Harriet Tubman. During the unit, the two teachers discussed how runaway enslaved people used mathematics and science to read the land and sky for navigation, connecting these ideas to Black

students' racial identity, heritage of freedom work, and heritage of being natural mathematicians and scientists (Leonard, 2008). These and other examples in her book do not explicitly reference Black women teachers employing culturally specific pedagogy in mathematics. In her latest edition, Leonard (2019) frames her work using critical race and Black feminist theory to discuss how culture and mathematics have intertwined in her own lived experiences through teaching, her own history and ancestry, and the Black Lives Matter movement.

Muhammad (2020) builds on culturally responsive and relevant teaching, using the term "culturally relevant education" (p.39). She traces elements of culturally relevant education through African philosophies of education, Black-centered schools in the U.S., practices in Black literary societies, Civil Rights and Black Power movements' directives for education, and scholarship from such authors as Anna Julia Cooper, Mary McLeod Bethune, Carter G. Woodson, and W.E.B. DuBois (p. 43). Muhammad emphasizes the historical aspect of Black students' culture to build a culturally and historically responsive literacy framework for teaching all students. In her second book, Muhammad extends her literacy framework to education more broadly. She names five goals or "pursuits" of Black literary societies in the 1800s that can be applied across subject areas: identity, skills, intellect, criticality, and joy (Muhammad, 2023).

Love (2019) draws on abolitionist practices from pre-Civil War times and the Civil Rights Movement to conceptualize "abolitionist teaching" (p.68). She draws inspiration from Ella Baker, a Black woman activist, and her methods for organizing communities during the Civil Rights Movement to progress from surviving to thriving in a country oriented against Black and Brown people. Love builds on Ella Baker's grassroots activism to define abolitionist teaching:

> [A]bolitionist teaching is built on the cultural wealth of students' communities and creating classrooms in parallel with those communities aimed at facilitating interactions where people matter to each other, fight together in the pursuit of creating a homeplace that represents their hopes and dreams, and resist oppression all while building a new future" (p. 68).

Abolitionist teaching forges connections to Black and Brown communities that are "homeplaces" or places of refuge for children. The pedagogy requires freedom dreaming of all we seek to empower Black folks and educators who love Blackness to fight for Black and Brown children.

I pause here as a Black woman educator who once read these works independently of one another but now recognizes how *together,* these comprise five *powerful* pedagogies, imbued with connections across time to Black ancestors, lessons learned from previous generations of teachers, and previous iterations of Black women's pedagogies. I am warmed with a love of Blackness, Black culture, Black children, and a love of humanity and hope. I hear an articulation across these pages: This is how we educate *our* children. This is how you can educate *all* children.

To locate commonalities across pedagogies, I studied these pedagogies, composed outlines and memos, and engaged in conversations with colleagues about what each author described as important teaching components when working with Black and Brown students. Looking across these five bodies of work to unearth the components of Black Woman Pedagogy, I found commonalities across culturally relevant, culturally responsive, culturally specific, and abolitionist pedagogies, and culturally and historically responsive teaching. Each pedagogy involves teachers having an *ethic of caring* about teaching students and deep respect for the hard work of teaching. Each pedagogy situates teachers as *identity workers* for students, whether by

building students' racial and academic identities or supporting and maintaining the intersections of their multiple identities in the classroom. Each pedagogy examines Blackness in the classroom through curriculum, cultural and community knowledge, or philosophies of learning. Thus, each pedagogy incorporates a *Black cultural ethos.* These elements often overlap and support one another's development. For example, using a *Black cultural ethos* in the classroom contributes to students' positive *identity* formation.

After noting how these themes manifested in each pedagogy, I applied the themes across other texts about Black teachers on teaching. I drew on historical data of Black teachers, which is still being pieced together by Black education historians like Vanessa Siddle Walker (1996; 2018) and Jarvis Givens (2021). Other current examples include Michelle Foster's (1994) and Melanie Acosta's (2018, 2019; Acosta et al., 2018) work on Black teachers and Black woman teachers. I found three themes articulated in various ways in Black teacher literature to describe the pedagogy of Black teachers. What follows is a definition of Black Woman Pedagogy and a discussion of the three key themes as grounded in Black women teacher literature.

Defining Black Woman Pedagogy

Black Woman Pedagogy is a synthesis of how politically conscious Black women teach Black and Brown children with the goal of liberation. Black Woman Pedagogy is an ethic of teaching that Black women with political consciousness enact. Political consciousness allows Black women to be attuned to the politics of world, including their influences in education, to understand how oppression operates, and seek to refuse, resist, dismantle, and transform oppression in order to liberate both students and themselves to exercise their full humanity. Black Woman Pedagogy is composed of three common elements: embodying an ethic of care, serving as an identity worker who maintains and uplifts students' multiple identities, and

teaching with and through a Black cultural ethos. Black Woman Pedagogy consists of "practices of freedom," wherein both teachers and students engage in democratic practices, build critical consciousness, and become self-actualized (hooks, 1994, p. 14). "Freedom" means liberation from oppression within schools and practices that cause hurt, harm, or pain to students (Muhammad, 2023) by having them oppress themselves and their brilliance. Enacting Black Woman Pedagogy centers on loving Blackness and celebrating Black excellence with both Black and non-Black students.

Black Woman Pedagogy is enduring, articulated again and again throughout history as Black women teachers worked together with families and communities in segregated schools in the late 1800s through Brown v. Board environments where teachers could support raising students to their highest potential learning for community uplift and self-determination (Anderson, 1988; Givens, 2021; Siddle Walker, 1996). Even as the Black teaching force dwindled during integration, which prioritized white teachers over even the most highly educated Black teachers, Black women teachers maintained their pedagogical legacy (Acosta et al., 2018). Even today, the 7% of public school teachers who are Black remain far more likely to teach in Black schools (National Center for Education Statistics, 2019). Yet, as Black women teachers over time began teaching in more diverse classrooms, they maintained traditions of Black Woman Pedagogy and supported students facing interlocking oppression, particularly Brown and Black students.

Because few opportunities draw Black women teachers together, this political work of teaching Black and Brown kids seems more difficult to carry out. Often, Black women teachers find themselves either one of a few or the sole Black teacher in a school. Because Black Woman Pedagogy goes against the dominant norm of teaching methods—by, for example, possessing the

confidence to teach lessons beyond the textbook's scope—Black teachers exercising this pedagogy may have to contend with school administrators and colleagues who do not share the same perspective of teaching children. Black women may be negatively stereotyped and their teaching effectiveness may go unappreciated (Acosta, 2019). Nonetheless, Black Woman Pedagogy lives on in the literature, conversations in hallways, professional development spaces, teacher education, writing, journals, books, podcasts, etc. I begin with element one below.

Element 1: Black Women Teachers and an Ethic of Care

"Care" is a ubiquitous term in education. Black Woman Pedagogy supersedes the generic sense of teaching "because I care about kids" or "I like kids." Black feminist caring is a deeply held responsibility rooted in Black women's commitment to care about others in their communities. Black teachers' caring is that "of concerned adults, who command respect, are respectful of pupils, and who through caring require all students to meet high academic and behavioral standards" (Foster, 1994, p. 213). Black feminist caring connects to Black women's tradition of rearing or "othermothering" the children of kinfolk or close friends. Othermothering is a Black feminist teaching tradition of mothering Black students while parents are away. Teachers do not supplant parents. Rather, they ensure the psychological and physical wellbeing of children outside parental care (Case, 1997; Collins, 2000; Dixson, 2003). Black women teachers who embody this role ensure that "their children" are looked after and have their needs met. Such caring is rooted in Black feminism (Collins, 2000), Black teacher political clarity (Dixson, 2003; McKinney de Royston, 2020), and African American pedagogical excellence (Acosta et al., 2018). This type of deep caring for Black and Brown students is radical enough to qualify as activism (Beauboeuf-Lafontant, 2005; Dixson, 2003) and a form of protection (McKinney de Royston et al., 2020) from institutionalized schooling policies and practices

steeped in whiteness and white supremacy. Our schooling institutions are not designed to nurture the minds and souls of Black and Brown students. Thus, a Black feminist ethic of care equates to an ethic of refusal and resistance on behalf of Black and Brown children.

As an enduring theme throughout much of Black teacher literature, an ethic of care is a cornerstone of culturally responsive teaching. Gay (2000) states that caring amounts to an ethic because it requires teachers to "honor humanity, hold students in high esteem, expect higher performance from them, and use strategies to fulfill expectations… model academic, social, personal and moral behaviors and values for students to emulate" (p. 46). Gay's ethic of care sustains the approach of politically conscious Black teachers working in all-Black schools during segregation. In *Their Highest Potential*, as an example, Siddle Walker (1996) studied a segregated Black high school in the earlier 20th century that, despite a lack of support from the white-led school district, uplifted its students by caring for their well-being, organized an elaborate community transportation system to ensure that students got to school, and created extracurricular activities and field trip experiences that helped to prepare students for the world beyond their nurturing high school. These characteristics of Black teachers' work, performing an ethic of caring, would today be categorized as "going above and beyond." But to Black teachers of the time, it was necessary work connected with community uplift.

Gay (2000) refers to care in schools as "an unavoidable moral mandate" (p. 75). In her research, Gay found that African American students experienced their segregated school as a "home away from home" and "a consistently caring climate" (p. 47). The phrase "home away from home" pairs nicely with Love's abolitionist teaching idea of a *homeplace.* A homeplace is any community space that feels safe for Black and Brown students to be themselves and work to achieve their potential. The purpose of a homeplace is "protecting children's potential" (Love,

2019, pp. 82-83). Interestingly, Love found her homeplace in a local community center and through a handful of teachers and coaches in her K-12 career. However, this sense of "a homeplace" was not consistent in her schooling experiences. Part of Love's abolitionist teaching movement is to bring into schools a homeplace for students where they can feel secure, loved, and encouraged to reach their highest potential.

Using Black feminist theory as a methodology, Ladson-Billings (1994) noted when discussing the work of teaching African American students that culturally relevant teachers exhibit an ethic of caring. In her Dreamkeepers study, Ladson-Billings used "Afrocentric feminist epistemology" to understand care among seven teachers, five of whom were Black. Though for white teachers to exhibit care when teaching Black students is both plausible and necessary, and while such care is featured in many types of feminism, Ladson-Billings specifies a distinctly Black feminist tradition of care. As Ladson-Billings explains in her methodology section, "I argue that Collins's use of caring refers not merely to affective connections between and among people but to the articulation of a greater sense of commitment to what scholarship and/or pedagogy can mean in the lives of people" (p. 474). An ethic of caring goes beyond a mere affection for children. Care means a responsibility to students, families, and communities to participate as a co-parent in raising students. Interestingly, Ladson-Billings believed the Black women teachers in her *Dreamkeepers* study may have "set the tone" and determined the group's cultural "ethos" when articulating how they cared about students, community, and teaching (p.156). I find myself wondering what would be possible if a school were taught by Black women teachers predominantly, all of them sharing this ethic of caring.

Though Muhammad (2020, 2023) and Leonard (2019) do not explicitly call out care as an element of culturally and historically responsive pedagogy or culturally specific pedagogy, I

find it impossible based on the descriptions of care above, for a teacher to lack an ethic of caring yet fully engage in both pedagogies. Leonard's research centers Black, Latinx, and Native American cultural, racial and ethnic groups that are typically pushed out of mathematics because the discipline is typically congruent with white culture and ways of understanding the world. Culturally specific pedagogy requires teachers to bring culture into mathematics, which renders mathematics more congruent and meaningful to students, thereby facilitating better learning opportunities. Furthermore, connecting culture to mathematics can be performed in ways that encourage Black and Brown students to critique the world around them, question, and push back on inequities. Leonard includes girls and women in culturally specific pedagogy as well, given that mathematics continues to be a predominantly male space, and calls for an overhaul of curricula to better focus content on student cultures.

Similar to culturally specific pedagogy, Muhammad's culturally and historically responsive pedagogy necessitates establishing Black students' cultural histories as a starting point for instruction. I connect this idea to Gay's (2000) notion that students must see that their culture is worthy of being taught in formal curriculum (p. 29). Culturally and historically responsive pedagogy emphasizes learning about Black peoples' histories and excellence, incorporating both into lessons and curriculum for all students to provide an education more rigorous and empowering than that currently relied upon for English language arts standards. Furthermore, such as pedagogy connects to Love's abolitionist teachers who love Blackness and root for Blackness to succeed and excel. Making learning any subject more relevant to students requires a profound depth of care on the teachers' part.

An ethic of caring is fundamental to Black Woman Pedagogy. Gay (2000) states that a teacher's caring "manifests in the form of teacher attitudes, expectations, and behaviors about

students' human value, intellectual capability, and performance responsibilities" (p. 46). Because care is, unfortunately, so radical (McKinney de Royston et al., 2020) in an education culture wrongly labeling deficits in Black and Brown children, families, and communities, Black teachers are often left to enact this caring in their practice on their own, drawing from a deeply rooted sense of responsibility.

A Black feminist ethic of care differs from other conceptions of an "ethics of care" within education literature, such as that proposed by Nel Noddings (2005). Black women's ethic of care comes from an embodied sense of caring for others in the community. Though Noddings identifies with feminism, her perspective is predominantly informed by white feminism, the ideologies of which differ from Black feminism regarding connections to self and community. As a philosopher, Noddings generalizes her personal beliefs—those of a white female—about the nature of schooling to apply to all students. In her 2005 second edition *The Challenge to Care in Schools*, Noddings' argument draws primarily on white authors and researchers, her own beliefs, and a perfunctory mention of one Black woman author. She omits mention of Patricia Hill Collins's "ethic of care" from the 1990 first edition or 2000 second edition of *Black Feminist Thought*, as well as every other Black feminist author, philosopher, or educator.

Though Noddings has greatly influenced care ideology in education, the nature of this care is limited, based on a perspective of relational exchange:

> An ethic of care embodies a relational view of caring; that is, when I speak of caring, my emphasis is on the relation containing carer and cared-for. Both carer and cared-for contribute to this relation. If, for whatever reason, the cared-for denies that she or he is cared for, there is no caring relation" (2005, p.xv).

From Noddings' perspective, a requisite of caring is that the cared-for person acknowledge receiving the care. A Black feminist ethic of caring, by contrast, espouses the ideologies of the Black community, including Black women mathematics teachers, and even my own epistemological stances as a researcher, Black woman, and mother working in community with Black and other marginalized and oppressed people. In Black feminist care, teachers do not withhold care from students, especially not those most oppressed in schools who need care most. In fact, care is given without condition and without any expectation that the student acknowledge or reciprocate. For example, in prior work I observed a third-grade Black woman teacher who enacted a Black feminist ethic of care by giving love, support, and encouragement to her students, especially her Black students (McVicar, 2024). She wanted to ensure that they left her classroom more than prepared to entering classrooms possibly taught by uncaring white teachers. "I'mma love all up on you" was her stance to care for Black students in her mathematics classroom and extend that caring love beyond her classroom, even after teacher-student interaction between them was past (p.15). Thus, among politically conscious Black women teachers, a *Black feminist* ethic of care is enduring.

In mathematics education, few scholars study care, and none study an ethic of care specific to Black feminist thought. Rather, care studies focus on measuring a teacher's care and whether it exists. Maloney and Matthews (2020), for example, investigated the extent to which teachers, some of whom were Black women, cared in middle and high school mathematics classrooms. Matthews and Maloney categorized care into three types: "transactional care," meaning teachers superficially showed care to encourage student behavior; "empathetic care," informed by culturally relevant sociopolitical teacher literature, characterized by "a teacher's authentic expression of identifying with the challenges of their students and prioritizing students'

well-being as equal to or above their own" (p. 408), and shown by the most caring teachings; and "blended care," which combines transactional and empathetic care. The authors studied teachers of various races, including Black teachers. Findings concluded that teachers across races, including Black teachers, fell into both superficial or emphatic care. However, the study did not determine whether Black teachers with emphatic caring also embodied a Black feminist ethic of care, nor did it discuss whether a Black feminist ethic of care related to an empathetic care for the Black women teachers.

Bartell (2011) synthesized care research outside mathematics to create a framework for mathematics teacher care. Though she draws on Black women care literature, the act of caring becomes something that white teachers must learn or build, not unequivocally have for Black and Brown students. Bartell examines care studies and theories outside of mathematics such as Noddings and notes that many teacher care studies fail to attend to power and identity. Thus, Bartell turns to Black women scholars and that of other scholars of color for examples of care for Black and Brown students. She devotes particular attention to Ladson-Billings' cultural relevant pedagogy, specifically about how culturally relevant teachers possess the political consciousness to decenter whiteness and incorporate discussions about race and ethnicities in mathematics classrooms.

Though I agree with Bartell that this work is necessary in mathematics education, such work differs from an ethic of care in a Black feminist perspective. Black women teachers who engage in an ethic of care start their caring practices before they even meet their students. Their ethic of care originates from within the Black community and is framed within a collectivist ideology. For example, some in the Black community adopt a kinship perspective, referring to one another as Brother, Sister, Auntie, and Uncle, because we are all somehow related in our

shared history in the U.S. Those with whom we interact may very well be distant relatives connected through ancestral bonds lost due to the evils of former enslavement. Our shared oppression connects us to a shared love of one another, including our children. For politically conscious Black women teachers, to extend love to other people's children is innate, especially our Black children who are like kin to us.

Element 2: Black Women Teachers as Identity Workers

Identity work in Black Woman Pedagogy centers on developing positive racial, academic, and social identities. For the purposes of my study, I focus on the intersection of racial, mathematical, and social identities. Below, I open with a discussion of how Black Woman Pedagogy attends to the *racial identity* of students through Black women's identity work. Given that only Leonard has a mathematics background and that very few mentions of mathematics arise in the other four pedagogies, I postulate that Black women can be *mathematics identity* workers.

Racial Identity. Culture informs racial identity. Gay (2000) speaks to the importance of validating students' cultures, and thus their race, in schools. She quotes African American scholar Molefi Kete Asante on the detriments of building students' academic but not personal identities. Asante states, "students 'may learn, but without cultural grounding, the learning will have destroyed their sense of place' and personal integrity" (Asante, 1991/1992, p. 30, in Gay 2000, p. 175). Gay talks about the importance of cultural congruency, a term proposed by many scholars who study the learning experiences of students of color in the classroom. A disconnect occurs between a student's cultural and racial identity and their growing academic identity when "they are not being taught in schools as they learn in their cultural communities" (Gay, 2000, p.182). Without cultural congruency, students not fluent in white dominant cultural discourses

struggle not only to learn, but to feel validated about their racial identity. Furthermore, they struggle to align their racial and academic identities.

Students benefit most when teachers accept students' racial identities and how these intersect with their mathematics identity so that students can learn and achieve while maintaining their sense of self. In abolitionist teaching, Love (2019) writes about loving Blackness to support Black and Brown people's thriving. Blackness is not the sum of our racial traumas, but a "sovereignty rooted in Black joy, Black love, and humanity" (p. 156). Finding the beauty in Blackness, and celebrating that beauty celebrated through instruction and curriculum grows a positive Black identity. Loving Blackness in school is practicing thriving and liberation for Black and Brown students as well as Black teachers. Black teachers attending to racial identity and loving Blackness along with students across racial lines pairs nicely with hooks' (1994) idea of creating a classroom space where both teacher and students can move towards liberation and enlightenment through shared knowledge building. Culturally and historically responsive education is grounded in shared knowledge building of Black literary histories. Specifically, culturally and historically responsive education studies the literary practices of Black students' ancestors. Connecting Black racial identity to past academic achievements is powerful learning and is a requirement of teachers and leaders. Muhammad (2023) posits that developing student identity involves the following: "Teachers and leaders must learn about and showcase evidence of students' histories, identities, literacies, and liberation. They must authentically respond to students' identities in curriculum, instruction, and leadership practices" (p.50).

While the identity-building scholarship above focuses on identity-building techniques that any teacher can adopt and Black women embody in Black Woman Pedagogy, I would be remiss not to acknowledge the literature on Black teachers as role models for Black students'

identity development. The idea that Black teachers are needed as role models for students is prevalent in Black teacher literature (e.g., Brown, 2009; King, 1993; Maylor, 2009; Stewart et al., 1989). Part of the role model idea is that Black students cannot be what they do not see. We cannot deny the wealth of knowledge, expertise, and commitment Black teachers can bring into the classroom. But as a Black woman who went through K-12 public schools, I can attest that not all Black teachers held my best interests in mind. I have experienced Black teachers who literally did not teach and instead let talent wither on the vine. I also experienced Black teachers who rose to the occasion and believed that I and my Black peers could do anything. Black teacher identity—like Blackness and Black people—is no monolith. Black women teachers possess agency to enact a pedagogy that aligns with, ignores, or blends the legacy of politically conscious Black women teachers.

More than role models, Irvine (1989) says Black students need mentors, "advocate teachers who help black students manipulate the school's culture, which is often contradictory and antithetical to their own" (p. 53). Black teachers who practice Black Woman Pedagogy not only teach students content but show them the language of school and the culture of power (Delpit, 2006), and cultivating students' sociopolitical consciousness to change power dynamics. Such teachers may act as cultural brokers for students, helping white teachers and administrators understand the strengths of Black students (Irvine, 1989) while helping students navigate the education system and the world. Black teachers who enact Black Woman Pedagogy defend and protect Black and Brown students' identities, whether by protecting children from unnecessarily harsh discipline policies, or taking on the students that nobody else wants (Milner, 2003). Black teachers who use Black Woman Pedagogy leverage their cultural frame of reference as an "outsider-within" (Collins, 1989) white school culture to mentor students and foster positive

identity development. Further research on Black teachers as mentors and mathematics teachers would develop a better understanding of how Black Woman Pedagogy fosters identity development in mathematics.

Mathematics Identity. For many reasons, a child can have a strong identity in both reading and writing, yet suffer from a poor mathematics identity. It is also possible for students to succeed in mathematics class yet fail to enjoy mathematics or appreciate its relevance in their lives. Martin (2000) defines mathematics identity as a person's beliefs about a) their ability to perform in mathematical context, b) the instrumental importance of mathematical knowledge, c) constraints and opportunities in mathematical contexts, and d) the resulting motivations and strategies used to obtain mathematics knowledge (p. 19). Narratives about who can and cannot do mathematics, steeped in racism and achievement gap rhetoric, are too frequently reinscribed in mathematics classrooms (Bullock, 2019; Gholson & Wilkes, 2017; Gutiérrez 2008; Martin et al, 2019). Negative narratives can influence students' beliefs about themselves and their mathematics identity. Thus, Gutiérrez (2013) names teachers as identity workers within mathematics classrooms. Teachers play a powerful role in positioning students as mathematical doers and thinkers and supporting them to develop a strong, positive mathematics identity through mathematics socialization. Mathematics socialization is the processes and experiences by which individual and collective mathematics identities are shaped in a wide range of contexts—sociohistorical, community, school, and interpersonal (Martin, 2000, p. 19).

Little is known about how Black Woman Pedagogy supports students' mathematics identity development. Aside from Leonard's culturally specific pedagogy, which focuses on mathematics, the other four pedagogies mention mathematics education in passing. Therefore, I speculate on how a positive mathematics identity can be forged through Black Woman

Pedagogy, and what purpose mathematics serves in a student's life. The goal for culturally relevant pedagogy is to make a way for Black children to have a "relevant Black personality" enabling them to choose excellence and still identify with Black culture (Ladson-Billings, 1994, p. 17). Culturally relevant teachers protect Black students in mathematics from stereotype threat or accusations of "acting white" (Steele, 1997). Instead of choosing between cultural affiliation and success, Black students can bridge culture and academic success as parts of their identity. This shift in becoming "relevant" is tied to "empowering students intellectually, socially, emotionally, and politically by using cultural references to impact knowledge, skills, and attitudes" (p. 18). Black and Brown youth experience relevance and validation as they progress to high-level mathematics and find they can to draw connections between themselves, their community and the world.

The difficulty of analyzing how Black Woman Pedagogy in mathematics operates in Ladson-Billings' *Dreamkeepers* (1994) is that, in the few examples where mathematics teaching was explained, the teacher was not Black. What we do see of a culturally relevant sixth grade mathematics classroom is that both students and teacher posed algebraic problems and students shared responsibility with the teacher for helping everyone learn. Students also learned about the African origins of Algebra. Shared responsibility for learning does contribute to mathematics success, but whether these students achieved a positive mathematics identity or saw the relevance of using algebra in daily life remained unclear. Though *Dreamkeepers* offers value in seeing how a non-Black teacher teaches mathematics to Black students, I wonder what similarities and differences emerge when the caring, identity development, and Black cultural ethos of Black Woman Pedagogy is taken up by a Black woman mathematics teacher.

It is important to mention that Ladson-Billings writes from a social studies background, while Leonard focuses on mathematics. Though Ladson-Billings (1997) critiques the inadequacy of mathematics education for Black students, Leonard expanded on Ladson-Billings's work and the work of other scholars of color, both in general education and mathematics specifically, to offer a new mindset for structuring mathematics classrooms to empower students for change and deeper identity-building. Leonard (2019) envisions a more robust culturally relevant mathematics teaching pedagogy through culturally specific pedagogy. In addition to culturally relevant teaching for students' academic learning, cultural competence, and sociopolitical consciousness, Leonard focuses on social justice and positive mathematics identity development. Leonard's culturally specific pedagogy "empowers underrepresented students to develop a mathematics identity and socializes them as they learn to use mathematics for their own purposes" (2019, p. 8). The purpose of mathematics is not simply for students' enjoyment, but for students to engage in mathematics to *know* themselves and *know* where justice and injustice lie in our world. In turn, students form a deeper connection to mathematics and a deeper sense of becoming a mathematical being.

Research centering Black women mathematics teachers' identity work connects with Leonard's vision of students becoming mathematical beings and connecting with mathematics. The few studies that do center Black women mathematics teachers underscore Black women's ability to support mathematics identity development in their Black students (Birky et al., 2013; Clark, Badertscher, et al., 2013; Frank et al., 2018; Leavitt, 2010). In this scholarship, supporting students' positive mathematics identity development occurs in tandem with students learning mathematics and perceiving how mathematics is relevant to their lives. For example, Birky and colleagues (2013) studied Madison Morgan, a Black woman who taught Algebra I to Black

students. They found that Morgan's mathematics expertise, which included teaching Algebra I as a connected set of mathematical principles existing in everyday life, encouraged her students' success. Furthermore, Birky and colleagues found that because Morgan engaged her students in meaningful mathematics, she also shaped her Black students' positive mathematics identity development. Similarly, Frank and colleagues found that retired Black Women mathematics teachers (Frank, View, & Williams, 2019) and current mathematics teachers (Frank et al., 2018) all engaged in teaching cognitively demanding mathematics while supporting Black students' mathematical identity development. Black women teachers in both studies taught remedial mathematics classes to students labelled difficult to teach, yet achieved success with these students. Black women mathematics teacher scholarship shows strong connections with Black women teaching rigorous mathematics while also building students' positive mathematics identity. More work is needed to further explore how Black Woman Pedagogy in mathematics leads to positive identity development across all students.

Element 3: Black Teachers use a Black Cultural Ethos

I define Black cultural ethos as bringing Black cultural norms into the classroom and Black cultural experiences, ideologies, and issues into curricula. Across culturally relevant pedagogy, culturally responsive teaching, culturally specific pedagogy, abolitionist teaching, and culturally and historically responsive pedagogy, the emphasis rests on using a Black cultural ethos to improve student learning and render instruction more meaningful. But exactly how instruction should proceed using a Black cultural ethos remains vague, giving way instead to many examples of how a Black cultural ethos *could* be used in the classroom. For instance, Black women enacting a Black cultural ethos could use Black history as the foundation for content learning such as with *Cultural Specific Pedagogy in Mathematics* (Leonard, 2019).

Another way could be nurturing Black cultural relationship between students and teachers within a classroom community, such as the classroom family created in *Dreamkeepers* (Ladson-Billings, 1994) or celebrating Blackness and Black joy as in *We Want to do More than Survive* (Love, 2019). Still another form of Black cultural ethos could call for the heavy lift of transforming curriculums to center on Black community ideologies and issues, as suggested in *Culturally Responsive Teaching* (Gay, 2000). Beyond these avenues, it could mean building an entirely new curriculum based on a Black community's desires and concerns, as did the Black literary societies of the 1800s in *Cultivating Genius* (Muhammad, 2020). Across these books, the authors resist creating a checklist or template on how to enact each pedagogy. Rather, Black Woman Pedagogy is a way of living that is consciously expressed as an ethic of teaching. Thus, below I explore infusing curricula with Black cultural ethos, then posit how Black cultural ethos may be enacted in mathematics.

Teaching with and through a Black Cultural Ethos. One element of Gay's culturally responsive teaching is cultural congruency, meaning that teaching must occur "with and through culture" in the instructional delivery and curriculum. Gay found that teaching with and through culture increases students' connections to content and overall learning. Gay's examples of teaching with and through culture attends to multiple learning styles, cooperative learning, active and affective engagement for Black students (p.154-172), as well as ethnic-centered classes and Afrocentric schools that center Black culture. In classrooms, this might look like students moving around the room, collaborating with one another, chanting, joking, and using slang and other cultural references. In cooperative learning structures that center a Black cultural ethos, *all* students will contribute to an answer. Rather than valuing meritocracy and individualism in mathematics, a Black cultural ethos values working in community.

Another take on teaching with and through culture involves teachers using a curriculum that connects to the ethos of the Black community. This ethos stems from community situations and ideologies relevant to members of the Black community. For example, Leonard (2019) found that fourth grade Black students were more successful with word problems that fit their community contexts, like church car washes to raise money. Students in this example achieved cultural congruency in their mathematics rather than filtering relevance through a dominant white middle-class discourse of teaching and problem contexts. Students learn better when the content is connected to their cultural and community contexts.

Black teachers continue a rich history of using Black cultural ethos to teach with and through culture. Historical evidence of politically conscious Black teachers using a Black cultural ethos in their teaching practices can guide Black Woman Pedagogy in mathematics today. Due to a lack of historical records on Black teachers in the late 1800s and first half of the 20th century, since most white male researchers in education neglected to focus on Black teachers and their teaching methods, we lack a fully informed grasp of how Black teachers thought about teaching mathematics specifically. However, we do have the writing of Ethel Grubbs, a Black woman mathematics teacher whose work Bullock (2019) uncovered. In 1941, Ethel Grubbs published an article in the National Council of Teachers of Mathematics' (NCTM) journal *The Mathematics Teacher* discussing what needed to be done for Black students learning mathematics. Grubbs recommended that "NCTM advocate for a mathematics program specific to Black children 'to include participation in individual and group activities based upon their individual and group experiences in the community in which they live'" (Grubbs, p. 255 in Bullock, 2019, p. 81). It is probable that Grubbs already taught her Black students mathematics

using group activities grounded in community experiences, which would explain her encouragement of widespread adoption of this method.

What we can surmise about Grubbs and other Black teachers of the time is a history of subversiveness, with bold Black teachers choosing to teach beyond the official curriculum. In a lecture, African American education historian Jarvis Givens (2019a) reported on "fugitive pedagogy," referencing how Black teachers during segregation resisted teaching the mandated curriculum. One Louisiana student left a record of how his teacher in the 1930s, Tessie McGee, kept the mandated history curriculum on her desk but, when the principal was not around, read from a Black history book by Carter G. Woodson. This example illustrates how McGee subversively taught her Black students their cultural history rather than imposing on them the distortions of white history. Further evidence exists that Black teachers throughout history have taught Black students more than they were supposed to. Across segregated high schools in the South during the 1800-1940s, most Black schools were labeled as trade or vocational schools, but Black faculty, supported by Black leaders, taught a liberal classical curriculum that included geometry and algebra (Anderson, 1988). Subversive teaching was imperative to prepare their Black students for life beyond school.

Black teachers of the past also supplemented their curricula with lessons about Black history and transformed written materials to be more relevant, meaningful, and racial affirming. For example, when Carter G. Woodson established Negro History Week in the 1930s, Black teachers, students, and community members collaborated to bring it to fruition. Whether it was teaching Black history, African history, or inviting in community members to talk to students, teachers foregrounded learning related to Black culture (Givens, 2019b). In another example, Muhammad (2020) found that Black literary societies arose in the northern states in the 1800s as

a place for Black men and women to cultivate their genius while also working for freedom from second-class citizenry. Muhammad recognized that "rather than wait for their rights and education to be granted from those with legislative power, they instead created their own agendas and claimed authority by organizing into professional organizations focused on literacy" (p. 24). Black literary societies provided spaces to cultivate Black excellence while also working towards Black liberation. Historically, Black teachers were energized by a *Black cultural ethos* to exceed the mandated curriculum and teach Black students what they needed to survive and thrive in the U.S. In the present, Muhammad calls on teachers and leaders to "authentically respond to students' identities in curriculum" by continuing to foster Black excellence and worthy standards for students (p.50).

Black Cultural Ethos and Subversiveness in Mathematics. Across history, Black teachers critically engaged students in Black pride, Black excellence, and Black liberation. Historically, these were subversive practices embedded within a Black cultural ethos that were either forbidden or unaccepted by white dominant society. Rochelle Gutiérrez (2013) says that "any form of teaching that breaks with tradition can be seen as subversive," particularly in mathematics (p.11). Using Black cultural ethos to transform mathematics teaching goes against traditional white institutional policies in schools. It is dangerous and courageous work, given that white institutional schooling policies, which dictate what, how, when, and why should be taught in order to perpetuate whiteness, white supremacy, and patriarchy while positioning Black and Brown students as inferior (Battey & Leyva, 2016; Bullock, 2018; Martin, 2007, 2015). Yet, Black women teachers who possess political consciousness resist business as usual in their classrooms because they know its long-term impact on Black students' academic, racial, and social wellbeing. The impact of mathematics policies is highlighted when we consider whose

knowledge is deemed valuable in the classroom. Mathematics education researchers have critiqued mathematics reforms for not putting students from "the collective Black,"—Black, Asian, Latinx, Native American, and poor children—front and center to deconstruct mathematics inequities (Martin, 2015).

These subversive teaching stances of Black people were and continue to be the work of politically conscious Black women teachers. In a white supremacist institution like U.S. public schools that tightly controls what counts as mathematics, Leonard (2019) found that across cultures, students solved mathematics problems more successfully when cultural references were used. Another benefit from a Black cultural ethos in mathematics is that students of all backgrounds find mathematics lessons more meaningful. Leonard envisions that the phrase "when will I ever use this?" will vanish because couching mathematics in culturally relevant scenarios reduces the disconnect between what students are learning and what they see as relevant.

I propose that the education field support Black Woman Pedagogy by offering Black teachers the pedagogical freedom and support to create more meaningful mathematics learning opportunities. Looking back to culturally responsive, culturally relevant, culturally specific, abolitionist teaching, and culturally and historically responsive education, all these theories impart information for Black women teachers on how to teach. But they also feature a call to action for teacher educators, district leaders, administrators, and colleagues to support Black Woman Pedagogy, too. Abolitionist teaching, for example, implores teachers to break away from testing structure that causes "spirit murdering" and instead create a homeplace to nurture students and weave Black and Brown students' "community cultural wealth" (Yosso, 2005) into mathematics. Leonard (2019) calls for teaching developmentally appropriate mathematics (not

too hard, not too easy) but also teaching mathematics for empowerment. This goal is difficult to quantify. Teaching for computation fluency only, as Leonard concludes, can be wrongly overemphasized for students of color because of its alignment with preset standards, including Common Core standards (p. 41). Instead, Leonard calls for work that connects to the interests of students within the context of challenging and rigorous mathematics problems.

All teachers, including Black women teachers, need support and guidance on what a mathematics education grounded in a Black cultural ethos could look like. Though not guided by a Black cultural ethos, Aguirre and colleagues (Aguirre et al., 2019, 2020) created mathematical modeling lessons that draw on students' cultural and community knowledge bases to solve real world problems. Examples include students using their own experiences of fair sharing with family members to purchase a gift for a grandparent, or modeling how much bottled water a classroom would need if their water became unsafe. Using mathematical modeling lessons and other types of problem-based learning scenarios through a Black cultural ethos could provide one avenue to pursue. Another options is offering lesson analysis rubrics for teaching culturally responsive and equity-based practices in mathematics (Aguirre et al., 2024; Zavala & Aguirre, 2024). These possibilities are available and sorely needed. Further research is likewise needed to understand how to structure mathematics classrooms to better serve Black students while also empowering Black women teachers who teach via Black culture to enact change across the K-12 spectrum of learning. Because mathematics curricula, traditionally viewed as culturally neutral, are generally set and heavily policed by principles and school districts, Black cultural ethos has been lacking. Martin and colleagues (2019) propose that "a mathematics education that is worthy of Black children is a mathematics that prioritizes their liberation above all else" (p. 47). Steps

toward developing a mathematics worthy of students can be unlocked by understanding the day-to-day mathematics teaching of Black women through Black Woman Pedagogy.

Part 2: Black Feminist Math Pedagogical Content Knowledge

Most literature on Black women pedagogies focuses on the beliefs Black teachers have held about teaching and their students broadly. Empirical work on Black teachers' beliefs focuses on how those beliefs are enacted during teaching. What is missing is how the combination of beliefs, general [teaching] pedagogy, *and* subject matter pedagogy operate in harmony. In other words, when Ladson-Billings says teachers need to build students' sociopolitical consciousness, when Gay says students' cultures are worthy of the curriculum, and when Love says we need to hone students' community wealth—how, exactly does this happen in the day-to-day teaching of mathematics when enacting Black Woman Pedagogy? I consult the literature on pedagogical content knowledge (PCK), i.e. the knowledge needed to teach students content, to advance the study of Black Women Math Pedagogy in Black women's teaching practices. Few, if any, have researched mathematics pedagogical content knowledge from a Black feminist perspective. Thus, my review below addresses this literature gap. What follows is an analysis of the literature on PCK and how Black Women Math Pedagogy accounts for Black feminist epistemologies—Black women's ways of interpreting the world and mathematics teaching—in research on Black women math teachers.

Conventional Pedagogical Content Knowledge Constructs

A suitable vantagepoint from which to study Black women's liberatory mathematics pedagogy is a study of their pedagogical content knowledge (PCK), i.e. the knowledge needed to teach mathematics. A conventional PCK construct consists of a general knowledge of teaching, knowledge of students' potential subject matter understanding or misunderstandings, knowledge

of curriculum, and knowledge of representations and strategies that best facilitate learning (Ball et al., 2008; Grossman et al., 2005; Shulman, 1987; Shulman, 1986; Sowder, 2007). Shulman (1987) calls PCK "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (p. 8). In other words, PCK is unique to each teacher and consists of their "own special forms of professional understanding" when determining how to teach students. PCK is where Black women liberatory practices originate for teaching mathematics to students.

Ball and colleagues (2008) build off of Shulman's work to offer the Domains of Mathematics Knowledge for Teaching framework. Mathematics Knowledge for Teaching is a heavily cited, widely used interpretation of how mathematics content knowledge and pedagogical content knowledge operate when a teacher engages in teaching mathematics. I will focus on these authors' interpretation of PCK within Mathematics Knowledge for Teaching. The three subdomains of PCK are knowledge of content and students, knowledge of content and teaching, and knowledge of content in curriculum. Ball and colleagues' PCK construct is theoretically grounded such that "our definition begins with teaching, not teachers. It is concerned with the tasks involved in teaching and the mathematical demands of these tasks" (p. 395). Thus, Ball and colleagues' construct has been used in PCK research mainly to identify what teachers need to learn so they can teach mathematics.

Focusing on knowledge gaps is an unproductive way to investigate what Black Woman Pedagogy *brings* to mathematics teaching. Thus, I focus on the *assets* Black women bring to their mathematics teaching based on their lived racialized experience both in and outside mathematics classrooms, which shapes the choices they make in their mathematics teaching.

Therefore, I created a PCK construct that honors how Black women use their assets in mathematics to interpret how they teach mathematics (Figure 1).

A Black Feminist Pedagogical Content Knowledge Construct

From a Black feminist perspective, Black women's lived experiences constitute a criterion of meaning. Therefore, Black women teachers can use their lived racialized experiences around teaching and learning mathematics as criteria of meaning. Black women mathematics teachers carry knowledge about teaching and learning mathematics that is overlooked by conventional conceptions of PCK. They possess "alternative knowledge" about how racism, sexism, and power operate within mathematics and mathematical learning. This knowledge stands outside mainstream knowledge of how mathematics operates because those who benefit from whiteness and patriarchy in mathematics remain indifferent to how culture, race, and gender figure into mathematics. Black women's knowledge assets about teaching and learning mathematics evolves from their own racialized lived experiences learning mathematics as girls and becoming teachers as women. Other experiences include living within a racialized society and teaching in a field dominated by white males.

Nowhere in Ball and colleagues' conceptualization of PCK does a focus on teacher assets appear, nor do discussions about power, identity, and whose knowledge is valued within mathematics. However, pedagogical content knowledge alone cannot support students' mathematics success, positive mathematics identity development, or socialization as a doer and thinker of mathematics. From a critical perspective, teachers impact how students accept, negotiate, or refuse mathematics teaching and learning. As an "outsider-within" mathematics (Collins, 1989), Black women bring knowledge that can inform a more critical PCK construct. A *Black Feminist Math PCK* construct connects to critical frameworks in mathematics that address

power, knowledge, and identity in mathematics classrooms (Aguirre, 2009; Aguirre & Zavala, 2013; Gay, 2009; Gutiérrez, 2018; Gutstein, 2006; Joseph, 2021; Joseph et al., 2021; Martin, 2007; Martin & McGee, 2009; Zavala & Aguirre, 2024) while acknowledging the full humanity and knowledge bases of Black women mathematics teachers. Black Feminist Math PCK attends to politically minded Black women teachers who are drawn to teaching in Black and Brown communities from which they themselves identify. This idea connects to Martin's (2007) commentary on needing mathematics teachers who possess an "experience lens" that attends to "how and why African Americans experience mathematics as they do" (p.13). Politically conscious teachers are needed who know firsthand how mathematics can present a racialized space that inflicts unjust deficits on Black and Brown students while privileging whiteness. We need a critical discussion that engages stakeholders "to think more deeply about highly qualified mathematics teachers in contexts predominated by African American children" (p. 7) and the need for teachers to possess critical perspectives about teaching mathematics to all students.

Black Feminist Math PCK is a critical perspective of teaching mathematics that accounts for teaching beliefs and actions based on those beliefs. Mapolepo and Akinsola (2015) researched teacher beliefs and actions in the mathematics classroom. They found that a teacher's classroom behavior is influenced not only by their knowledge of mathematics, how students learn, and methods to teach mathematics, but also by attitudes and beliefs about teaching and learning mathematics (p. 508). In other words, attitudes and beliefs affect a teacher's approach to teaching (how they choose to teach) and conception of students (what they know about their students and how they choose to act based on that knowledge). In Black feminist epistemology, Black women engage in a cycle of dialog and action with themselves and other likeminded people to inform how they move about the world (Collins, 2000). This process connects to

thinking about lived racialized experiences, beliefs about teaching mathematics informed by those experiences, and decisions on how to enact a liberatory mathematics practice.

Black women's identities and lived experiences influence their mathematics teaching (Birky et al., 2013; Frank et al., 2018; McVicar, 2024). This composite includes the teacher's own racialized experiences in mathematics, her knowledge of how students experience mathematics given the power and identity dynamics of the classroom, and how she can create a space for identity development and shared power. Black women mathematics teacher assets could, therefore, impact how they attend to the multifaceted identities of students, how students interact with one another, how power operates in the classroom, who students are in relation to the teacher and to one another, and knowledge production within the mathematics classroom. Again, since Black Woman Pedagogy is a liberatory pedagogy, Black women mathematics teachers who take this up reverse historic trends of power around what is considered mathematical, who can do mathematics, and what does mathematical success look like.

Components of Black Feminist Math Pedagogical Content Knowledge

Below I juxtapose the components of conventional PCK with direct counterparts infused with a Black feminist perspective to conceptualize how Black Feminist Math PCK is enacted in Black women's mathematics practices. From this perspective, knowledge of students, knowledge of mathematics curriculum, knowledge of students' mathematical thinking, and knowledge of mathematical content and learning are all interpreted through Black women's alternative knowledge, assets grounded in their lived racialized experiences. These experiences in turn shape how each component of PCK is taken up by politically conscious Black women mathematics teachers.

Alternative Knowledge. From a Black feminist perspective (Collins, 2000), Black women possess alternative knowledge that is distinct from white mainstream conceptualizations of our society, including ideas about mathematics teaching and learning. Politically conscious Black women leverage their alternative knowledge to construct learning opportunities for students while also keeping in mind how racism and power typically operate and can be reproduced within their own mathematics classroom unless they actively refuse and resist this oppression. Black women teachers with political consciousness attend to the conventional PCK construct, which consists of general knowledge of teaching, knowledge of students' potential subject matter understanding or misunderstandings, knowledge of curriculum, and knowledge of representations and strategies to facilitate learning (Grossman et al., 2005; Shulman, 1987; Sowder, 2007). However, their lived racialized experience shapes how they interpret each element in their mathematics practice and how they adapt their mathematics PCK accordingly.

Knowledge of Students and Students' Mathematical Thinking. Ball and colleagues' construct considers a teacher's knowledge of students solely in terms of students' mathematical knowledge. Knowledge of students' mathematical thinking is "knowledge that combines knowing about students and knowing about mathematics" specifically "knowledge of common student conceptions and misconceptions about particular mathematical content" (p. 401). A Black feminist perspective considers not only this general sense of students' mathematical knowledge, but also how each individual student, in light of who they are, experiences mathematics content. This perspective considers the history of mathematics instruction as a racialized, oppressive space for Black and Brown students and a space predisposed for white student success based on a myopic view of what dominant white culture views as mathematical. These narrow views include an emphasis on speed, standardized test success, and lessons written

and taught in ways that privilege white culture through an emphasis on symbolic notation, abstraction, and norms of white cultural discourse (Gutiérrez, 2018a; Martin, 2015; Stinson, 2013).

Black women teachers using Black Feminist Math PCK draw on the entirety of what they know about each unique student in their classroom to inform their teaching practice, which includes students' lived experiences in and outside of mathematics classrooms, their mathematical knowledge bases, and their identities. Identities include racial, cultural, and gendered identities as well as labels externally imposed upon students, such as "gifted" or "remedial," and those students place on themselves, such as "not good at math" or "good at math." The intersections of all dimensions of student identities are considered.

Knowledge of Mathematics Content and Teaching. Designing mathematics instruction involves knowing how to teach mathematical concepts to students. Typically, this component of PCK consists of a teacher's knowledge base of making decisions when planning and teaching mathematics. Teaching decisions include students' common preconceptions, successful teaching methods, and what the teacher knows about the particular student they are engaged with. Infusing a Black feminist perspective, the knowledge of content and teaching not only includes what academic knowledge the teacher has about teaching mathematics, but what experience the teacher has inside and outside mathematics classrooms that influences what and how she teaches her students. This includes relationships that teachers have with students outside of mathematics teaching and learning.

Knowledge of Mathematics Curriculum. I define this component as the mathematical knowledge teachers need to interpret and decide which curriculum to use and how. Typically, mathematics teachers are expected to use district-approved textbooks and conform to district

policy guidelines that leave little room to adjust support for student learning (Gutiérrez, 2013). Official guidelines also express power and authority about what is considered worthy of teaching and what is considered mathematical, specifying everything from topics to strategies students are required to learn. However, Black women teachers are curriculum writers, too, and can draw on their lived racialized experiences to create approaches to mathematics that better appeal to their students. These approaches might include games, physical activities, creative projects, and adapted lessons and units that support students' mathematical learning. Furthermore, they can conceive and develop units that are more rigorous and better designed to create coherence for students than mainstream curricula, thereby building a deeper mathematical understanding of concepts (e.g., Birky et al., 2013).

Studying Black Feminist Math Pedagogical Content Knowledge

Black women teachers with political consciousness may come under scrutiny or be strongly discouraged from using their preferred methods of teaching (see for examples Acosta 2019; Irving, 1989). But what might result if a Black teacher were *encouraged* to use her Black Feminist Math PCK in the mathematics classroom? The "special amalgam" for a mathematics teacher, for example, could mean "the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the most useful ways of representing and formulating the subject that make it comprehensible to others (Shulman, 1986, p. 9). Ball and colleagues (2008) concur that more research needs to be conducted to understand how knowledge for teaching mathematics can be culturally specific to the teacher and dependent on an individual's teaching style (p. 405). For a Black woman teacher, these examples would be context-dependent and also influenced by the knowledge bases she and

her students bring to the classroom, including how she incorporates interpretation of her lived racialized experiences when making day-to-day instructional decisions.

In sum, Black Feminist Math PCK is how politically conscious Black women attend to power, identity, and knowledge in mathematics teaching and learning. It encompasses their assets, grounded in their lived racialized experiences. These experiences impact their stances and actions within their mathematics practice. We need research that studies how Black feminist math PCK influences Black Women Math Pedagogy to shape choices in lessons, what teachers teach, how they teach, and how students participate, all while attending to racial and power dynamics in and outside the mathematics classroom.

Part 3: Conceptualizing Black Woman Math Pedagogy

I defined Black Woman Math Pedagogy as the dialogical relationship between politically conscious Black women teachers' thoughts and actions about their day-to-day mathematics teaching. Black Woman Math Pedagogy is situated within Black Woman Pedagogy and shares the same elements: an ethics of care, identity work, and a Black cultural ethos. Black Woman Pedagogy synthesizes teaching and worldly knowledge from Black women researchers, scholars, and teachers. Black Feminist Math PCK is a construct by which to interpret Black Women Math Pedagogy, the day-to-day teaching of mathematics that occurs when politically conscious Black women mathematics teachers teach. Black Feminist Math PCK is informed by Black women's alternative knowledge based on differing epistemological stances in contrast to white institutional knowledge (Collins, 1989), which includes teaching mathematics. Black Feminist Math PCK attends to how Black women use their alternative knowledge from their lived racialized experiences as foundations upon which to enact their pedagogical content knowledge toward justice and liberation. Black Feminist Math PCK is a more critical construct than its

conventional counterpart because it attends to power, identity, belonging, and the assets-based alternative knowledge Black women teachers bring from their lived racialized experiences.

All Black women mathematics teachers may not enact Black Woman Math Pedagogy. A calling to Black Women Math Pedagogy may occur for politically conscious Black women teachers who want students to move from surviving to thriving in this country by choosing to act on their alternative knowledge of how the world works for Black and Brown children and exert the effort to change lives. Black Woman Pedagogy is about the caring relationships Black teachers have with students even before they meet them, helping Black and Brown students navigate the education system with their identities intact. It is about teaching with and through a Black cultural ethos. And often, it is about subversiveness on the job, deviating from the traditional curriculum and other traditional norms that are silent about injustices against Black and Brown peoples. Black Woman Pedagogy acknowledges the "work" of teachers operating in a racialized, patriarchal, and capitalistic education system.

How might we study Black Woman Math Pedagogy, specifically? Existing research that explicitly centers Black women mathematics teachers focuses on four topics: trajectories into the classroom, beliefs, practices, and racialized experiences from preservice to inservice teaching (Birky et al., 2013; Clark, Frank, et al., 2013; Frank et al., 2018, 2021; Frank, View, & Williams, 2019; Leavitt, 2010; McVicar, 2024). One part of understanding a teacher's practice is understanding the impact lived experience has on their mathematical pedagogical content knowledge. The assets Black women bring into the mathematics classroom enable them to interpret knowledge of students, teaching, and curriculum while teaching mathematics in ways that support all students to learn, particularly Black and Brown students. They protect and care

for the students most marginalized. PCK also influences curriculum design, particularly when aligned with the culture of students.

I argue that Black Woman Math Pedagogy in mathematics may be seen as subversive teaching. Teachers possessing both the knowledge and desire to teach using a Black Woman Math Pedagogy may be discouraged in their schools. Mathematics teaching is tightly controlled in the U.S. through curriculum adoptions, pacing guides, grade-level standards, and teacher evaluations that dictate to Black teachers what they should teach and how. Instances abound in Black teacher literature where administration and colleagues have discouraged Black teachers from using their pedagogical expertise by (Acosta, 2019). Some Black women may turn away from Black Woman Math Pedagogy or feel a disconnect from its practices due to internalized intersectional oppression. Black Woman Pedagogy itself flows from a connection to ancestors, a connection that many (but not all) Black women teachers have—a *knowing*. In working with Black women and talking about their mathematics teaching, one productive practice could be to focus on the "goodness" of their practice. Sarah Lawrence Lightfoot (1986) talked about the "goodness" of schools when composing her portrait of a school. Drawing inspiration from Lightfoot, I seek the inherent goodness of Black women mathematics teachers' work. Through this seeking I hope to amplify for Black women the good work they are doing that might go unrecognized by white colleagues or principals, so that Black women mathematics teachers may flourish.

More research is needed to support and document Black women who enact Black Woman Math Pedagogy to determine how to teach mathematics in caring ways that build identity and positively position students' cultural knowledge in the learning of mathematics. My goal is that this literature analysis will not only help the field of education better conceptualize

the work of Black women teachers in mathematics, but also serve as a lineage map for current and future Black teachers to better appreciate our teaching history and its influence on our teaching perspectives, especially in teaching mathematics. This analysis is a story of who we are as Black teachers and Black women teachers of mathematics. This is a story of us.

Chapter 3: Methodology

In Chapter 2, I outlined a conceptualization of *Black Woman Math Pedagogy*. I also articulated how Black Feminist Math Pedagogical Content Knowledge (PCK) is impacted by Black women's assets that are grounded in lived experiences. Black Feminist Math PCK is a pathway to interpret Black women's mathematics teaching and how that teaching connects to the legacy of Black Woman Pedagogy.

In Chapter 3, I describe the methodology I used to study Black Woman Math Pedagogy, providing a rationale for using qualitative Black feminist methodology to study Black women's mathematics practice (Lampert, 2010). I start by posing my research questions, followed by a definition of Black feminist methodology and why it best suits this study. I consider how my identity and positionality informed my methodology and my work on behalf of Black women. In this light, I introduce my participants and the data corpus from which I drew my analysis of these teachers' mathematics practices. I detail the methods used to collect, manage, and analyze my data. Lastly, I address study limitations.

Research Questions

Questions that supported my empirical research are as follows:

1) How does Black women mathematics teachers' methods of teaching connect to pedagogies developed by Black women education scholars (i.e., culturally relevant, culturally responsive, culturally specific, abolitionist, culturally and historically responsive)?
2) What pedagogical expertise of Black women mathematics teachers becomes apparent when teaching mathematics to racially and ethnically diverse learners?

3) How do Black women mathematics teachers' lived racialized experiences and ideas about power, criticality, and knowledge production shape their Black Feminist Math Pedagogical Content Knowledge (Black Feminist Math PCK)?
4) What commonalities and differences emerge in how Black Feminist Math PCK presents in Black women's mathematics classrooms?

Research Design and Rationale: Black Feminist Methodology

To study Black Woman Math Pedagogy, I used Black feminist methodology (Hamilton, 2020; Mullings, 2000), which combines qualitative study (Merriam & Tisdell, 2016) with Black feminist thought (Collins, 2000). I followed in the research traditions of Ladson-Billings (1994) and Dixson and Dingus (2008), who used Black feminist epistemology in their studies of Black women teachers, in which they created "thick descriptions" from the Black women's pedagogies (Geertz, 1973). Using Black feminist epistemology as methodology honors the knowledge bases Black women use when building theory as well as my own commitments as a researcher to my community.

Black feminist methodology has roots both within and outside the academy. It is not a new methodology. Indeed, Black women commonly engage in Black feminist methodology to make sense of their experiences and create new theories about living in the world. However, Black feminist methodology remains undertheorized in academic settings. Furthermore, the work done focuses primarily in social science spaces outside education, in writings where Black women apply it, both purposefully and informally, to make sense of their lives. More recently, formal documentation has begun to emerge in academic settings (Caretta & Riaño, 2016; Evans-Winters, 2019; Nadar, 2016; Patterson et al., 2016). I use Black feminist methodology as a lens and strengthen its conceptualization with traditional qualitative methods (Merriam & Tisdell,

2016). I use Black feminist thought (Collins, 2000) as a guide to engage in an inquiry that is in service of Black women rather than "done on" Black women. My efforts include maintaining a collaborative nature of working with Black women, positioning myself as a member of the community, and aiming to be of service to the community. I rely on Collins's distinguishing features of Black feminist thought to ground this study. I approach my research emphasizing four Black feminist epistemological tenets: 1) lived experiences as a criterion of meaning 2) the use of dialog to assess knowledge claims 3) an ethic of caring 4) an ethic of personal accountability. Following these tenets brings implications for how I position myself in my relationships with participants: I interpret their perspectives as a colleague and fellow Black woman educator.

My data collection and analysis approaches strive to position Black women as shared creators of knowledge, to dismantle hierarchies, to engage in reflective thinking about power and positionality in reference to both myself and participants, and to take action toward a democratic researcher-participant dynamic (Hamilton, 2020). Collectively, we reflect on Black womanhood and our mathematics teaching practices to define Black Woman Math Pedagogy. These methodological steps are consistent with the tenets of Black feminist epistemology and Black feminist methodology as participatory research (Hamilton, 2020; Mullings, 2000).

Participants

Recruitment

I reached out to teacher networks, including in-service elementary teachers and teacher education program directors, to recruit politically conscious Black women elementary teachers in a major metropolitan area with diverse school populations. My research is highly dependent on building relationships with my participants. Creating partnerships meant that my potential participants and I would have to get along and share common commitments to teaching.

Moreover, a teacher would have to display a willingness to share their deeply personal racialized lived experiences and their teaching practice in a profession that is typically isolating. In turn, I would likewise be vulnerable about teaching mathematics and my own lived racialized experiences. My background as an elementary teacher, expertise in K-5 mathematics education, and familiarity with elementary schools and teacher networks in the greater metropolitan area informed my recruitment of Black women elementary teachers.

I started by sending out a flyer to colleagues with connections to Black women mathematics teachers in the area. The flyer was titled "Black Women K-5 Math Teachers: Let's Connect & Share Our Stories." I included my contact information and goal of gathering a small group to meet and greet online or in-person. As the reality of my research location is such that only 2% of public school teachers in the state are Black, few teachers qualified for this study. Thus, I did not hear back from enough teachers to allow a small gathering. Over time, I did meet with three teachers individually, whether in person or over Zoom. I used purposeful selection (Merriam & Tisdell, 2016) for choosing my participants. My criteria were that participants had to currently teach mathematics, teach mathematics during the study year, and have accrued at least three years of teaching experience during which they had developed a mathematics teaching practice. During my initial meet and greets, I talked to potential teachers about mathematics teaching and learning, their political consciousness regarding beliefs about educating Black and Brown students, and their openness to have ongoing, in-depth conversations with me about mathematics teaching and learning. In essence, I assessed potential participants' connections to the traditional epistemic stances of Black women teachers, a knowing that understands, "*this* is what Black women teachers do and have *always* done." I required a yearlong commitment to

working with me to represent Black women teachers as pedagogues who possess insights to share with the world. Based on these criteria, I identified two suitable research participants.

My study consisted of collaborative work with these two Black women elementary teachers who taught mathematics in two racially and ethnically diverse urban schools in the Pacific Northwest. This teaching context differs from contexts for most literature on Black teachers, which tends to isolate single case studies in predominantly Black schools in the South (e.g., Birky et al., 2013; Davis et al., 2013; Frank, 2018). Thus, it provides insight into how Black teachers support a broad range of students, and relatedly, make sense of teaching more than just "kin." Situating this study in elementary schools provided a rich context for exploring *Black Woman Math Pedagogy* because of the intimate context of elementary settings where students and teachers interact throughout the day. These elements lent themselves to encouraging teachers to think critically about their mathematics teaching practices and to view students' mathematical knowledge bases in productive ways, facilitating student learning from an asset-based perspective.

Leslie

Leslie was a fourth-grade teacher at Sunnyhill Elementary who taught multiple subjects, including mathematics. At the time of our collaboration, she had six years of experience teaching the third and the fourth grades. Leslie identified as a Black woman, a mathematics teacher, a socio-emotional learning (SEL) teacher, a social justice teacher, a neurodivergent teacher, and a high school dropout. She brought a humanizing perspective to teaching: "I focus on how to be good humans. And then all of the education components come once we're feeling safe and secure in our environment, and that's when our brains are best ready to learn" (Interview 1, October 20,

Table 1

Participant Demographic Information

Participant	# of Students	Highest Degree	Years of Experience	Grades taught	# years at current school	School demographics
Leslie 4th Grade	24	Masters in teaching	6	4TH, 3RD	6	60% Free or Reduced Lunch 20% Multilingual Racial Demographics: 40% White 20% Black 15% Latinx <10% Two or more races <10% AAPI <5 % American Indian/Alaska Native
Shawna Kindergarten	16	Masters in teaching	6	K	6	80% Free or Reduced Lunch 30% Multilingual Learners Racial Demographics: 70% Black 15% White, 10% Latinx <10% AAPI <10% Two or more races

Note: Demographic numbers rounded to produce anonymity

2022). Leslie's school was racially, ethnically, and economically diverse, a school with affluent students learning alongside students who faced homelessness and poverty (Table 1). Leslie had lived her whole life in this Pacific Northwest city and could not imagine doing anything else other than teaching. A school leader, she sat on many committees, including the race and equity team and SEL team.

I visited Leslie weekly during the fall and daily from January to mid-February. Due to personal matters in Leslie's life and my schedule of observing my other participant daily from March to mid-April, I observed Leslie only six times in the spring. In total, I conducted 31 observations of Leslie's mathematics classroom. Lessons typically lasted 70 minutes. Leslie was open about her teaching practice and relationships with students, families, and colleagues. With the exception of one other Black teacher, all teachers, administration, and office staff at Leslie's school were white. For most of her time teaching, she felt alone, her views radically different than those of her white colleagues. I, however, positioned myself as a thought partner eager to puzzle through mathematics teaching and learning with her. I could tell Leslie sincerely welcomed my presence and genuine excitement about her mathematics teaching, as she had become "so used to the world telling me that I'm trash for just existing" (Interview 2, January 5, 2023). But as I visited Leslie weekly in the fall and spring, along with daily visits for two winter months, and dialoged about mathematics teaching, how she made sense of curricular changes, and how she created a warm, humorous, and joyful mathematics community, I saw clearly that her teaching was anything but trash.

Shawna

As a kindergarten teacher at Waterbrook Elementary, Shawna taught many subjects, including mathematics. At the time of this study, she had six years' experience teaching kindergarten. Shawna identified as a Black woman and culturally responsive teacher. She was confident in her ability to teach kindergartners everything they need to understand. She once said, "I know the standards like the back of my hand" (Gathering 1, March 18, 2023). Shawna's school had a high population of Black students from East Africa and African American students, and a small proportion of white, Latinx, and Southeast Asian students (Table 1). Compared to

Leslie's school and most schools in the area, the percentage of Black educators, Black administration leaders, and Black support staff at Shawna's school was high. Having lived her whole life in the metropolitan area of this Pacific Northwest city, she had always loved working with young children, from newborns to kindergarteners. She served as kindergarten team leader, even among faculty with more seniority. For most of her time teaching, she was supported and uplifted by her administration and colleagues to do whatever she believed best for students.

I visited Shawna weekly in the fall though winter, then daily for one month in spring. My observations of Shawna were broken up as she had a student teacher who taught mathematics full time in February and from mid-April to the end of May. In total, I observed Shawna's mathematics classroom 27 times, with lessons typically lasting 75 minutes. Being open about her teaching practice, Shawna spoke at length about the instructional decisions she made when planning her lessons and designing assessments, and how she planned collaboratively with the mathematics intervention teacher, Theresa, another Black woman. Shawna was a master teacher who created an environment with high expectations, hard work, and learning through play.

Researcher Identity and Positionality

As a Black woman mathematics teacher educator, former elementary teacher, and mother of two elementary children in local public schools, I approached this work as a collaborator. Collins (2000) explains, "For Black women, new knowledge claims are rarely worked out in isolation from other individuals and are usually developed through dialogues with other members of a community" (p. 260). Because this research is deeply relational work, working with two focal participants allowed me time to develop bonds, visit classrooms, and delve into robust dialog. I approached this research, not as a passive observer, but as a colleague with an asset-based lens who wanted to understand the "goodness" (Lightfoot, 1986) of Leslie and Shawna's

mathematics teaching. I uplifted Leslie and Shawna's teaching much as Black women uplift young Black students. As a former elementary teacher in the area and researcher who has spent much time inside elementary mathematics classrooms, I recognized both their mathematics teaching practices as distinguished. I openly shared my hunches, excitements, and noticings with each participant, meaning that I searched for what was effective about their mathematics teaching and asked for their input. I compared their teaching to that of other teachers based on my own teaching experience, familiarity with schools in the area, and years of having observed elementary mathematics teachers' lessons and conversations about mathematics for other research projects. I knew from my own experience teaching alone in a classroom how difficult it can be to recognize "taken-for-granted knowledge" (Collins, 2000) as unique to my own practice. Thus I shared my insights openly with both Leslie and Shawna, which served to empower them as professionals.

I was attuned to the teachers' perspectives and what they valued in their teaching. I also noted that I tended to value the same things. In qualitative Black feminist methodology, my ability to bring my whole self to my research through my interaction with participants strengthened my relationships with participants, the types of data I was drawn to, and my interpretations of data (Evans-Winters, 2019). Given my identity, living in the same area, having formally taught in the same district, and knowing the history of mathematics curriculum adoptions and professional development, I was able to dialogue on shared ground with these teachers about our shared perspectives, given our similar positionalities as Black women educators invested in enriching the educational experiences of Black and Brown children. I also attended more to the experiences of Black and Brown students in the classroom than to those of white children because I am most concerned with the former receiving educational justice. My

own lived experiences in schools have cast a natural affinity with Black and Brown students – "we who are dark" (Love, 2019), people with melanin-rich skin often subjected to othering based on our skin color.

Though I shared much in common with my participants, my interpretations of teaching are rooted in lived experiences from my formative years that differ from theirs as natives to this metropolitan area. Though I, too, have roots in the Pacific Northwest, raising a family and children in a school district neighboring my participants', my formative years were spent in southern Louisiana. Having grown up in largely Black communities in the New Orleans, Louisiana, area, I have my own interpretation of race, racism, and racialization. This includes having had many Black teachers in my K-12 experiences, some of them wonderful, and others demonstrating neither political consciousness nor connection to the legacy of Black women teachers. For this work, I relied on my experiential knowledge about Black women teachers, rooted in my own identity and lived experiences, because my experiential knowledge strengthens my research conceptualization, relationships, and analyses.

While Shawna and I had never met prior to this study, I knew Leslie when she was in her Masters in Teaching program and I worked as her Math Methods Teaching Assistant and also her Racial Caucusing facilitator in the teacher education program. Later, we lost touch with one another, until a colleague reconnected me with Leslie during my recruitment period. Viewing her as a colleague throughout this year-long study, I deeply valued her expertise, as she in turn valued mine.

Research Context and Data Sources

In the year of my study, the district had just adopted a new mathematics curriculum. For the purpose of anonymity, I refer to it generally as "the official curriculum." In the 15 years I

lived in the area, the district had undergone three official curriculum adoptions, with many schools opting to use different materials. Whether someone liked or disliked a mathematics curriculum always guaranteed passionate conversation. In the mathematics education elementary teacher circles I was part of, most people felt ambivalent about this adoption. I found the circumstances of studying Black Woman Math Pedagogy with a new curriculum adoption intriguing; I knew it could provide a healthy starting point for conversations about curriculum – both the official curriculum of the district's governing agents and the unofficial curriculum that teachers created in service of who their students were that year, based on their pedagogical content knowledge expertise. Table 2 below summarizes the data sources for this study.

Table 2

Data Sources

	Shawna	**Leslie's**
Classroom observations	75 min math lesson avg. 25 Observations with field notes 21 Video recorded mathematics lessons	70 min math lesson avg. 31 Observations with field notes 25 Video recorded mathematics lessons
Interviews	1 semi-structured • 70 min math autobiography interview 11 Impromptu Interviews 12 Interview Memos	2 semi-structured • 100 min math autobiography interview • 100 min teaching math interview 12 Impromptu interviews 14 Interview Memos
Artifacts	Student work Board Work Official curriculum materials Shawna's curriculum materials Summative assessments	Student work Board work Formative assessments Official curriculum materials Leslie's curriculum materials Text messages Classroom maps

Classroom Visits

Mathematics classroom observations comprised a major component of my study. I visited Leslie's fourth grade classroom 31 times and Shawna's kindergarten classroom 27 times for a total of 58 mathematics lesson observations. As a visitor in each teachers' classrooms, I positioned myself explicitly as a colleague who was curious about their expertise. Though classroom visits allowed me to engage as a participant-observer (Merriam & Tisdell, 2016) in teachers' practices, most of my participation occurred during breaks when I excitedly addressed Leslie or Shawna about something I had seen them do. I invited them to dialog with me, a curious colleague, often posing such questions as "Did you plan that?" or "How did you choose these lesson materials?" Likewise, I encouraged them to freely dialog about teaching mathematics and teaching in general. After a few visits, participants became accustomed to talking about their teaching with little prompting. Because of our commonalities, our similar experiences enabled us to provide one another insights into this profession we call "teaching."

During my mathematics classroom visits, I photographed student and whole group whiteboard work. After developing a strong rapport with each teacher and allowing time for students to get used to my presence, I began video recording lessons facilitated directly by the teacher. Though the structure of Leslie's lessons changed periodically, typical patterns emerged, such as heterogeneously grouping students for a warmup task followed by whole group discussion about that task. After a 10-minute recess break, students worked for 30 minutes in small groups with Leslie, or independently on workbook problems and/or a district paid tech game, with Leslie assigning problems tailored to student needs. Shawna's classroom patterns rarely deviated from her standard format. Her 75-minute mathematics lessons included a Calendar routine, counting, a whole group minilesson either from the official district curriculum

or her own lesson creation, followed by Math Centers, and ended with an approximately three-minute YouTube video focused on a mathematical domain aimed at the kindergarten level.

During lessons I collected field notes and noted the teacher's tone with students, which students they focused attention on, how they conducted the lesson, how they navigated student dynamics related to friendship, and how they positioned students. These noticings served as connecting points for formation of my concept of Black Woman Pedagogy, including an ethic of care, being an identity worker, and using a Black cultural ethos. I also documented what occurred in each teachers' mathematics lesson, including attending to student engagement, teacher-student engagement, and curriculum facilitation, along with practices related to Black women teacher literature, including how students are positioned in class, sources of cultural and community knowledge, and teacher and student accountability.

Interviews

Interviews served as an opportunity for teachers to share their knowledge. One Black feminist epistemological tenet is that Black women use dialog to assess knowledge claims. This dialog could consist of thinking to oneself or making meaning with another. Much of a teacher's reflection time occurs in isolation. Interviews rendered explicit this dialogical process of thought and action. In interviews, I encouraged teachers to reflect on their mathematics experiences and how they influenced their mathematics instruction. I conducted semi-structured and impromptu interviews before, during, or after participants taught mathematics lessons.

Semi-structured Interviews. This interview mode served as an important starting point to understand how Black identity and lived experiences influence Black Woman Math Pedagogy. Oral interviews afforded teachers space to articulate their epistemological standpoints (Mullings, 2000) or shared ways of teaching, based on their social realities and insights from their formative

years of learning mathematics and current years teaching mathematics. For the first individual interviews with Leslie and Shawna, I adapted a Math Autobiography protocol (Aguirre et al., 2013), prompting them to explain previous mathematics experiences, lived experiences inside and outside school, and how each viewed teaching mathematics.

Midway through the year, I conducted a second semi-structured interview with Leslie to reflect on curriculum, planning, teaching, and assessing student learning. During this interview, I couched my questions in salient quotes from Leslie's first interview that articulated emerging Black Feminist Math PCK elements. For example, in one interview I asked Leslie to extend her thinking about empowering students during her mathematics teaching as follows: "In the first interview, you stated that teaching math involved 'decentering me as the knowledge giver' and having students be more autonomous in their learning.' Given what you said about this, how do you see that in relation to figuring out how to use curriculum materials?" I posed similar questions to Shawna during a series of impromptu interviews, probing how she enacts the mathematics lessons found below.

Impromptu Interviews. During mathematics lessons, I found opportunities to voice record Leslie's thinking midway through mathematics lessons or during five- to 10-minute transitions to the next subject for the day, taking advantage of the natural opportunity opened by a 10-minute recess midway through mathematics lessons. These 15 noteworthy impromptu meetings were transcribed and marked with initial noticings for further exploration. Typically I asked Leslie about student thinking or her choice to structure a lesson a particular way. Leslie provided further insights into her individual students, having known many since kindergarten through interactions at Sunnyhill.

In Shawna's situation, I held 12 impromptu interviews after mathematics lessons, each of which I voice recorded and then transcribed on otter.ai. These informal conversations, conducted as students worked independently or while her student teacher led them, focused on teaching mathematics with curriculum, planning, teaching, and assessing students throughout the second part of the year. Shawna quickly became used to my following her around during Math Centers and listening in on her conversations with students. Often, she would explain to me what she was learning about a particular student mathematically or about their identity related to positive mathematics identity and social identity (i.e., being a student). She would also grab the official curriculum teacher's guide and share with me her thinking about the lessons, and how they compared or contrasted to her own mathematics pedagogy, such as comparing student progress with the official curriculum and stating "students would know how to subtract by now" in comparison to when she used her own mathematics curriculum. I often asked follow up questions and offered my own knowledge of mathematics curriculums and lesson formats.

Memoing

Following observations, I wrote memos about lessons and noted anything that stood out. I formed questions to pose to teachers later or notes about what to look for in future observations. I always attended to any interactions or ideas I observed that were related to Black Woman Pedagogy and Black Feminist Math PCK.

Gathering Meetings

Because the dialogical process of Black women coming together to talk and make knowledge claims generates stronger validity (Caretta & Riaño, 2016; Collins, 2000), I brought Leslie and Shawna together for one "Gathering" to serve as collective sensemaking about our Black woman mathematics teaching. At this time, I also invited Theresa, Shawna's colleague, to

participate, as she did in Gatherings 2 and 3. For the purposes of this study, I did not analyze Theresa's data. Personal matters caused Leslie to miss Gatherings 2 and 3 with Shawna and Theresa. I conducted two separate Gatherings with just Leslie two weeks later.

During our Gatherings, we engaged with literature based on my Black Woman Pedagogy theorizing. During Gathering 1, we read and discussed excerpts from *We Want to Do More than Survive,* by Bettina Love (2019). For Gathering 2, Leslie and Shawna wanted to read about teaching for joy in *Unearthing Joy,* by Gholdy Muhammad (2023). For Gathering 3, I brought in two conceptual frameworks from Black Woman Pedagogy to generate ideas about how our mathematics teaching connected to Black Woman Pedagogy: Culturally Relevant Pedagogy, by Gloria Ladson-Billings (1995), and Culturally Responsive Teaching, from Geneva Gay (2000). In addition, I brought in the Culturally Responsive Math Teaching 2 framework from Maria del Rosario Zavala and Julia Aguirre (2024) to make connections between Black Woman Pedagogy and teaching mathematics. I asked participants, *What resonates? How does this relate to teaching math? What's missing?* Conversations were semi-structured and I participated in them.

These meetings served as an open space for me as the researcher to pose follow-up questions from my initial hunches explaining Leslie and Shawna's mathematics practice, the connections they had to Black Woman Pedagogy, and how lived experience impacted their mathematics teaching. Additionally, these group-level conversations served as member check opportunities, allowing me to check my initial hunches on how to define Black Woman Math Pedagogy and each participant's Black Feminist Math PCK. This open form of member checking served as the dialogical process for knowledge creation among Black women mathematics teachers (Caretta & Riaño, 2016). Throughout our three Gatherings, we discussed themes from lived experiences, ideas about Black girls from our readings, being Black in this country,

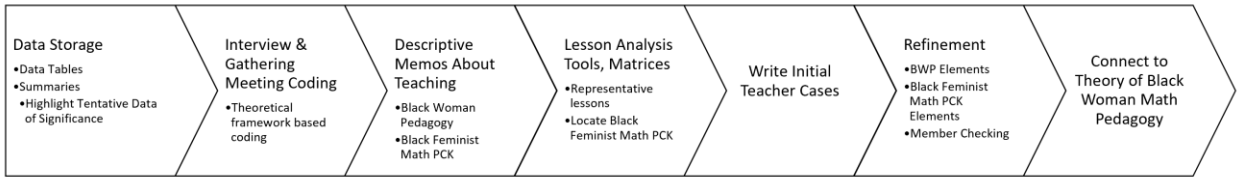
"unearthing joy," and "wanting to do more than survive" in schools and in the world. Each Gathering lasted about two hours and was video recorded. The audio portions were transcribed using Otter.ai, and I wrote memos about each Gathering to capture ideas for data analysis.

Data Management & Analysis

An overview of my data analysis methods is located in Table 3. I managed data on a secure One Drive cloud platform with an external backup drive. Data logs were tracked in Excel tables and marked with keywords, summaries of classroom observation, and types of data collected during observations. Teachers, students, and places were given pseudonyms. Memos were recorded post-interviews, classroom observations, and Gatherings as voice recordings and then transcribed. Transcriptions were briefly summarized and marked according to the teacher they pertained to. Collected data that had the potential to define elements of each teacher's Black Woman Math Pedagogy was marked as being of tentative significance. These would be some of the first data analyzed.

Table 3

Data Analysis Overview Chart



Phase 1: Interview Analysis

The first phase of data analysis consisted of identifying elements of each teacher's Black Woman Math Pedagogy through Black Woman Pedagogy and Black Feminist Math PCK. Thus, I started by analyzing the semi-structured interviews and Gathering meetings because these were conversations in which I explicitly asked teachers to discuss their lived experiences in

mathematics and how those connect to their current mathematics teaching. These data provided candid opportunities for participants to profess their values and beliefs about teaching broadly, mathematics specifically, and, in the case of the Gatherings, make connections to other Black women's lived experiences. I used ATLAS.ti to analyze each interview and Gathering meeting by creating analytic questions and codes based on my theoretical framework. My initial analytic questions were: *How does each teacher connect to Black Woman Pedagogy, if at all? What is each teacher's mathematics pedagogical content knowledge?*

Codes for Black Woman Pedagogy derived from my literature review of Black Woman Pedagogy and consisted of an *ethic of care*, *identity worke*r, and *Black cultural ethos*. I marked instances when a teacher described one of these three elements of Black Woman Pedagogy in their conversations. Initial Black Feminist Math PCK codes were grounded Ball and colleague's PCK construct (2008) and Collins's (2000) conception of alternative knowledge. To identify how participants used Black Feminist Math PCK, I created the codes *alternative knowledge, knowledge from lived racialized experiences*, *knowledge of students*, *knowledge of students' mathematical thinking, knowledge of mathematics content and teaching*, and *knowledge of mathematics curriculum*. For example, I defined the code *alternative knowledge* as knowledge from an outsider-within perspective that differs from mainstream knowledge. I interpreted Black Feminist Math PCK codes *knowledge of students* in and outside the mathematics classroom and *knowledge of mathematical content and teaching* as derived from a teacher's knowledge of her current students or any hypothetical student. All code definitions were refined over time and kept in a coding book.

To analyze participants' teaching practice, I needed a critical framework to study mathematics teaching and learning. Therefore, I used Zavala and Aguirre's (2024) Culturally

Responsive Mathematics Teaching Tool to capture the critical ways participants attended to students' knowledge and identities, created scaffolds and supports for student learning, and discussed dynamics of power and participation in mathematics classrooms. To broaden how I interpreted each teacher's mathematics teaching practice, I created codes using the three strands of the Culturally Responsive Mathematics Teaching Tool: *knowledge and identities, rigor and support,* and *power and participation*. Using Zavala and Aguirre's tool as codes helped me identify instances in the transcripts when a teacher's description of her mathematics practice indicated critical pedagogical engagement with students, which provided further insight into how I could study and define Black Feminist Math PCK through my data. My analytic question based on the Culturally Responsive Mathematics Teaching Tool was: *How is this teacher attending to knowledge and identities, rigor and support, and power and participation in her classroom?*

After initial coding, I first verified that each participant enacted Black Woman Pedagogy within their mathematics practice by reviewing Black Woman Pedagogy codes. According to my framework, each participant was consistent in their beliefs and mathematics teaching related to an ethic of care, being an identity worker for students, and using a Black cultural ethos in their mathematics teaching. I found this consistency within participant conversations about teaching in general and within mathematics lesson observations. Though *lived racialized experiences* was initially a Black Feminist Math PCK code, I recognized that lived racialized experiences impacted how the participants took up Black Woman Pedagogy. I wrote descriptive analytic memos and began naming themes to describe how each teacher connected to Black Woman Pedagogy and impactful lived experiences, such as how *math was inaccessible* for Leslie and how *personal accountability* had been missing from Shawna's teachers.

I then wrote descriptive analytic memos about each teacher's Black Feminist Math PCK based on instances in the transcripts when teachers described their mathematics pedagogical content knowledge, lived racialized experiences, and alternative knowledge. These instances included instructional decisions made while teaching, whether planned or impromptu, or knowledge discussed in interviews or conversations while teaching. I then looked for connections between instances where the teachers described their lived racialize experiences and what I considered alternative knowledge related to how they described teaching mathematics. I reviewed transcripts with the following analytic questions in mind: *What teaching stances does each teacher hold that stem from their lived racialized experiences? What stands out about each teacher's mathematics lessons? How does the teacher's instruction link to their own racial and gendered identities and lived experiences related to her identities?* These analytic questions were derived from my previous work (McVicar, 2024) about Black women mathematics teachers from a Black feminist perspective. I connected Black women mathematics teachers' personal beliefs and values about themselves to stances about teaching mathematics. Those stances were linked to actions carried out while teaching mathematics.

For this analysis, I wanted to locate each Black woman teacher's dialogical relationship between her thoughts and actions, which would then inform the pedagogical decisions she made when teaching mathematics. For example, as a stance, Shawna valued students having Black teachers. Therefore, her accompanying action had been to become an effective Black teacher. I viewed these thoughts and actions as asset-based stances that each teacher brought into their classroom through their alternative knowledge. Broadly, these stances are not taught in teacher education programs or professional development. Rather they are inherent to each unique teacher. Though each stance may differ to a degree, Black women teachers often take similar

actions while teaching. For example, both Leslie and Shawna valued building relationships with their students. However, how they arrived at these stances and how each teacher went about getting to know students depended on each teacher's unique upbringing, lived experiences, and personalities.

Phase 2: Classroom Lesson Analysis

The second phase of data analysis consisted of connecting what participants described about their mathematics teaching practices and their stances about teaching mathematics to their day-to-day mathematics teaching. Identifying Black Feminist Math PCK themes became an iterative process of analyzing a teacher's mathematics lesson, locating connections to their lived racialized experiences, naming their alternative knowledge asset-based stances, and naming the pedagogical decisions made as they taught mathematics. Because my observational data set was vast, I engaged in data reduction by selecting three representative lessons for each participant. A lesson was representative if it was characteristic of a teacher's mathematics teaching practice over a period of time. For example, Leslie's mathematics teaching structures and curriculum usage changed often throughout the year. However, once she established a new routine for mathematics class, long periods of time elapsed during which she adhered consistently to the same pattern in terms of how she organized her mathematics lessons. A representative lesson of Leslie's would come from one such period of time. In comparison, Shawna's mathematics teaching structures were consistent across the school year and distinguished by whether or not she used the official curriculum or her own curriculum materials for unit minilessons. Thus, three representative lessons of Shawna's would come from three different curricular units.

Table 4

Lesson Analysis Tool Example from Shawna's Observation, Lesson 7-5

What's happening	FN	Shawna's Impromptu Interview	Analysis
Math Centers Theresa works with some students	I talk to Shawna during group rotations. She talks about the rest of the topics for the year, how she agrees that addition should be taught separate from subtraction, and then all together. She likes that the curriculum splits them up, but doesn't like *how* the curriculum teaches each part. We discuss how this is an optimal class to teach math, because the class is so small. 14 kids total, and there's always kids missing. Everyone is on track except for G., who is working through learning English. Shawna said she loves that she's translanguaging. Also talked about how long the math block is. District says 75 min block a day. I wondered how long Savvas expected kinder to do math, which Shawna didn't know. I assumed it's short because it's just doing the Solve and Share, and then the "Independent Work" with the teacher walking around with a manual and reading the problem out loud. Shawna said she did this in September, and hated it. It was no fun. So in October she started doing different stuff. She also sees how independent her students are. She kinds of misses when they needed her a lot. Now they can do centers on their own.	agrees that addition should be taught separate from subtraction, and then all together. She likes that the curriculum splits them up, but doesn't like *how* the curriculum teaches each part. the "Independent Work" with the teacher walking around with a manual and reading the problem out loud. Shawna said she did this in September, and hated it. It was no fun. So in October she started doing different stuff. She also sees how independent her students are. She kind of misses when they needed her a lot. Now they can do centers on their own.	**Math centers used to be with teacher supports a lot, now they're really independent.** **Theresa started working with small groups doing workbook at back table. Shawna uses her supports! But if her classroom didn't have intervention support, she would have the same structure with math games until they're independent. Unknown if she'd do the whole group.** **It's typical in title 1 schools to have extra adult support at times. This is something many teachers could implement, actually planning out with their intervention a cohesive predictable plan for both teachers and students.**

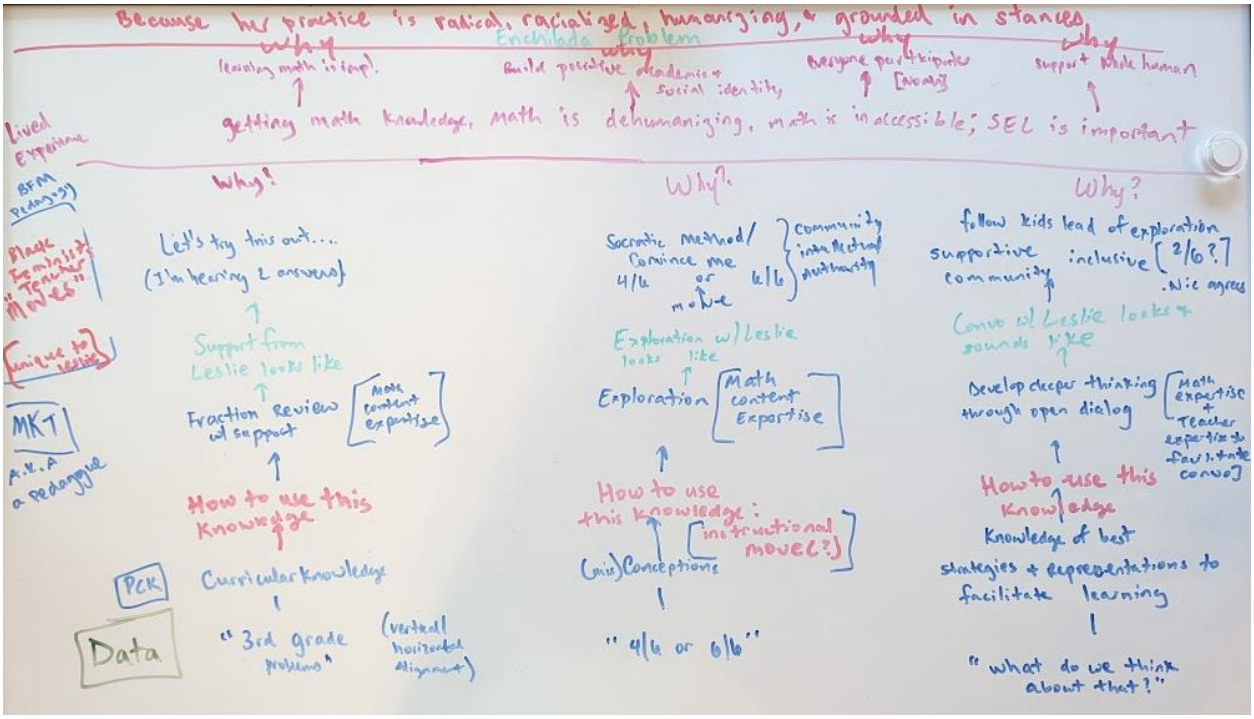
To choose representative lessons for each teacher, I located one lesson from each trimester of the year: fall, winter, and spring. I divided my data log by the three trimesters and reviewed lesson summaries and field notes. I chose lessons that held significance for me. This could have been because the teacher said something memorable that stayed with me throughout my observations; or perhaps the teacher had a remarkable lesson that stood out from a string of lessons following a typical teaching pattern. I reviewed lessons that came before and after potential representative lessons to confirm that the chosen lesson was indeed characteristic of that teacher's mathematics teaching practice during that time period. I created a summary of each

lesson using a lesson analysis tool (Table 4) to coordinate my fieldnotes with teacher interviews and initial analysis of what I interpreted from the data, noting events that stood out to me.

In a second round of analysis, I create matrices (Miles et al., 2020) of interview findings with lesson summaries to triangulate what teachers said (thoughts) to their mathematics teaching (actions). I used matrices as a useful way to organize multiple sets of data while mapping Black Woman Math Pedagogy, which is the connection between thought and action that informs a Black woman's teaching practice. The matrices allowed for mapping Black Feminist Math PCK along with confirming each teacher's mathematics subject matter expertise. I also mapped on the alternative knowledge each participant possessed from their lived racialized experiences by asking a series of "Why?" questions. For example, in the matrix shown in Figure 2, I asked of the data, "Why did Leslie do X?" I mapped on what Leslie had learned from her lived experiences (thoughts) and how she drew inspiration from those experiences in her teaching (actions) (McVicar, 2024). From here, I applied initial characterizations of teachers' alternative knowledge asset-based stances to instances when the teachers made pedagogical decisions related to their stances. For example, in the second column of Leslie's matrix (Figure 2), I worked from the classroom observation data located at the bottom of the matrices, "4/6 or 6/6," to connect "instructional moves." From instructional moves, I connected PCK knowledge (i.e. "math content knowledge") and asset-based alternative knowledge (i.e. "community, intellectual authority") to stances grounded in lived racialized experiences: "getting math knowledge, math is dehumanizing, math is inaccessible, SEL is important." Finally I arrived at a Black Feminist Math PCK element (i.e. "building positive academic and social identities") that connects to Black Woman Math Pedagogy theory, that Leslie's "practice is radical, racialized,

Figure 2

Mapping Matrix of Leslie's Second Representative Lesson



humanizing, and grounded in stances." The findings of this lesson are described in detail in Leslie's case.

For Shawna's case, I broadened my unit of analysis to an entire subtraction unit because the data was rich with Shawna's thoughts. During the subtraction unit taught in the spring of 2023, Shawna taught the newly adopted official curriculum and then compared student mathematics learning before and after she taught the same aspect of subtraction using what she called "My way of teaching" (Impromptu Interview, March 6, 2023). Shawna's way of teaching was a subtraction reteach based on her own beliefs about successfully teaching students mathematics, which differed markedly from official curriculum's approach. Shawna did this to test the newly adopted curriculum's effectiveness on student learning versus her own curricular

methods' effectiveness. Her test served as a productive opportunity to document and describe her pedagogical expertise in interpreting curriculum. I created lesson analysis tools based on my four observations of Shawna teaching first from the official curriculum's subtraction unit and then all 10 reteach lessons. I included Shawna's comments about curricula throughout the process and how students responded differently when she taught using her own materials. Then, as I had in Leslie's case, I created a matrix of Shawna's unit with interview findings to locate her Black Feminist Math PCK.

I then revisited the impromptu interviews conducted immediately after each teacher's classroom lessons to connect what teachers had said about their mathematics teaching, beliefs, and values before triangulating with other participant interviews. For example, I used open coding to look for themes in how Leslie described her practice, such as "got to keep the pot bubbling without flipping off" (Interview 1, October 20, 2022) to describe how she wanted her class to be a place for humor without letting the class get out of hand, or Leslie's declaration that she would not police children in school. Instead, she gave students the expectation that "you can handle yourself in a way that feels good to you" (Interview 1, October 20, 2022). I connected these comments to her lived racialized experiences of how she envisioned and enacted teaching mathematics and confirmed the categories of her alternative knowledge asset-based stances derived from lived racialized experiences. Finally, I wrote initial cases documenting each teacher's Black Feminist Math PCK and Black Woman Pedagogy and how these two concepts worked synergistically to form Black Woman Math Pedagogy.

Though I was nearly done, I wondered how to interpret each teacher's power and agency in the classroom and how they each empowered students while also teaching more traditional mathematics. I wanted to analyze how, if at all, my initial findings connected to the liberatory

teaching traditions of Black woman teachers and critical mathematics education scholarship. I considered the role of subversive teaching (Gutiérrez, 2013) and how to interpret it in an elementary mathematics context. This element complemented my initial *power and participation* and *knowledge and identities* analyses using the Culturally Responsive Mathematics Teaching Tool (Zavala & Aguirre, 2024). Particularly, I paid close attention to where *power* and *identity* appeared in coding interviews and lesson memos. These connections contributed to a more robust interpretation of how each teacher's alternative knowledge informed their Black Feminist Math PCK. The *alternative knowledge* of each teacher consisted of liberatory stances pertaining to how teachers shared power, enacted criticality in their teaching, and encouraged knowledge production in mathematics. These elements appeared in data as combinations that supported student learning, encouraged students to take critical stances about their own learning, or emerged as critical stances teachers took on behalf of students, often without the appearance of students' conscious awareness. For example, Shawna's criticality emerged in the form of protection for her kindergarten students against negative narratives about Black and Brown students in mathematics, which contributed to positive identity development. Leslie's criticality emerged through explicit conversations with her students about how racism operates in society, which empowered students to identify how injustice comes about. I recognized that criticality and liberatory pedagogy operated in nuanced ways for each teacher, which helped me refine my cases and connect my analysis back to my theory of Black Woman Math Pedagogy.

Member Checking

Member checking comprised a significant component of co-knowledge construction. Therefore, participants were informed of my process and prompted to offer insights as I continued data analysis during and after data collection. Member checking (Miles & Huberman,

1994) took place naturally as I began presenting my findings about Leslie and Shawna at conferences. An impactful point of member checking occurred when Leslie, Shawna, and I presented at a regional conference about their mathematics teaching practices. I drew on prior presentations to create a shared presentation in which participants spoke about their mathematics teaching practices in depth. As the presentation creator, I had participants review their segments of the presentation and confirm whether I had accurately represented their experiences as well as whatever they felt comfortable sharing and expressing about their mathematics teaching practice. During Gathering 3, which occurred in June 2023 during the last month of classroom observations, I drafted a synthesis of Black Woman Math Pedagogy and asked my participants for feedback. Additional check points occurred when I presented at the Association of Mathematics Teacher Educators conference in February 2023 and the American Education Research Association in April 2023.

From my analysis, I crafted two cases articulating Black Woman Mathematics Pedagogy. Leslie's case findings follow in Chapter 4 while Shawna's appear in Chapter 5.

Limitations of Design

The case study approach generalizes to theory rather than specific groups of people. As I stated before, Black women mathematics teachers are not monolith. My study focused on capturing each participant's perspective about her mathematics practice in order to generate theory. During data collection, I did not engage students in conversations about their own experiences in mathematics or with their teacher. Though in my analysis and findings I make claims about how students experienced the learning environment, I never directly asked students about their mathematics experiences or lived experiences inside or outside of school. However, my claims are derived from discussions I had with the teachers and field notes from lesson

observations. I relied on context, body language, what teachers said, and my own knowledge about students to make claims about student experiences. Additionally, any claims I make about Leslie and Shawna's colleagues were based on Leslie and Shawna's conversations about their experience of colleagues in staff meetings, team meetings, and hallway conversations. I did not observe any meetings among colleagues, nor have I met many of the colleagues referred to in my data. I formed claims based on data gathered about each participant's experiences in schools and what I know to be true, having had worked in the same school district and experienced similarly structured schools, colleagues, and meetings years ago.

Chapter 4: Leslie's Case

In Chapter 2, I conceptualized *Black Woman Math Pedagogy* as lying at the intersection of Black Woman Pedagogy and pedagogical content knowledge shaped by Black feminist theory, or what I call *Black Feminist Math Pedagogical Content Knowledge* (Black Feminist Math PCK). Black Feminist Math PCK is a teacher knowledge construct that works synergistically with Black Woman Pedagogy to study Black women's day-to-day teaching of mathematics. Black Feminist Math PCK is informed by Black women's alternative knowledge based on epistemological stances that differ from white institutional knowledge (Collins, 1989). In the case of teacher knowledge needed to teach mathematics, Black Feminist Math PCK includes stances that are asset-based and grounded in the alternative knowledge derived from Black women's lived racialized experiences. In this chapter, I apply key features of Black Woman Pedagogy and Black Feminist Math PCK to Leslie's mathematics practice to document and describe Black Woman Math Pedagogy.

To explore Leslie's Black Woman Math Pedagogy, I first discuss Leslie's racialized life experiences that influenced her mathematics teaching practice. I connect her lived experiences, interviews, lessons, and conversations with her mathematics students with enacting a Black Woman Pedagogy. Next, I interpret through a Black feminist lens how Leslie's Black Feminist Math PCK drew from alternative knowledge about teaching and learning mathematics that stemmed from her racialized mathematics experiences. These alternative knowledge asset-based stances—learning should be accessible, schools should be more humanizing, and teachers should ground their teaching in socioemotional learning—impacted Leslie's stances on teaching mathematics. I document Leslie's Black Woman Math Pedagogy in her day-to-day mathematics teaching using three lessons examples. I end with a summary of the impact of Leslie's story for

conceptualizing Black Woman Math Pedagogy, highlighting key learnings about the interrelatedness between Leslie's lived racialized experiences, her stance on teaching mathematics, and how these informed all aspects of her mathematics practice.

Alternative Knowledge Based on Lived Experience

Below, I summarize Leslie's lived experience. I view her experience using a Black feminist lens to interpret the assets she brings to mathematics teaching and learning. As a Black girl who became a Black woman, Leslie was an "outsider-within" who had "alternative knowledge" (Collins, 1989) which positioned her to question white institutional schooling knowledge and conventional knowledge about teaching and learning mathematics. This alternative knowledge differs from that of our largely white women teaching force in the US. From Leslie's experiences, I locate the alternative knowledge that informed the asset-based stances she brought into her mathematics classroom. Leslie's three asset-based stances were to make mathematics accessible, humanize mathematics, and ground mathematics spaces in socioemotional learning.

Leslie's Classroom

Leslie's classroom sat at the end of the hallway at Sunnyhill Elementary. For every classroom visit, I walked past the K-3 classrooms where children sat crisscross on the carpet, teachers were talking at students, or students were working quietly at their desks. Whenever I arrived at Leslie's classroom, I always noticed the difference between her atmosphere and that of her majority white women colleagues. In Leslie's classroom, students sat on the floor, or comfy orange sofa, fuzzy papasan chairs, and wobble stools. The lighting was dim, with strings of lights around the room. Lo-fi music played over the speakers. Students had the freedom to move about

the room to find the best seat or space to access learning. Leslie asked students to call her by her first name, “Leslie.”

During my visits, I noticed that everyone participated in mathematics daily. Students worked in intentionally created heterogeneous groups, where students could use their strengths to support the group, whether it be reading, comprehending, developing a strategy, or asking questions about the problem. Soft chatting and laughing were commonly heard in the classroom while students got their work done. This was atypical of many elementary mathematics classrooms, particularly in her school. These differences were intentional and grounded in her alternative knowledge stemming from her lived racialized experience, to produce the opposite of her traumatic classroom experiences, particularly in mathematics.

Leslie’s Lived Racialized Experience in Mathematics

> I would definitely say that who I am as a teacher is I'm very focused on helping grow the whole human, the whole child. That is going to be doing things like social justice work every day, and talking about different cultures and how they connect to either the cultures we come from, or how they might be different. But they need to be understood to understand the person standing next to you, and that we do a lot of SEL work. We focus on how to be good humans. *Then*, all of the education components come once we're feeling safe and secure in our environment. That's when our brains are best ready to learn. (Interview 1, October 20, 2022)

Leslie had traumatizing schooling experiences. She attended a predominantly white Catholic elementary school in a large urban Pacific Northwest city. She remembered being the only Black girl in all of fourth grade. Leslie was also an undiagnosed neurodivergent Black girl with autism. Her elementary teachers used the banking model of education (Freire, 1970), by

which information was taught in the dominant white cultural pattern of sitting and receiving information in one mode of teaching, with students either succeeding or failing. Because Leslie appeared continually unsuccessful, she believed that teachers found working with her difficult. Also, Leslie struggled to build friendships and a positive relationship with teachers. Her frustration with this process led to attention-seeking behavior, ranging from acting out to fawning over teachers, both methods being a trauma response to her need for more love and attention. To manage Leslie, one teacher thought it best to face Leslie's desk against the wall while everyone else was facing the other way and far from Leslie. This was a painful, dehumanizing experience that exacerbated Leslie's blocked longing for community.

> In my fourth-grade year, I was actually put in my own desk facing the wall. And that was, that was my life. And so I'd spend all day slowly inching the desk back to face the front of the room. And then I would try to see how far I could get it to the table groups where everybody else was, and then on the next day it would be back against the wall. (Interview 1, October 10, 2022)

Leslie experienced school, which included mathematics, as a violent place where her humanity was ignored (Joseph et al., 2019). Situations like Leslie's are all too common in mathematics classrooms, especially for Black girls (Joseph, 2022; Nasir, 2002). How many times have we seen such ostracism in education? The number of times we approach a classroom and encounter the Black student banished outside the classroom door, or seated away from the rest of the class, or sent away either to a buddy room or the principal's office. The instances are too many to count. Because Leslie faced the wall, she was not a part of learning mathematics. Throughout her K-5 experiences, she struggled with numbers and operations, developing only

beginner reading skills. In Leslie's elementary years, she learned that mathematics was inaccessible, and schools were dehumanizing places.

In middle school, Leslie attended an alternative public school that was, as Leslie describes it, "big into socioemotional learning." Here, academics were not as big of a deal. Yet these experiences had a major impact on the teacher Leslie was to become. Leslie imprinted these ideas of socioemotional learning into her lifelong well-being. For example, during one of my classroom observations, Leslie's sixth through eighth grade teacher Ms. Robinson, a white woman who was subbing at Sunnyhill, walked into Leslie's mathematics class while I was recording. Leslie was glad that I recorded her hugging her old teacher. Afterward, Leslie shared with me: "That was the first person that gave me boundaries." She reminisced about an all-school field trip with her middle school. At the time, she was really into spitting, so she just kept doing it. After some while, Ms. Robinson had had enough of Leslie's behavior. She approached Leslie and quietly told her, "Leslie, cut that shit out." Leslie recalled being surprised. It made her think, "This is a person that I don't want to make upset. I think I'm gonna try harder, you know, to change" (Impromptu Interview, January 9, 2023).

For Leslie, Ms. Robinson served as a professional teaching role model and surrogate mother. Leslie's own mother was busy working multiple jobs as a single mother and struggled to support Leslie at school. At home, Leslie was free to act however she wanted. She realized as an adult that it had been she who ran the house, not her mom. Her mother provided no boundaries for Leslie. But the boundaries Ms. Robinson set enabled Leslie to build a connection with an adult. This insight became overlaid with the socioemotional learning supports that Leslie learned and later drew upon when building connections with her own students. For Leslie, Ms. Robinson

showed the political consciousness to love students while also setting firm boundaries for them. Leslie directly emulated this stance when teaching her own students.

In high school, Leslie attended an alternative school far across the city. Once again, she could not access personal connections with her teachers and eventually found it pointless to even attend school every day. In Leslie's senior year of high school, only a few credits shy of graduation, Leslie talked with a school counselor and realized she would not be able to graduate. Low attendance was causing her to fail a class because she felt that "no one cared if I was there" (Interview 1, October 20, 2022). Once again, Leslie experienced school as a dehumanizing place. She attempted to devise a work plan with the social studies teacher in question, but the teacher refused her.

> I was battling a LOT back then. I didn't know I wouldn't graduate on time until 6 weeks before my graduation. I made tons of deals with teachers to make up all these different core classes I needed, but the American government teacher refused. He was a failed local politician, and he felt his yearlong class was too important and dense for me to make up in 6 weeks. So... that was it. I left. I tried to get my transcripts a year later to do high school completion, but I think I had like 15 credits to my name. That math was wrong, but my former core teacher had become the principal, so his calculations on my credits stayed set in stone. (Personal Communication, April 14, 2023)

Leslie's high school teachers offered no othermothering, or fictitious kinship relationships with Leslie (Foster, 1994). Instead, she was met with uncooperative authority figures who refused to connect with her or support her as a growing scholar and child. One of countless Black girls pushed out of schools (Morris, 2016), Leslie decided to drop out. An undiagnosed neurodivergent teenager, she lacked connections with teachers, found herself

segregated and dehumanized by school administrators, counselors, and most teachers, and could see no point in graduating.

Years later, however, Leslie decided to become a teacher. She had noticed a trend of how passionate she became in conversations about inequities in schools and the philosophies of school reforms. She pursued her GED, then attended community college to earn her Bachelor's degree, and finally graduated with a Masters in Teaching from a highly competitive teaching program in her hometown. The entire time she was in higher education, she struggled through mathematics requirements, yet she found the drive within to learn the mathematics necessary for teaching elementary students. She took it upon herself to reach out to mathematics professors and form peer study groups for layered support.

At this point of her career, with a Master's degree and in her 6th year of teaching, Leslie tells her students to take advantage of learning fourth grade content now; otherwise they will get passed along to the next grade, as she was, without ever learning to do mathematics. Once she told a group of chatty boys during a whole-group mathematics lesson, "The reality of our school system is that you keep getting pushed through. You only get fourth grade once. Don't take away your learning opportunity" (Classroom Observation, January 24, 2023). Here, Leslie articulated her experience that the education system is designed not to educate, but to pass students through the grade levels until they reaches a systemic barrier, such as the number of credits needed to graduate high school. She passes down to students the expectation to take responsibility for their learning. This advice connects to the many times Leslie shared her experience of being unable to read in fourth grade or entering high school without knowing how to do any mathematics. Willing to be open and vulnerable, she shared her experiences with her students because it had literally been her reality, and she implored them to strive toward experiences better than hers had

been, to implicitly want to learn *because* the opportunity in her fourth grade classroom was present.

In sum, Leslie's lived experiences influenced what she strived to do in her mathematics classroom. Leslie worked to create a mathematics space that was *humanizing* instead of dehumanizing, *accessible* instead of inaccessible, and grounded in *socioemotional learning* instead of institutional indifference. These stances about mathematics teaching and learning developed in response to her own lived racialized experiences, which created firsthand knowledge about how schooling systems were not built for Black neurodivergent girls to thrive.

Leslie's Black Woman Pedagogy

Above I summarized Leslie's lived racialized experience to identify the alternative teaching knowledge that impacted how she constructed a mathematics space to be humanizing, accessible, and grounded in socioemotional learning. Next, I explore Leslie's Black Woman Math Pedagogy by connecting to Black Woman Pedagogy. I looked across interviews, conversations, and mathematics lessons to understand how she enacted an ethic of care, identity work, and a Black cultural ethos in mathematics.

Leslie's Ethic of Care

Lived racialized experiences drove Leslie's ethic of care values. An ethic of care aligns with the care of politically conscious Black women teachers who are "concerned adults, who command respect, are respectful of pupils, and who through caring require all students to meet high academic and behavioral standards" (Foster, 1994, p. 213). For example, Leslie experienced othermothering and otherfathering, which is parenting-like behaviors exhibited from Black teachers (Case, 1997; Collins, 2000; Dixson, 2003) from both her middle school teacher, Ms. Robinson, and her principal, Mr. Andrews. Interestingly, both were white educators who enacted

these parenting behaviors, showing that all educators have the potential to enact an ethic of care that holistically affirms children's well-being, especially Black children's. Leslie stated, "I had people that were safe and were supporting me and were loving me… they very much were like the only people that ever questioned what I did, and held me accountable, which I had never experienced before" (Interview 1, October 20, 2022). Leslie's middle school experience, followed by becoming a high school dropout, informed how she emotionally supported students in mathematics. She recognized that how she facilitated learning and gave students the freedom to make choices while also supporting them with love made her a teacher different than most. In an interview, Leslie named how most teachers typically become teachers to reenact how schooling functioned for them. And if a child did not fit with a teacher's ideas of what a good student should do, that was the student's problem. However, Leslie believed that "my job is in service to you" (Classroom Observation, February 16, 2023). Her stance was that teaching and working for students was her job, work that she did not take on lightly. Her service was to love and hold students accountable because of that love and concern.

Leslie showed an ethic of care by conveying to students a sense of urgency to seize the learning opportunities that she had missed in fourth grade. She empathized with academically and socioemotionally struggling students. For example, Leslie tried to talk to kids about caring about their own learning. I remember Leslie explaining that primary teachers referred to grades three through five as "the land of Swiss cheese" because of the perceived holes in conceptual development that kids are left with once they reach fourth grade. In an interview about classroom practice, Leslie talked about a Black girl in her classroom and the amount of care Leslie knew she needed, which she had provided since the beginning of the school year. She reflects on the first days of school:

Leslie: When Jasmine was in my room, and I saw two meltdowns within the first day or two, I was like, 'Okay, this doesn't happen in here. We don't do this.'

Elzena: I think it was yesterday? Who was the person. There was a little "What do you need?" [moment with Jasmine]. Yeah.

Leslie: Yeah, I am such an SEL person that I can't deal with crying that's hiding something else. We need to actually talk about what that something else is so that we can bring that anxiety, or whatever that feeling is, down. And if we're hiding what that feeling is with a secondary emotion, we're not really going to be able to hit the heart of what you're going through, and then we're not going to be able to have it subside so that you're ready to actually do your work. And so with Jasmine, it's just been a lot of like, "No, you got this. You can persevere. You're smart. You're capable." She has such a negative internal voice.

Leslie was able to form a caring relationship because Jasmine's lived experiences in school and in mathematics resembled her own. Leslie saying "we don't do this here" meant that we do not leave kids to cry without being attended to. Leslie wanted to get at the root of Jasmine's sorrow, because the crying was standing in as a "secondary emotion" to something bigger. Restating Leslie, "And if we're hiding what that feeling is with a secondary emotion, we're not really going to be able to hit the heart of what you're going through, and then we're not going to be able to have it subside so that you're ready to actually do your work." Leslie explained that *when* we choose to care about our students, our Black girls, then they can begin healing. Learning mathematics comes after hurt, harm, or pain is attended to. Having an ethic of care made Leslie attuned to students' emotional trauma and empathy to not ignore struggling

Black girls, like she was ignored in her fourth grade classroom. She maintained an ethical stance that before a struggling student can "actually do the work," they have to begin healing.

Lastly, Leslie had an ethic of care about the "work" of teaching (McKinney de Royston et. al, 2020). While learning mathematics content was difficult for Leslie, she worked hard because she held herself personally accountable for teaching students what they needed to learn. Leslie demonstrated personal accountability by taking it upon herself to pay for professional development training in mathematics teaching and seeking out learning strategies by watching YouTube videos. For example, when Leslie switched from third grade to fourth grade mathematics, she encountered a stark lack of teacher resources, so she took content knowledge development into her own hands on behalf of her future students.

> There wasn't anything for us to fall back on. So then we have to put that on ourselves. Like, how are we going to make ourselves better for our students? Because the resources just aren't here for any of us. So I bought a subscription to this website. And then I would watch those videos, learn the strategy, do a couple of the problems that the kids were going to do so that I kind of had an idea of how to anticipate it, and then launch it. (Interview 2, January 9, 2023)

Another reason Leslie went to such great lengths to continue developing her own mathematics content knowledge, an element of mainstream PCK, was that she loved being a teacher. She often spoke of teaching with marked enthusiasm. She has a tattoo of her past two classroom numbers, one of which she got with Ms. Robinson at the end of a school year. Leslie's ethic of care showed dedication to the joys of teaching and working with students.

Leslie as an Identity Worker

Leslie's own identity development as a neurodivergent Black student influenced how she fostered identity development in her students. Identity work in Black Woman Pedagogy considers the positive development of students' racial, academic, and social identities. Leslie identified as a Black woman who was a teacher and who had a learning disability. Early in life Leslie had struggled with her identity development. An adopted mixed-race child with Black and white heritage, Leslie lost her Black adoptive dad when she was young and was raised by her white adoptive mother, who had few conversations about race with Leslie. Leslie's peers and teachers had been almost exclusively white until she reached middle school. Her first contact with the Black community in her city occurred during bus rides to high school, which were uncomfortable. Black males questioned her race based on her body appearance and style of bright colorful clothing. This narrow view of race is common in the Black community, where mainstream media offers few options for Black girls and women to *be* in the world (Collins, 2000; Joseph, 2021). Her gendered identity was policed by Black males, making the already difficult trip across town to high school even more difficult.

Her intersecting identities impacted how she supported and maintained positive student identity development as students learned mathematics. Because Leslie had struggled with her multiple identities, she was conscientious of her students' struggle to create and maintain positive racial, social, and academic identities. The difficulties with belonging and being Black that she had experienced in youth impacted how she supported Black girls and boys in her classroom to feel comfortable in and beyond her classroom with who they were. Outside and inside mathematics, Leslie worked diligently to offer a "relevant Black identity" (Ladson-Billings, 1994) for her Black students and for non-Black students to recognize and celebrate the diversity of Blackness in the world. For example, Leslie diversified her classroom library beyond

the predominantly white reading curriculum to include racial- and gender-inclusive books with social justice themes. During a fraction unit, Leslie used a rap-style fraction video to teach students about unit fractions, representing fraction parts, and writing fractions. She printed color screen shots of each example in the video and added them to the array of images on her classroom walls. In doing so, Leslie elevated the Black cultural artifact of rap music and videos to curriculum, validating both as worthy (Gay, 2000). Additionally, the class collectively wrote a rap song about fractions, with students using a computer program come up with rhyming words from a fraction-based lexicon. Once each song was composed, small groups of students rapped it in front of the class. Even Leslie took a turn. This activity was community-oriented and blended Black rap culture with a mathematics learning environment. Both rap songs from Leslie's fraction unit contributed to Blackness and Black identity being relevant in mathematics.

Another essential component of Leslie's identity was having been a high school dropout. Leslie identified strongly with this label and referred to it many times throughout the year as a warning to her students. To be clear, dropping out of school is a common manifestation of multiple systemic structures that actively push Black girls out. Black girls make up 7.4% of the public school population, yet they receive almost double the average rate of out-of-school suspensions at 13.3% (U.S. Department of Education Office for Civil Rights, 2021). Specific to mathematics classrooms, Black girls caught in intersectional oppression are rendered largely invisible, subject to both limited access to high quality instruction and low expectations from adults (Joseph, 2017). From her elementary school years in mathematics to her senior year of high school, Leslie experienced exclusion by the adults who were to care for her. To come to terms with the shame associated with being a high school dropout, Leslie had to put in many years of personal work.

> I didn't attempt any form of education again for another four years. The dropout stigma was super deep, and ultimately, I was the one judging myself into the corner. You just can't actually see that while you're in it. I think that's why so many dropouts get stuck. We carry the stigma so deep inside of ourselves that it can freeze our actual abilities and opportunities. (Personal Communication, April 13, 2023)

Today Leslie uses her dropout identity experience as a warning to her students, as well as an example that a person can always grow, even after experiencing personal struggles. She offers this advice in reference to seizing the opportunity to learn now in fourth grade rather than being merely shuffled ahead into the next grade without having learned anything. During one interview, I confessed my awe at how she used her personal experiences and grappled with negative schooling experiences to shift the negative labels that students placed on themselves or were given to them. She replied that she was glad she could take her bad experiences and use them for good. “Take it. Transmute it into something that is good and helps people. And then it heals me. And it helps heal others” (Interview 1, October 20, 2022).

Another identity that Leslie shared with students to support building positive mathematics identities was having a learning disability that made mathematics learning difficult. Leslie often explained to her class the different ways brains may process understanding mathematics. Leslie favored using multiple modalities to teach mathematics content, whether it be via varied communication styles, using manipulatives, making drawings, etc. For example, leading up to the fractions unit, she spent months excitedly brainstorming ideas about incorporating tactile learning opportunities such as water pouring and manipulating kinetic sand with cups to create fraction pieces. During lessons, she often used her body to make shapes, such as gestures to create greater than and less than symbols, or arms for addition and subtraction

symbols. Her students benefited from multiple learning modalities. Leslie also talked with students who struggled with their own disabilities and encouraged them to persevere.

> I am very, very open all the time that I have learning disabilities, that certain things are harder for me. But I find other ways because I know that I'm modeling for all my kids that do have disabilities, that we just find another way. Yeah, I'm not gonna lie to you. It is harder for us. Like when we are talking one-on-one, [a] student with learning disability and myself, and you're saying to me that this feels really hard. You're right. It is. And it is harder for us. But it does not mean we can't do it. And there's something that we're not being graded on right now that we're actually better at than all of these people. But in this moment, this is the one skill that's being looked at. And yes, that thing is harder for us. But we have all these other gifts. So it's a give and take. But I hear you. (Interview 1, October 2022)

Leslie used her experiences to empathize with those students who likewise struggled with learning disabilities and differences, not just to learn mathematics, but to develop the mindset that having a learning disability or a difference in general had its pros and cons. At some undertakings people shone, and with others, such as a specific skill students were expected to learn in mathematics, they might struggle.

Ultimately, Leslie wanted to "develop the whole human," a phrase she used that I connect to allowing for students' own self-determination in schools. In other words, instead of controlling students, Leslie allowed her students to make their own decisions about wanting to learn for their own self-improvement and personal desire to grow. Leslie and I had conversations about how different her classroom was compared to those of colleagues in her school. In her classroom one could sense an ease, an environment where students were not controlled, but

rather allowed to be themselves while learning and doing their work. From listening to music or sitting by their friends to enjoying each other's company and forming new relationships, students in Leslie's classroom were encouraged to just be themselves.

Leslie had commented before:

> A lot of teaching is about controlling children throughout the entire day. And so like, I already know, a lot of people aren't going to get what happens in my classroom. That's like going back to that idea, again, of walking down the hallway and what you hear in all those classrooms, and it's just like, that is not why I got into this job at all. It is to be me. And for them to be them. And for us to find harmony in 24 people who are all really different coming together and sharing a space together. And like yeah, identity. It's a big deal. Being present being loved. (Interview 2, January 5, 2023)

Rather than transform her students into little versions of herself, Leslie fostered a student-centered approach to teaching students that honored student knowledge, identities, and ways of being.

Leslie's Black Cultural Ethos

Leslie brought a Black cultural ethos into her mathematics teaching. She had developed this ethos as a young adult during the early days of the Black Lives Matter movement, which occurred while she was attending graduate school for her master's degree. This was that point at which she began developing political consciousness about being a Black woman who was about to become a teacher in America. To be clear, Blackness and a Black cultural ethos can be represented in multitude of ways in a Black woman's teaching. As such, I draw on more than just Black Woman Pedagogy literature to allow for those elements that are significant to Leslie's teaching to emerge. Consistent with my methodological approach and positionality, I draw on

conversations with Leslie, my own lived experience as a Black woman, and other Black teacher literature to identify the components of Black cultural ethos that Leslie most drew on in her mathematics teaching. I label them as *community*, *truth-telling*, and *Black cultural learning styles.*

Community. Community formed the cornerstone of Leslie's teaching practice. Community is an element of Black communities such as in churches, community groups, and cooperative sports. During her middle school years, Leslie had spent time in social groups organized by her teachers. Similarly, Leslie found success in mathematics as a higher education student when she worked in peer groups. Being in community with others allows for collaboration, which supports not only academic learning by working with friends on tasks, but also the wellbeing of wellbeing of students to feel they are not going it alone in mathematics. Highly valued in the African American community, collaboration has been shown to contribute to Black student success in classrooms (Foster, 1994; Gay, 2000; Ladson-Billings, 1994).

Leslie's classroom defied pressures from the white dominant school culture to value oneself based on individual merit alone. For example, the first section of mathematics class involved groups of four to six students working together to solve a problem. These were heterogenous groups that disrupted power structures around who can be successful in mathematics. Students then engaged in a whole group conversation, during which Leslie structured the share out by calling on a student who had their hand raised, followed by a person chosen randomly by the name randomizer app on her phone. Leslie used this strategy to include students who indicated a desire to participate by raising their hands while also setting an expectation of inclusivity for all students. In Leslie's classroom, everyone had something to contribute. In all my observations, I never once heard students complain about being "cold

called," a typically negative phrase used in education when a teacher calls on students who may be unprepared or fear being put on the spot. Instead, attempting to answer or asking for help from a peer was an accepted norm in Leslie's classroom. During independent work time, students were free to work in small groups not only to support one another's learning, but to support their friendships. Leslie's classroom structure was intentionally designed to foster community. Leslie's stance on community was in stark contrast to her lived experience in her own fourth grade classroom, where she had been isolated and ignored by her teacher. In Leslie's classroom, the community participated in mathematics and each person was positioned as knowledgeable and belonging.

Truth-Telling. Leslie engaged in critical conversations with her students through discussions during which she engaged in truth-telling sessions. In these moments, Leslie was honest with her students about the ways racism operated in society and how injustices played out within school systems. She had a "tell it like it is" attitude that harkens back to Black teachers in segregated Black schools telling their all-Black classrooms the realities of the world, the harshness of racism, and the legacy and importance of Black excellence. For example, during one whole group warm up, a group of Brown and Black students were talking while the class reviewed a strategy on the overhead. Noticing them not paying attention, she started talking to the whole class about the reality of how school systems will push you through from grade to grade. Therefore, "take advantage of learning fourth grade now." In this discussion, Leslie made a choice to be honest with her students about how distracted behaviors could hurt their academic development. Typically, a teacher might try to control a chatting student's behavior by offering consequences, such as missing recess. Instead, Leslie shared with them as a group how they were in charge of themselves and needed to learn to care about their learning. Based on Leslie's

experience, the dominant education system cannot love them or care for their wellbeing. Rather, the system was designed to "push them through." Therefore, they should actively engage to "take advantage of learning fourth grade math now." These conversations connect to ways Black teachers talked to their Black students about doing better. In this example, Leslie was supplying the conversation "in mixed company," where all races of students could hear about the injustices of school not caring about students.

Along with identifying injustices, Leslie also shared Black excellence with her students. During my observations before mathematics class, Leslie shared read-alouds that showcased diversity, social justice themes, and connections to students. From LGBTQIA+ books with Black protagonists, to the Children's March, Leslie's truth-telling served to build students' sociopolitical consciousness and criticality as echoed in Black Woman Pedagogy.

Black Cultural Learning Styles. As described above, the atmosphere of Leslie's classroom was more relaxed than that of typical classrooms with students sitting on carpet spots or at their desks. Students could move about Leslie's room freely during work time, positioning their bodies in any way that felt safe and comfortable for them. Conversation and laughter were allowed, with students often talking and laughing and then getting back to their work. Lo-fi hip-hop from popular YouTube streams quietly played over the classroom speakers. Leslie herself found the wordless beats productive for her teaching compared to working amid dead silence.

In culturally responsive teaching, students from culturally diverse backgrounds are more likely to succeed when a teacher engages a variety of learning styles by offering visual aids, realia, cooperative learning, and kinetic learning opportunities (Gay, 2000). Leslie used multiple modalities in her learning. She had amassed a collection of manipulatives so students could touch Base 10 blocks to build conceptual understanding when adding and subtracting multidigit

numbers or touch kinetic sand to build fractions representations. Often in intermediate elementary classrooms, teachers feel urged to shift to abstraction alone and discontinue use of manipulatives, which hinders student learning.

Leslie also incorporated hip-hop into her mathematics lessons. As mentioned above, bringing rap music into mathematics class served as identity work for Black students. Leslie also brought a Black cultural ethos into mathematics through rap music, building a relevant Black identity for Black students while also centering Black culture as worthy of the curriculum. Leslie paid out of her own pocket for a web subscription that created catchy raps with good beats and cartoon graphics. For example, during her fraction unit discussed above, she played the "That's a Fraction" song almost daily. Sometimes students, particularly one Black boy named Keenan, would request the song. To capitalize on the well-liked rap, Leslie printed out images and lyrics from the video to remind students about unit fractions and the definition of a fraction. Another opportunity Leslie provided was for students to create their own raps. At the beginning of the same fraction unit, students created rhyming couplets of text, later coming to the front of the class in pairs and rapping their composition. Bringing rap into the mathematics classroom is similar to the work of science educator Chris Emdin (2016) who brought rap and cyphering into science education to increase high school Black and Latinx participation, learning, and belonging in science. Leslie's use of rap in a racially and ethnically diverse mathematics classroom affirmed the culture of Black students and any child who gravitates towards Black hip-hop culture. Gay (2000) refers to teaching kids "cultural capital" of academics, to enable students of color to both value their own culture and identity and relate it to the formal curriculum. Leslie's use of rap music showed her students that Black culture has "cultural capital" to offer in the mathematics classroom.

In sum, Leslie incorporated Black Woman Pedagogy into her mathematics teaching through caring conversations with students and deep thoughtfulness in planning mathematics lessons. Leslie's asset-based stances about teaching mathematics impacted not only her students' but her own mathematics teaching identity and Black cultural identity. Leslie's ability to share her pedagogy and identity with her students served to humanize both her and the children learning from her.

Leslie's Black Feminist Math Pedagogical Content Knowledge

In this section, I examine Leslie's mathematics teaching through Black Feminist Math Pedagogical Content Knowledge, or Black Feminist Math PCK. This construct attends to how Leslie's asset-based mathematics teaching was informed by her alternative knowledge stemming from her lived racialized experiences. Black Feminist Math PCK captures Leslie's knowledge of her individual students, how students demonstrate their mathematical thinking, mathematics content knowledge, and mathematics curriculum knowledge. Below, I offer a brief analysis of Leslie's asset-based stances and how alternative knowledge informed the four constructs of her Black Feminist Math PCK, followed by three explicit examples from her mathematics teaching.

Leslie's Knowledge of Students and Students' Mathematical Thinking

As a fourth-grade teacher, Leslie encountered students who had received inadequate mathematical support in previous grades. Earlier, I mentioned the nickname primary teachers in Leslie's school had for fourth and fifth grades: The Land of Swiss Cheese. In Leslie's view, students arrived at these intermediate grades with holes in their conceptual understanding. In our first and second interviews, she talked at length about knowing how big those conceptual understanding holes can get and how she negotiated supporting students to fill their knowledge gaps while simultaneously exposing students to grade level content. This was also in conjunction

with creating a collaborate learning environment where students supported one another's learning and built confidence in mathematics. Struggling to understand mathematics had worn away many students' confidence as they encountered teachers in previous grades who had presented and rewarded mathematics learning in alignment with the white education system. Mathematical thinking, these students had gathered, was either right or wrong, yes or no, good or bad. Leslie navigated her fourth-grade students' previous relationships with mathematics to build resistance to these narratives. She leveraged her strong classroom community-building skills to support positive mathematics identity development while teaching content. For example, Leslie typically structured her mathematics classroom in heterogeneous grouping, where students with different mathematical strengths were partnered together. When adult support was present in the room, with as many as five adults (a special education teacher, a special educator instructional assistant, a multilingual learner instructional assistant, a mathematics coach, and a general education instructional assistant) helping 24 students, Leslie ensured that she was supporting the students who struggled most. This structure was notable, given that it is common in elementary schools for struggling students to be paired with an instructional assistant or tutor instead of a highly trained teacher. Earlier in the year, Leslie often worked on the carpet or at a small table, surrounded by Base 10 blocks and students who needed an explanation that drew on third-grade or second-grade knowledge to build an understanding of multidigit addition and subtraction with regrouping. As the year progressed, students' growing strengths in mathematical strategies and identities emboldened them to ask for support among peer group members.

In sum, Leslie had general knowledge of how students typically think about and learn mathematics along with knowledge of each of her student's mathematics histories and identity development. Her knowledge included possible misunderstandings, how to teach when she

encountered a hole in a student's conceptual understanding to fill, and how to expose students to grade-level content in heterogeneous small groups and whole group learning modalities. Additionally, Leslie considered what students had previously learned and come to perceive about themselves as mathematical beings. She had lived experience of struggling and failing mathematics, which connected to her empathy and ethic of care for her own students. Her knowledge of teaching students mathematics included supporting the whole human and the complexities of human development.

Leslie's Knowledge of Mathematical Content and Teaching

Leslie went to great lengths to build her mathematical knowledge of teaching, since she lacked procedural and conceptual understandings of mathematics from her own K-12 experiences. When she entered college knowing that she was destined to become a teacher, she was motivated to learn how to do and teach mathematics because her own learning held immediate implications for what her students needed to learn. Her urgency to understand mathematics connected to the desire mentioned above, that her work was to be "in service to students." In other words, the purpose of all of her learning was ultimately to prepare her students to be successful in mathematics. As a teacher, despite her learning difficulties and having encountered no mathematics teachers who were "in service to" her own academic success, Leslie knew her future students would be depending on her. Once during a classroom observation when students were getting settled for a lesson on dividing a three-digit number by a one-digit number, Leslie described to them how she had learned mathematics.

> My teachers didn't teach me very well. In college I learned about math… I took addition, subtraction, multiplication, and division, in three months. Then middle school math in

> three months. Then high school math in three months. Learn the math right now! (Class Observation, January 9, 2023)

Once out of school, she continued to pursue training for teaching mathematics as a third- and fourth-grade teacher by paying out-of-pocket for independent mathematical professional development. As another example of obtaining mathematical knowledge, when she shifted to teaching fourth grade, she worked out strategies in advance of teaching them to students. YouTube became a valuable learning tool to review the strategies she would teach the next day in mathematics class. She also found value in being able to tell students who struggled, “Hey, I thought the same thing,” or “That was hard for me, too.” In Leslie’s interviews, she reflected on how her own learning process helped her identify areas where students might incorrectly interpret mathematics problems.

> Sometimes that [preparation] will help me find where kids are going to struggle. Like, oh, this is where I had a problem. And then I can tell them, “Y'all, I was doing this last night. And I had that too. Like, I'm an adult, and I have been through all these layers of school. I made that mistake, too. So if I made that mistake, it is okay for you to make that mistake. (Interview 2, January 5, 2023)

Leslie’s alternative knowledge on transforming mathematics classrooms to be accessible to students contributed to her Black Feminist Math PCK knowledge of teaching mathematics. She disrupted typical power dynamics in which the teacher positions herself as an authority who possesses all mathematical knowledge. Instead, Leslie chose to be vulnerable and share her own mistakes. Disrupting the power dynamics around who has mathematical knowledge humanized the occurrence of mistakes in mathematics.

Furthermore, given her emphasis on community, Leslie prioritized building mathematical knowledge *together* rather than presenting herself as the sole intellectual authority in the classroom. In her first interview, Leslie talked about organizing mathematics learning communally as a skill learned during her third year of teaching from observing an experienced teacher.

> It's a classroom management system that is essentially giving power to students. And when you have engaged students, you have less off-topic students who are off doing whatever they want to be doing. It's trying to make your classroom more dynamic and engaging and having them do work through games that are highly structured around communicating knowledge. And so you're constantly like trying different structures… So I've been able to replicate that. That's why I built my groups the way I did. The structures, they find them fun, so they're more engaged in their work and that's less classroom management for me. And we're a better learning community together. (Interview 1, October 20, 2022)

Leslie described how she combined a classroom management strategy from observing an effective teacher enact cooperative learning structures with high engagement. She combined this cooperative learning structure with her Black Feminist Math PCK component knowledge of her particular students, while her students found the structures "fun" and were "more engaged in their work" within mathematics class. Both these ideas center around Leslie's asset-based stance of being a community-oriented teacher. Here, I want to point out Leslie's ethic of care regarding the hard work of teaching. Throughout the year, she successfully enacted a dynamic, cooperative learning structure that changed throughout the school year. It was an innovative structure in mathematics that "gave power to students" about how they learned mathematics.

Leslie's Knowledge of Mathematics Curriculum

Knowledge of mathematics curriculum includes the official textbook curriculum, adopted mathematical common core standards, and any materials teachers use to support teaching students mathematics. Leslie possessed curricular knowledge about third- and fourth-grade common core mathematics standards. Because of her previous third-grade teaching experiences, she was knowledgeable in supporting students to meet fourth-grade learning goals. Leslie also understood the big ideas in fourth-grade mathematics and developed many strategies for teaching the content.

The difficulties of teaching mathematics curriculum came with the district's newly adopted mathematics textbook and assessments. Leslie struggled to balance following the curriculum lessons and ensuring her students would test successfully on the unit assessments with humanizing students and ensuring that they maintained their dignity as mathematical beings. In a January interview, four months into teaching the new curriculum, Leslie reflected on pitfalls she had not anticipated, such as the curriculum assessment not aligning with her strategies of teaching students how to demonstrate learning in group settings using students multiple modalities. As a result, many students struggled on the district's curriculum assessment and expressed feeling disheartened and defeated when they received their tests scores. Leslie used her socioemotional learning skills to add to the district assessment questions that asked students about their test-taking experience: "I feel strong on problem #_____. I'm not feeling sure on problem #_____. I felt _____ because _____ while taking this test" (Classroom Artifact, January 6, 2022). Using her students' assessment data and socioemotional data, Leslie reflected on her tension with students demonstrating learning in her humanized classroom setting versus the more sterile testing environment needed for the unit test.

> As I'm going through and getting more comfortable with the curriculum [I need to look] at the bookends of both sides of the unit. What are they starting them off with? What are they trying to get them to? And how does that help me scaffold across the entire way? Like, I already know where they're trying to get to, but sometimes it doesn't then show up on an assessment the same way. [I'm] having those thoughts of, if they can do this in front of us, why then are they not able to do it in a test? And what does that mean about them as a learner and about the test and about the environment or the feeling around the test? That there are different outcomes in different environments? (Interview 2, January 5, 2023)

In this quote, Leslie recognized a disconnect between her daily classroom structure that made mathematics more enjoyable, supportive, and humanized—i.e., through community, alongside friends, and through conversations—with the testing environment where those modalities were no longer in place, favoring paper and pencil and individual assessment. Leslie's Black Woman Math Pedagogy stood at odds with institutional structures that required students to demonstrate learning in narrowly limited ways. However, Leslie chose to follow her Black Feminist Math PCK that drew on multiple modalities to demonstrate learning and honor students' diverse ways of thinking.

Leslie's Mathematics Teaching: Three Examples of Black Woman Math Pedagogy

In this section, I provide three representative examples of Leslie's mathematics lessons from the 2022-2023 school year to illustrate Black Woman Math Pedagogy during Leslie's day-to-day teaching. Leslie's Black Woman Math Pedagogy was rooted in the connection between her politically conscious thoughts and her actions about mathematics teaching. What made Leslie's teaching unique was her Black Feminist Math PCK, i.e., how she used alternative

knowledge grounded in her lived racialized experiences to enhance mathematics learning by creating accessible, humanizing, and identity building-mathematics learning experiences in light of her students' racialized, academic, and social experiences in mathematics. In each lesson, I highlight how Leslie's teaching connected to Black Woman Pedagogy and Black Feminist Math PCK, which allowed me to interpret her Black Woman Math Pedagogy. Each lesson summary provides further elaboration on Leslie's Black Woman Math Pedagogy, including lesson transcripts. For the purpose of attending to power and identity dynamics and how Leslie dismantled racial scripts (Gholson & Wilkes, 2017) that typically structure poor learning opportunities for Black and Brown students, I provide the racial category of each student throughout the transcripts.

Table 5 provides an overview of Leslie's three mathematics lessons and how her teaching practice connected to Black Woman Pedagogy and Black Feminist Math PCK. For each lesson excerpt, I list the topic and the mathematical goal. Under the header "Black Woman Pedagogy," I interpret how Leslie connected to an ethic of care, being an identity worker and enacting a Black cultural ethos in that lesson excerpt. Under the header "Black Feminist Math PCK," I list Leslie's three stances that stemmed from her alternative knowledge: humanize mathematics, make mathematics accessible, and provide socioemotional learning in mathematics. Leslie's alternative knowledge impacted how she demonstrated Black Feminist Math PCK elements knowledge of students, knowledge of students' mathematical thinking, knowledge of mathematical content and teaching, and knowledge of mathematics curriculum in each lesson.

Table 5

Leslie's Black Woman Math Pedagogy: A Three Lesson Overview

	Black Woman Math Pedagogy	
	Black Woman Pedagogy • Ethic of Care • Identity Work • Black Cultural Ethos	**Black Feminist Math PCK** Leslie's stances that stem from her alternative knowledge (e.g., power, criticality, knowledge production) o Humanize mathematics o Make mathematics accessible o Provide socioemotional learning in mathematics Leslie's alternative knowledge influenced her: o Knowledge of students o Knowledge of students' mathematical thinking o Knowledge of mathematical content and teaching o Knowledge of mathematics curriculum
Lesson 1 *Reasoning - Adding and Subtracting within 1000* Goal: Use reasoning to solve addition and subtraction word problems	**Ethic of care**: Cared about students' mathematical thinking **Identity worker**: Defined strong mathematicians as students who worked together **Black cultural ethos:** Used cooperative learning structures to	**Alternative Knowledge: Changing what counts as mathematics** Disrupted what counts as mathematics Honored diverse student mathematical thinking **Knowledge of students: Redefining mathematics success** • Presented learning and doing mathematics as collaborative • Valued explaining thinking over right answers **Knowledge of students' mathematical thinking: Elevating multiple forms of mathematical thinking** • Honored multiple representations used to solve a problem • Challenged power dynamics around what counted as valid mathematical thinking **Knowledge of mathematical content and teaching: Attending to student engagements & learning**

	encouraged students to support one another's mathematical learning	● Supported student learning through collaborative structures **Knowledge of mathematics curriculum: Building on students' prior learning experiences** ● Recognized that fourth grade content builds on prior place value knowledge ● Used tools from previous grade levels to facilitate learning (Base 10 blocks)
Lesson 2 *The Enchilada Problem* Goal: Interpret fraction representations	**Ethic of care**: Invested in students' mathematical thinking **Identity worker:** Empowered students as mathematics intellectual authorities and knowledge producers **Black culture ethos:** Created a mathematics learning community with student-led conversations, play, and joy	**Alternative Knowledge: Making mathematics accessible to everyone** Centered mathematics as an activity that belonged to the community, not to certain students, the textbook, or teacher **Knowledge of students: Building confidence before tackling new mathematical ideas** ● Tailored learning specifically to what students needed to learn about fractions ● Created multiple entry points into fourth grade fraction content **Knowledge of students' mathematical thinking: Honoring students' mathematical thinking** ● Empowered students to produce mathematical knowledge ● Increased inclusivity by allowing for open interpretation of the mathematics problem **Knowledge of mathematical content and teaching: Leveraging opportunities for deep mathematical learning** ● Recognized a noteworthy representation to facilitate mathematical learning ● Made in-the-moment instructional decision to open a problem for interpretation **Knowledge of mathematics curriculum: Attending to student learning needs** ● Used third-grade curriculum materials to support fourth-grade fraction learning goals
Lesson 3 *Slicing Cake*	**Ethic of care:** Attended professional development to grow her	**Alternative knowledge: Disrupting power in mathematics** Disrupted mathematics power hierarchies among students Randomized groups indicated that every student had mathematical strengths to contribute **Knowledge of students: Redefining mathematics success**

Goal: Develop criticality and creativity in mathematical thinking	mathematics practice **Identity worker:** Disrupted power and status among students in mathematics **Black cultural ethos:** Cultivated shared mathematical power	● Constructed learning opportunities to grow students' criticality and creativity in their mathematical thinking ● Encouraged cross-group collaboration to solve mathematical problems **Knowledge of students' mathematical thinking: Attending to student engagement** ● Facilitated opportunities for peer collaboration ● Provided opportunities for students to learn from other students' mathematical thinking **Knowledge of mathematical content and teaching: Leveraging opportunities for deep mathematical learning** ● Used the best representations and lesson structures to facilitate learning **Knowledge of mathematics curriculum: Teaching beyond the textbook** ● Fostered opportunities for students to improve their creativity and critical thinking skills

Lesson 1 Fall: Reasoning - Adding and Subtracting within 1000

This lesson took place three weeks into the school year on October 20, 2022. At the beginning of the year, Leslie had received a new district curriculum which recommended a lesson structure of independent problem solving, whole group sharing, and independent work time. Leslie found it "not a high leverage structure," meaning that the structure neither allowed her to attend to her students' mathematical needs nor supported students to engage in the mathematics at levels she would like. Thus, Leslie used her knowledge of curriculum and her knowledge of what her students needed to structure more collaboration across the daily lessons.

During week two of school, Leslie gave students a curriculum assessment that tested them on third-grade and beginning fourth-grade mathematical knowledge, then grouped her students heterogeneously based on the assessment and on who she believed would work well together. Her goal was to have the students who did well in the assessment support the students who were struggling while helping more the successful students hone the ability to explain their thinking to others rather than merely write down an answer or perform computations in their head.

During week three of school, Leslie changed the beginning of lessons to feature small groups working together, then whole group share outs, followed by student work time either independently or in small groups. However, Leslie had realized that when students worked together, one student was doing all the work or telling their peers the answers while the other students were just looking around and waiting. Leslie wanted to continue practicing group routines and attend to changing this behavior of sharing answers without explanation. This lesson example is taken from the second day of the new grouping structure. The official curriculum lesson explored using reasoning to solve addition and subtraction word problems.

Leslie started class by telling everyone to get into their six new groups. Groups were named after shapes, as in rhombus and cube group, and spread out in the classroom. The tile floor group had blankets and green leaf cushions. One group sat on the class sofa, while another sat in the library area with a low table and bean bag chairs. Some groups had more traditional seating such as the kidney table, the carpet, and the floor. After everyone settled, Leslie told the class, "We're going to do something different. I'm going to give you the answer." Leslie saw a lot of confused faces from the students. Leslie continued talking to her class:

Leslie: Oh, wow. It looks like a lot of people are confused. Can you share with me why you're confused?

Keenan (Black): Well, you haven't even given us time to try it.

Leslie: All right, so you haven't had any time to try?

Avery (white): Well, it's *our* job to find what the answer is. You're taking away our learning.

Leslie: Do you think I would take away your learning? (*Avery stares*) I mean, you said I'm taking what you're learning? Do you think that I, as a teacher, would choose to take away your learning?

Students: No.

Avery (white): I don't know.

Leslie: Well, you know, this is different. It is totally a different way. I don't care about getting the correct answer. I am not impressed if you know how to stack add or subtract. What I'm looking for is *how* you got the answer.

Saarah (Black): She cares about our thinking!

> Leslie: I'm changing the way that you think about math. It's not about the answer. It's about how you get there.

Leslie's conversation with her class about what was important in mathematical learning was the starting place for many class sessions to come that focused on student thinking rather than merely getting the right answer. Pedagogically, getting students to focus on the thinking process allowed students to explore their understanding of representations, one component of PCK, as well as assisting Leslie to see what students needed to be taught, such as skills. But aside from teaching mathematical skills, Leslie's Black Feminist Math PCK here highlights an ethic of care and the start of identity work in mathematics. What it meant to have a strong academic mathematics identity, she conveyed, was being able to explain your thinking process, not just getting the correct answer or solving with one specific strategy. This led to a difficult but caring conversation between teacher and students.

In the conversation, Keenan (Black) and Avery (white) exposed two lines of thinking students possessed. One is that demonstrating *learning* in mathematics means determining the correct answer. Another line of thinking was that demonstrating *smartness* in mathematics means determining the correct answer. In previous grades, Leslie's students demonstrated learning by giving an answer. When Avery (white) said, "You're taking away our learning," that was equivalent to blurting out the answer before a student could think through the answer. In Leslie's view, however, being first to shout an answer was not an issue in her classroom because she valued cooperative learning structures. In group work, students will *all* arrive at an answer. Cooperative learning structures in her classroom were currently in dissonance with the meritocracy and individualism indoctrinated in the students during previous, more traditional mathematics classrooms. Leslie's pedagogical decision to use cooperative learning structures in

mathematics aligned with Black cultural ethos of working in community. Demonstrating smartness was a learned behavior for students, particularly for students who had been labeled as "advanced learners." The way they had been successful in mathematics was based on meritocracy and individualism by getting right answers quickly, without being pressed to explain verbally or in writing how they had arrived at them. Leslie's cooperative group structure, grounded in Black cultural ethos of communalism, encouraged students to prioritize their thinking and reasoning over quick answers. In an interview, Leslie went into depth about how her lived experience learning mathematics in higher education impacted how she valued reasoning over procedure.

> The first layer of math that I had to take, that's what I was going to be teaching. So it started my journey with learning math for the classroom with an incredibly intentional, like, I'm going to be teaching these skills to kids. So I really have to understand kind of the way we teach now what's happening with the math, instead of plugging and chugging. Which is me being like, I don't care if you can get the answer, don't care. I don't care. I'm not impressed. ALs (advanced learners), I don't care… I care about your thinking. (Interview 1, October 20, 2022)

Leslie approached learning mathematics strategically because she realized she needed to understand mathematics not just for her own professional growth, but to be able to explain and facilitate mathematical learning. The experience that Leslie had growing up, as did many teachers of her generation and older, prioritized getting the right answer almost exclusively. In college, she realized the way mathematics ought to be taught to students was to emphasize the importance student thinking rather than merely student answers. The shift from getting the right answer to opening up mathematics classrooms as places where reasoning and problem solving

occur aligns with the National Council of Teachers of Mathematics (2014). However, most of Leslie's students were invested in the idea that supplying procedural answers was synonymous with demonstrating mathematical thinking. This fact is interesting, considering that her fourth-grade students comprised a single class cohort, most having attended the school since kindergarten before entering Leslie's fourth grade classroom. Based on students' fixation with meritocracy and answer-getting as equivalent to smartness, it seems that Leslie's K-3 peers reproduced the common yet limited ideology that being good at mathematics meant getting right answers all the time. Leslie's truth-telling about what mattered most in her mathematics classroom was clear in her statement: "I am not impressed if you know how to stack add and subtract." Rather, her Black Woman Math Pedagogy led her to "care about your thinking."

Leslie Honors Diverse Student Mathematical Thinking. After the opening discussion, students began working in their six groups on the workbook problem below (Figure 3).

Figure 3

Fourth Grade Workbook Problem. Lesson 2-8 Reasoning: Adding and Subtracting Within 1000.

> Solve and Share: A group of students collected donations for a toy drive. They collected a total of 3,288 toys one week and 1,022 toys the next week. They donated 1,550 toys to the Coal City Charity and the rest were donated to Hartville Charity. How many toys were donated to Hartville Charity? Use reasoning about numbers to show and explain how the two quantities of toys given to charity are related.

Heterogeneous cooperative learning groups were typical during this segment of Leslie's mathematics lessons. Leslie's group structuring was strategic to support students' mathematical

learning. Students who typically got correct answers were instructed to explain how they got their answer to support students who struggled. At this point in the year, students were still learning to avoid just giving or receiving correct answers. Many students struggled with accessing the grade level material, so there were upward of four additional support adults in the classroom rotating through, including one special education teacher, one instructional assistant, and one English Learner instructional assistant.

Today, Leslie assisted Jasmine (Black) and Rolanda (Black) who struggled to read the word problem and develop a strategy beyond drawing dots and counting on fingers. Jasmine started in her heterogeneous group but quickly became frustrated with the assignment. Leslie reflected on this interaction:

> Jasmine was gonna have a meltdown. She looked at the problem, and she just totally started to melt down and I was like, “Just try it. Would it be okay to try it for two minutes? We'll set a timer, and then I'll check in with you. As soon as that two minutes is done, let’s try two minutes more.” (Interview 1, October 20, 2022)

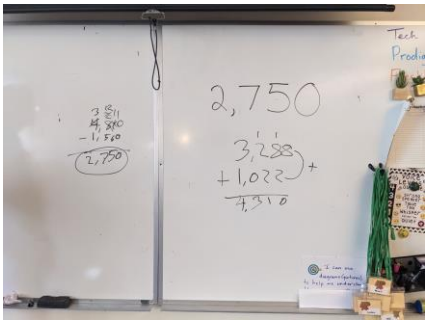
Accommodating Jasmine’s socioemotional and mathematical needs, Leslie intervened in ways that scaffolded Jasmine’s continued engagement with the task. Leslie implemented an ethic of care for Jasmine by breaking the task down into small chunks while offering Jasmine gentle encouragement to try. In addition, she paired Jasmine with another student who needed support, Rolanda. Leslie saw this pairing as beneficial because “Rolanda wants to get really close” to Jasmine and build a friendship (Interview 1, October 20, 2022). In their own small group, Leslie facilitated a conversation with Jasmine and Rolanda on how to work out the problem using Base 10 blocks to relate how addition and subtraction regrouping was needed to solve the problem.

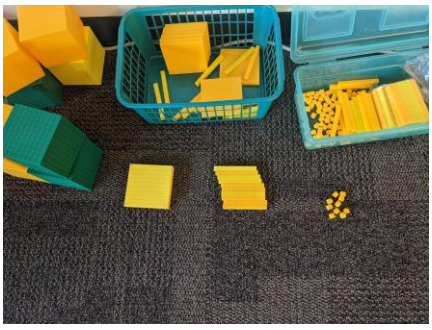
Pairing Jasmine with Rolanda, who also needed extra support, facilitated identity work to create a friendship through mathematics.

After 15 minutes of group work, Leslie facilitated a whole class discussion on mathematics strategies used to solve the problem. She asked select students to share two strategies (Figure 4). Saarah, an academically and socially high-status Black girl, went to the board and wrote down a two-step addition and subtraction standard algorithm. Saarah explained her rational for calculating 3288+1022=4310 followed by 4310-1560=2750. Then Leslie invited Avery and Neal, two white high status academic students, to demonstrate how they solved the same problem using Base 10 blocks and explain their process to the class as they built the problem. Avery and Neal sat at the carpet with students surrounding them in a semicircle. As the two students explained the process, Leslie realized that some students could not see what was going on. Leslie asked students to get up and move to where they could see, waving her hand over. Two students went to desks in the back, where they could not see. “I didn’t think I needed

Figure 4

Leslie’s Students Share Strategies for Solving a Word Problem





Note: Saarah’s strategy (left). Avery and Neal’s strategy (right).

to be *that* specific, especially given our conversation earlier this morning," Leslie said, in reference to her caring about students thinking and learning. The two Black boys moved to a closer desk. Later in the year, she would expect students to use their own agency to move their bodies without prompting so they could access the learning happening.

After two rounds of regrouping, Avery and Neal finished their explanation. Leslie followed along, then looked up at the class, saying, "This is highly visual. I want you to see this…. And now your brains are melting. Yay." She gave the class a thumbs-up. Leslie saw that students were quietly staring at the blocks, at her, or down at the floor. She used humor to alleviate the awkwardness of no lively community engagement from the class as they watched a regrouping strategy unfold. The new routines would eventually lead to more productive whole group conversations. Often during the earlier months of the school year, Leslie told her class (and herself) that "we're all learning something new." She gave grace to herself and to the students for learning structures and figuring problems that might feel quite challenging. Humor was a pedagogical move to connect with the students while simultaneously letting them know that her standard was higher engagement.

Interpreting Leslie's Black Woman Math Pedagogy in Lesson 1

I determined how Leslie used Black Woman Math Pedagogy in this lesson by identifying instances where she drew on Black Woman Pedagogy and Black Feminist Math PCK elements to support students' mathematical learning. I argue that Leslie's alternative knowledge on disrupting and redistributing mathematical power among her students operated as a racialized practice in this lesson. Instead of positioning learning as an individualized practice, Leslie created a mathematical learning community where everyone was expected to share their thinking. She did so by spending extra time with students who most needed high quality

instructional support and allowing multiple strategies to be deemed valid and shared among the collective. Not only did these stances differ from Leslie's lived racialized experiences as a mathematics student, they differed from her fourth graders' previous experiences in mathematics with white teachers at Sunnyhill Elementary who placed highest emphasis on right answers.

Leslie's first conversation with her class demonstrated that she possessed an ethic of care to develop students that shared their mathematical thinking with one another. This sharing came in cooperative group structures and whole group shares where Leslie expected for students to orient themselves to one another's mathematical thinking. Leslie intentionally wanted students to do these work structures because of her belief that working together created stronger mathematicians and supported building positive mathematical identity development. Collaborative structures in mathematics have been found to support all students' mathematical development across different learning needs (Featherstone et al., 2011). Leslie possessed knowledge of her students' need to redefine mathematical success beyond getting right answers. She also demonstrated her knowledge of mathematical content and teaching, specifically how to meet the learning goal of reasoning to solve addition and subtraction word problems by drawing on a Black cultural ethos of cooperative learning structures in mathematics as a function that encouraged students to support one another's mathematical learning.

Leslie used her knowledge of mathematics curriculum to bridge student learning from third grade to fourth grade place content. When students broke into groups, she found that Jasmine and Rolanda, two Black girls, needed support accessing the mathematics, both to read and develop their conceptual understanding about place value when adding and subtracting whole numbers. Leslie's work with these two students when there were so many other adults around in the room indicated not only Leslie's acknowledgement of her own pedagogical

expertise in earlier grade place value experiences that the girls needed to revisit, but connecting with two Black girls as a Black woman teacher is a level of care that would grow throughout the school year. In future mathematics lessons, that care appeared to increase both girls' engagement in mathematics class, which could contribute growing their mathematical, racial, and social identities.

Finally, Leslie's Black Woman Math Pedagogy included showcasing students' diverse mathematical thinking. During the solve and share, both a standard algorithm and a Base 10 strategy taught in a previous grade level were shared. I interpret Leslie's pedagogical decision to elevate both representations as an intentional disruption to what counted as acceptable mathematical thinking. Possibly, many students in Leslie's classroom believed that performing the standard algorithm equated students with smartness, especially given Leslie's earlier conversation with her class where she stated, "I am not impressed if you know how to stack add or subtract. What I'm looking for is *how* you got the answer." However, Leslie defined mathematical success by explaining why an answer was correct. Therefore, having Saarah (Black) explain her reasoning for using standard algorithm equations and Avery (white) and Neal (white) explain their Base 10 strategy demonstrated to students that diverse mathematical thinking was valued in her classroom.

Significantly, Leslie disrupted racism within mathematics by showcasing Saarah's mathematical thinking, a Black girl who typically achieved in mathematics. I interpret Leslie's choice to have Saarah (Black) share her strategy as showing students that sharing strategies was a community practices that disrupted traditional racial and mathematical success hierarchies. Leslie choosing Saarah positioned Black excellence in mathematics as axiomatic. Saarah had also been the student who, earlier in the lesson, helped Avery (white) and her classmates

understand that Leslie emphasized mathematical thinking over right answers. The combination of Leslie's teaching choices and centering a student like Saarah who understood classroom community dynamics in mathematics offered a combination of the best representations and strategies to facilitate student learning in Black Feminist Math PCK, identity work, and using Black cultural ethos in Black Woman Pedagogy. In this lesson, Leslie's Black Woman Math Pedagogy leveraged her power and that of her students to disrupt racialized and gendered stereotypes of who can do mathematics and affirmed individual and collective mathematical identities and agency.

Lesson 2 Winter: The Enchilada Problem

The second lesson I have selected occurred during the middle of the school year on February 15, 2023. Leslie was transitioning students into a fraction unit that would start after a week-long mid-winter school break. Leslie's purpose was to review third-grade fraction concepts for a week to help students start strong on fourth-grade fraction concepts after the mid-winter break. The day prior, students had taken a fraction assessment on a district approved computer app through which Leslie had assigned students fraction problems to get a sense of what they had learned about fractions prior to fourth grade, and what they already knew of fourth grade fraction content. Additionally, Leslie informally assessed what students knew now about fractions by asking students to describe what they remembered about fractions from third grade mathematics. Leslie used her knowledge of mathematics curriculum and knowledge of students in her classroom, two elements of Black Feminist Math PCK, to plan her next instructional steps to support students' mathematical learning.

After reviewing the assessment results, Leslie stayed after school looking through a third-grade curriculum workbook to locate practice work the class could work on in small groups. She

pulled work tailored specifically to those strands students need to learn fraction vocabulary and strategies: for example, What is a unit fraction and how do you determine one? As she planned, she thought about creating multiple entry points into fraction content to render mathematics more accessible to her learners. She also considered what would support students when new mathematical challenges arose in the unit. Leslie regularly mentioned in interviews that she wanted to build up students' confidence before they tackled new mathematical ideas. She intentionally chose the third-grade workbook pages as a structured way to reintroduce students to third-grade fraction concepts while familiarizing them with a new curriculum format more oriented to word problems than their previous third grade fraction curriculum had been.

This lesson excerpt exemplifies how Leslie used Black Feminist Math PCK to structure mathematics lessons, incorporating curriculum adaptations, planned and in-the-moment instructional decisions, student engagement, student dynamics throughout the lesson, and mathematics content learning. Below I provide an account of Leslie teaching a fraction review lesson and analyze how her teaching reflects Black Woman Math Pedagogy.

Leslie Centers Mathematics as an Activity that Belongs to the Community. Leslie began her mathematics lesson as usual. Students sat in the meeting area in the front of the classroom. As Leslie flipped through the third-grade workbook packet, she addressed her students:

> As you know we're doing third-grade fraction review. I printed some pages that are literally from the third-grade math book. It's been a whole year since you've talked about fractions as a class. We're doing third-grade math, and then after break, you'll be refreshed and ready for fourth-grade math. That's why we're doing it. A lot of it should

be pretty simple. I was intentional picking the pages. The packet is kinda thick. We're not doing all of it today.

Leslie showed the class two problems. The first was a picture of a rectangle with a task for students to represent dividing a garden into four equal parts, then show flowers planted in three of the parts. The second problem featured an image of a pie pan. Students had to draw lines and shade parts to show five 1/8 pieces were in the pan and three 1/8 pieces were eaten. Leslie and her students had a conversation on possible ways to answer each question. She talked about what she wanted students to notice, such as drawing a representation that could be divided into equal pieces based on information in a word problem. Her initial instructional plan was to do a walkthrough of the fraction packet before sending students off to complete the packet individually or in small groups. However, the third fraction problem flourished into a debate (Figure 5). Leslie showed students the third problem.

Leslie: "*What fraction names all the pieces in the pan?"* So don't blurt it out, don't blurt it out. "*What fraction names all the pieces in the pan?"*

Noah (Black): Can we turn and talk?

Leslie: Um… give it one more second.

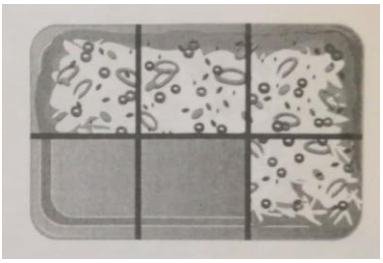
Thomas (Latinx): What is it?

Leslie: What fraction represents what is in this pan?

Thomas (Latinx): Oh.

Leslie: You may turn and talk. (To herself) interesting…

Figure 5
Fourth Grade Student Workbook Image for the Enchilada Problem



Here, Leslie found students' responses “interesting” because as she listened to students’ turn and talks, some students said 4/6 pieces, referring to the enchilada pieces left in the pan, while others said 6/6, which referred to all the possible pieces in the pan. Here, Leslie made a choice based on her Black Feminist Math PCK knowledge of students’ mathematical thinking and knowledge of mathematical content and teaching to explore students’ conceptions of the fraction representations through whole group engagement. She stated in an interview that at this point of the lesson, “I [was] sensing that we could kind of balloon this out, but you never know how big it’s going to get until you start doing it” (Impromptu Interview, February 15, 2023). Leslie used a structure that had students pick one of the two viewpoints and convince the other students through argumentation to join their side. This discussion method encouraged students to give valid explanations based on reasoning:

> I heard some different ideas here. I heard somebody say 6/6. I heard somebody say 4/6. If you think that this pan represents 6/6, would you take your body and put it on this side (points to right). If you think this picture represents 4/6, would you take your body and put it on this side (points to left).

Some students moved to the left, while other students stood in the middle trying to choose a side. After a few moments, students in the middle went to 4/6. No one went to the 6/6 side. Leslie tested students to see if they were sure about their reasoning by choosing a side, too

Leslie (turning to kids): Is this 4/6?

Ss: yeah

Leslie quietly walked to the 6/6 side and stood facing the 4/6 group. Afterwards, a few students trickled towards her, until a good chunk of kids stood on the 6/6 side. Reggie, a Black boy, started to walk towards 6/6. Then, he looked at the enchilada image and exclaimed, "How is that six-sixths!?" He walked back to the 4/6 group. Mike, a white boy and an "advanced learning" student, looked at the image and determined, "Oh the whole *thing* is just 6/6. I thought it was in general [4/6]." Once students stopped moving, Leslie walked back to the 4/6 side.

Anna (white): I think it's both.

Helen (white): I'm in the middle.

Nayani (Indian): (standing in the middle) I'm so confused.

Leslie: (walks to Nayani) Good. Because you're puzzling through it. Because you're actually trying to gain knowledge. And you're not sure what's happening around you and that's ok. That's what happens before we understand.

There was excitement in the room, and students were now talking with one another. Reggie (Black) pointed to the screen. Rolanda (Black) talked to a student next to her, holding her thumb and index finger up to size up the chunks of enchilada. Leslie chatted with two white girls who wanted to reread the problem. "What fraction does this represent? 4/6? 6/6?"

Leslie then asked students to sit down and took a moment before speaking. She asked the class "What do we think about that?" This is an important pedagogical decision here. Leslie did not ask "which side was right or wrong." Instead, she posed a question that led to a productive conversation about understanding fraction parts. Posing "What do we think about that?" was a purposeful question that simultaneously opened the stated problem up for critique. This was also

a Black Feminist Math PCK moment when Leslie positioned everyone as mathematical and created an open entry point into the conversation. Leslie regularly used a name randomizing app on her phone during mathematics discussions to achieve equitable participation. She typically alternated from using the name randomizer to taking a raised hand from students. She used the app to select a student to go first. Saarah, a Black girl, came up to the enchilada representation.

> Saarah (Black): I think it's 4/6 because there's only 4 pieces in it (*points*), and there's 6 squares.
>
> Leslie: Elijah (Latinx), Avery (white), a bunch of people are agreeing (*using I agree sign*). Saarah goes, "Well there's 1, 2 ,3 ,4, 5 slices, 6 slices. I have 4 out of 6 slices. 4/6." How else can we think about this problem? (*Some students raise their hands.*) Think about whose voice hasn't been heard yet. (*Saarah passes the pointer to Noah who had his hand raised*).
>
> Noah (Black): (P*oints to the enchilada squares.*) 6 squares. If 2 people took them, that makes 1, 2, 3, 4, 5, 6. There was 6.
>
> Leslie: I hear Noah making this into a subtraction problem. Who else haven't we heard from today? (*Gloria raises her hand.*)
>
> Keenan (Black): I wanna hear from someone who thinks 6/6.
>
> Leslie: Yeah, I would love to hear from someone who thinks 6/6. (*Noah passes the pointer to Gloria*).
>
> Gloria (white): I think it's 6/6 because it says here, "all the pieces in the pan." I think it's both because there used to be 6 all together, and then if they took 2 away, there would be 4/6. So it's kind of both.
>
> Leslie: I see Neal (white) agreeing with you.

Someone asked if the fraction could be 5/6. Leslie responded no because the image did not represent 5 pieces in any way. Then Saarah asked if it could be 2/6.

Leslie: So Saarah (Black) just asked a question. Could it be 2/6? What would be the question to this problem that the answer would be 2/6? Turn and talk to someone.

Students turned to one another again. During the turn and talk, a white "advanced learning" student wondered why the class was taking the time to talk about 4/6 or 6/6 or 2/6.

Avery (white): Can we do math?

Leslie: Avery, we are doing math.

Avery (white): We are?

Leslie: Are you saying this discussion is not math?

Avery (white): I'm saying it is, but are we going to get to do it (the worksheets)?

Leslie: What we're doing right now is much deeper math than you doing this worksheet. Because we're rationalizing about this problem. Right now we're making four separate problems out of this one picture. That is much deeper math than just sitting there and answering a bunch of questions on a piece of paper.

After a short turn and talk, some students raise their hand with ideas.

Dori (white): If the pan looked like enchiladas. And they made very gray looking brownies, then there would be 2/6.

Leslie: EW! You are not wrong, but EW! (*Other students laugh and say "ew."*) Enchiladas and brownies in the same pan, ew! (M*akes barf motion.*) Thank you Dori. 4/6 enchiladas and 2/6 brownies. Great! Alright, so, you're going to be like Geni. That's what I say for geniuses, even though it's not a real word. (*Class banter.*) When we come back

> in [from recess], we're going to be doing workbook pages. (Class Transcript, February 15, 2023)

Interpreting Leslie's Black Woman Math Pedagogy in Lesson 2

Many pedagogical options lay before Leslie in teaching the enchilada problem. She could have stated that the correct answer was 4/6 after she heard some students stating 6/6. This move would have kept the teacher as the intellectual authority of mathematics. Instead, Leslie made the pedagogical decision to pursue two lines of thinking that arose when she overheard her students explain "how many slices are there" in the first turn and talk and let the conversation "balloon out." Leslie demonstrated Black Feminist Math PCK through her sophisticated knowledge of mathematical content and teaching. When she overheard students during their turn and talk that the enchilada pan held 4/6 and 6/6 pieces, she recognized that the enchilada problem was a great representation to facilitate mathematical learning. Because Leslie kept the problem open, much livelier conversation occurred versus going to desks and doing workbook pages. The ensuing conversation was "much deeper math than just sitting there and answering a bunch of questions on a piece of paper." I argue that Leslie's decision to open up space for mathematical argumentation demonstrated how she used her alternative knowledge from her lived experiences—mathematics needs to be accessible—and Black Woman Pedagogy elements of Black cultural ethos through a mathematical community conversation. Furthermore, the opportunity allowed for positive mathematics identity development while students participated in a high cognitive demand problem.

Leslie allowed for ambiguity in the textbook problem. Furthermore, Leslie allowed students to make sense of that ambiguity by creating a rich conversational space around understanding fraction representations. This is why Leslie's prompt to open up the floor for

discussion, “What do we think about that?” was a Black Feminist Math PCK element that honored students’ mathematical thinking. Leslie’s pedagogical decision empowered students by decentering curriculum and teachers as the only purveyors of mathematical knowledge. Instead, mathematics belonged to the community.

Leslie was able to craft an inclusive atmosphere for students to engage in critical thinking because of the ongoing work that Leslie had done to build classroom community that positioned students as intellectual authorities. For example, at the offset of the share out, Saarah (Black) gave a solid argument as to why the representation showed 4/6. Yet, Leslie called other students to share their thinking to allow for open interpretation of the mathematics problem. Another element of inclusivity occurred with Noah, a Black boy who had an IEP for mathematics support. He participated in this math class and many other mathematics lessons prior. He engaged in rigorous thinking in light of his learning needs, because Leslie provided supports such as open-ended questions to allow space for Noah in conversations to show his critical thinking. Leslie spoke on this during her impromptu interview that day:

> I've read so many different things about how naturally kids understand fractions. But then when we put all of the language around it, it loses all of its meaning. So he naturally just did a fourth-grade standard, while looking at a third-grade problem without realizing it. And it's like, that's what we want to build right now. You want to build all of those little pieces. (Impromptu Interview, February 15, 2023)

Because Leslie left space for conversation, Noah had space to demonstrate his mathematical brilliance. This was one of many times during the year that Leslie tapped into Black Woman Pedagogy as an identity worker and her own Black Feminist Math PCK. Leslie

used her knowledge of Noah—his learning needs and his Black excellence—to support his mathematical learning and position him as a mathematical being in the classroom.

Another pedagogical decision was to let students reason about how the answer could have been 6/6. The students could have debated until convincing most people and forcing others to cave under peer pressure to state that the answer was 4/6, even if it did not make sense to some students. Instead, Keenan, a Black student, was the person who stated "I wanna hear from someone who thinks 6/6." The fact that Keenan requested input from the alternate group is a testament to Leslie's Black Woman Math Pedagogy and the mathematical community she cultivated with her fourth graders. Keenan positioned himself as a facilitator of his mathematical learning and that of his peers. Keenan participating as a facilitator of discussion stemmed from Leslie's alternative knowledge around how she envisioned mathematics classrooms where she is not the sole purveyor of knowledge. Though Keenan's comment could easily be missed in the dialog, the way he participated speaks to Leslie's Black Feminist Math PCK as disrupting racialized narratives about participation in mathematics and power dynamics about who can control what mathematics is discussed. In October, after one month in school, I interviewed Leslie and asked what her ideal mathematics class looked like. She responded:

> I think what I'm starting to do right now is definitely getting closer to there. Decentering me as the knowledge giver and having them be more autonomous in their learning, and that I support in places where there's misconception and exploring math. (Interview 1, October 20, 2022)

Another pedagogical decision Leslie made was to explain to a student, Avery (white), how the enchilada problem conversation made for deeper mathematics connections. Avery was a white student designated as an "advanced learner" who typically experienced mathematics as

quickly getting the right answer and moving on to the next. Leslie explained to Avery that "this is much deeper math than you doing this worksheet. Because we're rationalizing about this problem." This was a sentiment that Leslie had shared in Lesson 1 from the Fall, and during many of our impromptu interviews. Leslie's approach to her students labeled as "advanced learners" was that "I do not care if you know the answer. Don't care. I want to know *why* you know the answer" (Interview 2, January 5, 2023). Her quote aligned with how she probed Avery who questioned why they were spending so much time thinking about an enchilada pan. Leslie conveyed to Avery that deep thinking was more meaningful than giving the correct answer. This pedagogical move attempted to shift Avery's thinking around her mathematical identity of considering herself successful because she filled out worksheets correctly. Instead, Leslie invited Avery to consider that pondering a fraction representation and considering alternative interpretations was a part of going deeper into the mathematics. Thus, Leslie's Black Woman Math Pedagogy stretched Avery's thinking around what counted as mathematics and who was positioned as a mathematics authority.

Lastly, Leslie encouraged a Black cultural ethos centering play and joy. Dori (white) mentioned an enchilada pan with 2/6 "very grey looking brownies" which sent Leslie and students laughing and making hurling gestures because of the unlikely food combination of brownies and enchiladas in the same pan. Leslie drew on her Black Feminist Math PCK to bring laughter and joy into mathematics spaces. Dori's comment about cooking brownies and enchiladas together struck Leslie as humorous, and her laughter was shared by her students. This lesson demonstrated how mathematics teaching and learning can be playful and exist alongside productive student discourse.

To summarize, in light of how Leslie's lived experience informed her conversations with students and how she constructed with students a thriving mathematics environment, I argue that Leslie created a rigorous and supportive mathematics space using her Black Woman Math Pedagogy. Students were positioned as intellectual authorities, a powerful position usually reserved for teachers and textbooks. At the end of the lesson, students were not told to write 4/6 or 6/6 or 2/6 as the final answer. Students decided the answer on their own during independent work time. Furthermore, Leslie created a humanizing space where ideas were shared, and no students degraded as being or knowing less than others. This lesson occurred in a space where students felt that they could take risks and be supported. Overall, because of Leslie's lived experience, her vision of teaching and learning mathematics, and her mathematics pedagogical expertise, her Black Woman Math Pedagogy created a liberatory learning environment.

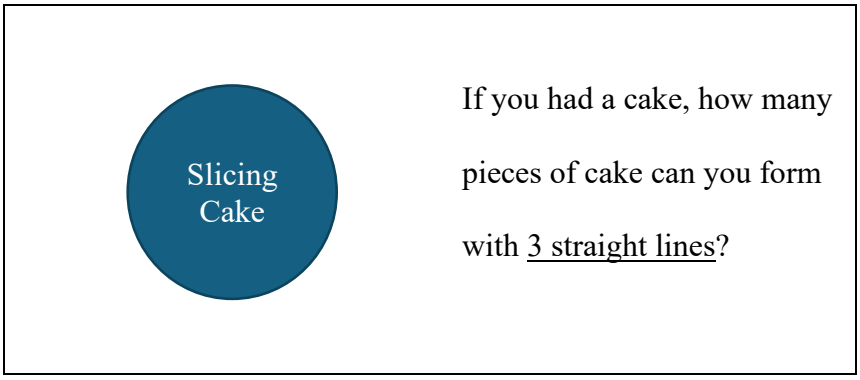
Lesson 3 Spring: Slicing Cake

The third lesson excerpt occurred two weeks before the end of school on June 20, 2023. During the last month of the school year, Leslie began a summer professional development (PD) for fourth-grade mathematics teachers focused on *Building Thinking Classrooms in Mathematics Grades K-12,* by Peter Liljedahl (2021). The nationwide online PD occurred in June when many U.S. teachers were out of school. Fortunately for Leslie, her school had two more weeks left. She was inspired to try out new classroom structures and tasks discussed in the PD that encouraged mathematical creativity and problem solving through group work. Leslie experimented with randomizing her small groups in the moment rather than prior to teaching the lesson. This randomization idea came from the book study text. Though Leslie experimented with new curriculum materials and classroom structure, she did so using her Black Woman Math Pedagogy.

At the beginning of the lesson, students gathered around the meeting area. Leslie randomly passed out a deck of 24 cards. Students with matching cards formed a small group for the lesson. Leslie asks everyone to break into their six groups. Each group had only one marker, had to work on the problems together, and was to stand at desk or the vertical whiteboard. After two minutes, someone else would use the marker. The first problem had a circle labeled "Slicing cake" and the question "If you had a cake, how many pieces of cake can you form with 3 straight lines?" (Figure 6). Students began drawing circles on the desks and whiteboard. Then a student asked, "Is it a circle?" Leslie looked up in thought, then replied, "You will have to decide if it matters what shape your cake is." Leslie continued walking around to groups, noticing the different ideas students came up with. Then she announced to the students, "Remember you can go around to different groups and borrow an idea!" Some students walked around to other groups while most continued working with their groupmates.

Figure 6

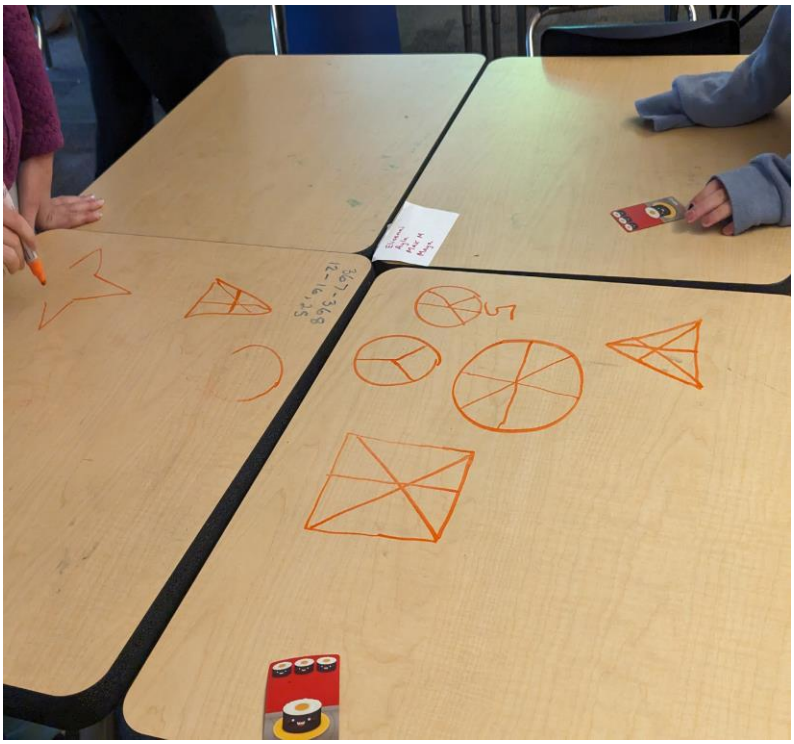
Slicing Cake Problem



After five more minutes of work time, Leslie paused everyone and had them walk around to see the progress of other groups (Figure 7). She posed questions for students to consider other groups' mathematical thinking, "What cakes are the same? What cakes are different? What's the highest number of slices you have seen?" Most groups had six slices, one had seven, and one had

Figure 7

Slicing Cake Problem: Student Work



Note: One student group experimented with three lines through different cake shapes.

eight. Reggie (Black) walked around with his group and noticed that the eight slices group arranged their lines to not give same size slices.

Reggie (Black): They're not even.

Leslie: Nothing in the problem says they need to be equal.

Reggie: *(Facial expression changes.)*

Leslie: I'm seeing this group have a big reaction. Take that information to your table.

Reggie (Black), Keenan (Black), Mike (white): (*Walks to table. Then Leslie calls them back.)*

Leslie: I'm seeing you have a big response to this.

Reggie to Keenan (Black): You sabotaged us!

Leslie: He didn't sabotage you. He thought it was the rule.

Keenan (Black): It has to be three straight lines.

Leslie: Right. *(To class)* It has to be a straight line!

In this exchange, Reggie expressed frustration when he realized that his group had assumed that each slice of their cake had to be the same size. Reggie even believed that his group member, Keenan, sabotaged the group's thinking. Leslie cleared up Reggie's confusion by insisting that Keenan merely assumed a rule that had not been stated in the problem. Reggie's group possibly assumed that the slices needed to be equivalent because in typical mathematics lessons about fractions, students spend a great deal of time attending to problems prompting students to draw lines and create same size pieces (e.g., Lesson 2 in this chapter). The fact that Reggie's group imposed a rule on themselves further validated why Leslie decided to teach mathematics criticality and creativity through the Slicing Cake problem. Leslie's knowledge of her students pulled on her asset-based alternative knowledge that mathematics needed to be more assessable to students. Leslie wanted students to think beyond a textbook lesson. Leslie attempted to get students to stretch their thinking and go beyond what was pictured (a circular cake) and be critical, creative thinkers. The group went back to their desk and tried out ideas presented by the group with eight slices. They experimented with circular and rectangular cakes for two minutes before Leslie called everyone back to the carpet.

Keenan (Black) presented his group's idea, a circle with three lines that create a tiny triangle between the three intersecting points. As Keenan walked back to his group, Reggie (Black) slapped him five. Then Meeka, a Black girl, walked up to the whiteboard and drew her group's idea, a diamond with six slices. Leslie said to the class, "It is interesting that so many of

them make six slices. Why is that? Turn and talk with your group." After a moment, Leslie called on Emilio (Latinx).

Leslie: Emilio, why is it?

Emilio (Latinx): Because there's six.

Leslie: Yes, they're six pieces.

German (Mestizo): Because three lines are crossing.

Leslie: Yeah, because three lines are crossing, they keep making six. (She points to the examples on the whiteboard that are six pieces. Then she draws a 3-dimensional cake.)

Student (undetermined): 3D?

Leslie: Yeah, 3D. It's about which way you're looking at the cake.

Interpreting Leslie's Black Woman Math Pedagogy in Lesson 3

In this exploratory lesson that broke away from the mandated curriculum, Leslie exhibited elements of Black Feminist Math PCK and Black Woman Pedagogy. Leslie displayed an ethic of care by taking it upon herself to search for her own PD to grow her mathematics practice. No one else that she knew was participating in the PD or anything similar, including her colleagues. Attending the PD aligned with Leslie's ethic of care to develop her students' mathematics identities as mathematics thinkers. She showed savviness in how she modified the district curriculum, introducing a new fractions lesson to foster creativity and critical thinking skills. Her PD encouraged reflections on how she could improve students' mathematical experiences by giving them open-ended collaborative problems. Leslie reflected on what the lesson had students do and compared it to what curriculum textbooks usually dictated. "It's not computation. It's about thinking. And that's not what curriculums make them do. The book calls it mimicking. Here's the strategy. We do it. Then we do it alone. But that's not thinking"

(Impromptu Interview, June 20, 2023). Leslie possessed an ethic of care around teaching children that mathematics was more than getting a correct answer on a test; rather, it is about thinking. Again, her stance expressed at the beginning of the school year to students in the Lesson 1 example, “I don’t care about the answer. I care about your thinking” arguably influenced how Leslie conceived and designed her mathematics practice.

Leslie’s lesson maintained high cognitive demand and cultivated shared mathematical power. For example, when Leslie took a moment to consider whether the cake had to maintain its circular shape, she made the pedagogical decision to let students explore different shapes while working within the confines of the stated problem. The written problem did not specify whether the cake had to be round. Additionally, Leslie discouraged students from hiding their work from one another, which also discouraged ideas of meritocracy and competition in mathematics. It reminded me of the *Dreamkeepers* (Ladson-Billings, 1994) teachers whose stance was that a student does not succeed unless everyone succeeds. This is also a common component of Black cultural ethos.

Leslie did identity work by disrupting status in her mathematics classroom. She attended to students’ perceptions of how a teacher chooses their groupmates. After five years of schooling, her fourth-grade students likely learned to recognize reasons why teachers strategically structured groups a certain way. Leslie provided further elaboration in an impromptu interview when she discussed the importance of creating class structures in which group members have to interact with each other mathematically.

> The two ways that we make groups generally in classrooms, we either let them do friendship groups, or we have meaningful placement groups where we try to, for some reason, put kids together that should learn something from. And that both of those are not

> conducive to learning. Because with friends, they have too much in common, and they often go off task or they don't push each other. But in the other group, they don't have identity. And they'll often feel themselves being an outsider to seeing the smart kid. And when they see the smart kid, they immediately give up their power to that kid and let them just do the whole problem. (Impromptu Interview, June 20, 2022)

Leslie's comment contradicted her community standard of letting students choose friends as partners. But for the sake of experimenting, she tried the structure. Coincidentally, Reggie and Keenan who were friends were still placed together randomly. Leslie came up against research knowledge that countered her own asset-based stance to teach mathematics with intentional heterogeneous grouping to support student learning and dismantle power hierarchies. At the time of this study, whether Leslie would abandon this new professional development philosophy or whether it would alter how she conceptualized mathematics learning communities in tandem with friendships remained an open question.

Some randomized groups did experience a disruption regarding which students were perceived as mathematically capable. For example, Emilio (Latinx), a multilingual Spanish speaking student who received special education services, rarely participated in mathematics class. At the vertical whiteboard, he initially tried to stand back during group work and let two white girls lead the drawing and conversation. Because they had to share the marker, they pressed Emilio to take the marker and participate. Leslie recounted their conversation.

> They are forced to talk to each other and constantly be changing their, like position, like, you could really see, they'd be like, "Here. Do you want the marker?" And he'd be like, no. And they're like, "Okay, but we're trying to do this." We've only done this for two days.

Though the class was on Day 2 of randomized groups, Emilio's group struggled to break away from established mathematics hierarchies of ability. Emilio struggled academically and linguistically to participate in general. But because Leslie had set the rules that everyone had to share the marker, Emilio and the two white students had to contend with changing established patterns of how group work functioned in mathematics classrooms, patterns long since established in this cohort of students. Surprisingly, Emilio participated in the whole group conversation. He had access to the lesson and, though he did not draw anything, he did recognize the mathematics that was going on. When Emilio was called on during the group discussion, he was able to demonstrate that he understood the task. Leslie asked the class why there were six slices and he responded, "Because there's six." Leslie could have interpreted his response, stating "there are six slices because there are six pieces," as indicating partial understanding of the problem. This is significant considering that he rarely participated in whole group conversations. In turn, Leslie supported his mathematical identity by validating his comment.

Interestingly, though Leslie did so much Black Woman Pedagogy work by establishing a strong classroom community, there was still more work to be done to disrupt the mathematics hierarchies in her classroom. This was noted by Leslie when she stated, "when they see the smart kid, they immediately give up their power to that kid and let them just do the whole problem." However, this mix-up in grouping revealed for Leslie how hierarchies can still operate within cooperative learning groups, and more Black Woman Math Pedagogy work was still needed to dismantle power dynamics among students. Leslie reflected, "It's so crazy that something so small can change engagement so much."

Discussion

Above, I explored the mathematics teaching practices of a politically conscious Black woman fourth-grade teacher named Leslie. I conceptualized her mathematics teaching practice as Black Woman Math Pedagogy by exploring elements of Leslie's Black Woman Pedagogy and Black Feminist Math PCK. The values of Leslie's mathematics teaching practice connected to the three elements of Black Woman Pedagogy. Leslie enacted an ethic of care by teaching with othermothering, urgency, and accountability to students' care and learning. She acted as an identity worker on behalf of her students with her openness about her own neurodivergence in mathematics, her journey to her own positive mathematics identity development, and celebration of Black culture within mathematics, all in order to develop the whole human. Leslie used a Black cultural ethos by building community, truth-telling about racism in society, and using Black cultural learning styles in mathematics. These components connected Leslie's mathematics teaching practice to the liberatory teaching of Black Woman Pedagogy. Leslie's alternative knowledge about teaching mathematics stemmed from her lived racialized experiences. From her alternative knowledge came three asset-based stances: 1) that mathematics must be more humanizing, 2) that mathematics needs to be accessible to students, and 3) that socioemotional learning is important in mathematics These three asset-based stances had implications for how Leslie carried out her Black Feminist Math PCK.

I analyzed three representative lessons from Leslie's mathematics teaching practice to interpret her Black Woman Math Pedagogy. Leslie taught fourth-grade mathematics content that supported students' mathematical learning and success while also using her alternative knowledge to redistribute power of who gets to be doers and thinkers of mathematics. She bolstered all students as capable mathematical beings, allowing for Black students to demonstrate Black excellence in mathematics. Leslie used her alternative knowledge to broaden

the definition of mathematics success and pushed students to go beyond getting correct answers to broadening and deepening their mathematical thinking. Leslie's Black Woman Math Pedagogy fostered a community-oriented mathematics classroom where deep mathematical thinking and creative thinking were valued. Leslie made pedagogical decisions that fostered an inclusive learning environment, maintained high cognitive demand, positioned students as intellectual authorities over the teacher and curricular text, and humanized mathematics by allowing for playfulness and joy to exist.

Leslie's case demonstrated the power of Black Woman Math Pedagogy. Leslie had been a girl who experienced violence in the mathematics classroom through exclusion. She now countered this violence by crafting her mathematics classroom as a space of comfort and allowing students to simply exist as the beautiful humans they were. The education field needs accounts of Black women mathematics teachers like Leslie and examples of her pedagogical expertise to lead mathematics education toward a more liberatory mathematics.

Chapter 5: Shawna's Case

In this chapter, I explore Shawna's *Black Woman Math Pedagogy* as applied in her kindergarten mathematics teaching practice. I trace out key features of Black Woman Pedagogy and view Shawna's pedagogical content knowledge through a Black feminist lens that illuminates what I call *Black Feminist Math Pedagogical Content Knowledge* (Black Feminist Math PCK). I use these frameworks to uplift the Black Woman Math Pedagogy that situates Shawna's day-to-day mathematics teaching. Black Feminist Math PCK elucidates Shawna's "alternative knowledge" (Collins, 1989) about teaching mathematics, an epistemological stance that differs from white institutional knowledge about teaching students, particularly Black and Brown children.

To explore Shawna's Black Woman Math Pedagogy, I first illustrate the racialized lived experiences that influenced Shawna's mathematics teaching practice. I connect her lived experiences and interviews to the stances about teaching mathematics informing her Black Woman Pedagogy. I then interpret through a Black feminist lens how Shawna's Black Feminist Math PCK consists of alternative knowledge about teaching and learning mathematics that connects to historical stances that Black women had about teaching Black students. Her alternative knowledge asset-based stance was to become the Black teacher she wished she had growing up. I document and describe Shawna's Black Woman Math Pedagogy during a subtraction unit. I end with a summary of the impact of Shawna's story for conceptualizing Black Woman Math Pedagogy, highlighting key learnings about the interrelatedness between Shawna's lived racialized experiences and how she enacted Black Woman Pedagogy and Black Feminist Math PCK in her mathematics practice.

Shawna's Classroom

Though the building was old, Water Brook Elementary had a remarkable feeling of comfort as I walked down the hallways decorated with and posters of Black historical figures and students' Black art projects. Water Brook's student body is predominantly made up of African American, African immigrant, and African descendant students from East and West Africa, with a small number of white and Latinx students. The school also had a large population of Black teachers, administration, and support staff. These facts were unusual, given that most schools in the district had small pockets of Black students and typically no more than two Black teachers working in a school, if any.

Shawna was a politically conscious teacher who took educating her kindergarteners seriously. In her classroom, time for seriousness and time for fun were both clearly designated. Shawna's mathematics lessons were conducted the same way every day, which made for a predictable but effective routine to support students' mathematical learning. Every day, students started mathematics by sitting attentively within marked squares on a rug arranged in colorful rows. Lessons began with a Calendar routine, followed by a minilesson, Math Center rotations, and choral counting. Lessons ended with a fun movement activity accompanied by a mix of YouTube videos with children's songs focused on mathematical domains such as Geometry and Counting and Cardinality. Students sat next to the same students all year and worked with the same small groups in Math Centers. Mathematics lessons lasted 75 to 90 minutes per day and Math Centers occurred every day. During Math Centers time, Shawna introduced and reviewed mathematical skills all year, along with independent and collaborative games and activities that rotated depending on the needs of her students.

Shawna had six years of experience teaching mathematics in kindergarten, and an additional year of student teaching kindergarten in the same school. Her class consisted of 14 students (after two moved away early on): six Black boys, four of whom were from West or East African descent, two white boys, one white girl, four mixed-race Black girls, and one Latina. Despite frequent absences of two students, Shawna felt confident all of her students would flourish. “If they come to school, they’ll be fine” (Class Observation, November 4, 2023). Shawna made this point to me at the beginning of the year. As I got to know Shawna, I wondered how she was so sure of herself with only six years of experience and 26 years total on this earth. She seemed to have a wisdom about kindergarten teaching and learning that I had lacked when I taught kindergarten almost a decade earlier.

Business as Usual in Shawna’s Mathematics Class

Let me take you inside Shawna’s classroom with this vignette from the sixth day of school. To attend to power, criticality, and knowledge production dynamics, I identify the racial category or place of international family origins in the transcripts.

Shawna picked up students from the library, 13 students being present that day. As I walked with the class down the hallway, Shawna’s student teacher glowed about the students, declaring they were really smart, already able to count up to 20. The student teacher declared that she loved working with Shawna, who held high expectations for her kindergarteners. Students walked into the classroom and sat quietly on the class meeting rug. Shawna started with a Calendar routine to find the month and day number 21. The numbers on the calendar alternated between red and blue reflecting “an A-B pattern,” which would later provide a focus for discussions about patterns. She grabbed a pointer and counted from 1 to 21 on the 100s chart, pausing to make sure children were following along with their eyes as they chorally

counted along with her. Two students were chosen to lead the class in a choral count, pausing whenever they chose to, and trying to catch their classmates not paying attention. Shawna reminded students that their goal was to count to 100 because doing so was a kindergarten standard. For additional practice, she played a YouTube video with a cartoon Black DJ rapping teen numbers over a catchy beat. The children counted and danced along, turning to one another and laughing.

After the video, Shawna prepared students for Math Center rotations. Gina (white) volunteered to demonstrate the first center, making A-B patters on the floor. "Give Gina a round of applause," said Shawna, and the class clapped. The second center was making A-B patterns with Unifix cubes and the third creating A-B patterns with colorful people figures. As they worked and rotated through different centers in seven-minute increments, Shawna walked around the class, watching students and complimenting their hard work. "Thank you, Patrick (Black) for getting straight to work. Thank you, Gina (white). Thank you, Issac (Ghanian). Thank you, Osman (Somali)." After three rotations, everyone cleaned up and returned to the carpet. Shawna announced, "Centers were short because you're building your stamina. Can you say stamina?" Student repeated, "Stamina." Patrick (Black) exclaimed, "That's a big word!" Shawna replied, "It is a big word. You're going to learn a lot of big words in kindergarten."

All throughout today's lesson, Shawna reinforced behavioral expectations. Students worked hard and experienced success in mathematics. I could imagine how this routine would play out throughout the year. Mathematics lessons would become increasingly longer as students grew their stamina, with longer math rotation, longer minilessons, more songs to sing. I thought to myself, "This is a strong teacher! She reminds me of me, when I was a kindergarten teacher: high expectations academically and behaviorally that she expects students to meet." Her

teaching deeply resonated with me, a fellow Black woman teacher. Some people think teaching kindergarten is easy. But there was no messing around in Shawna's classroom. She was teaching mathematics and laying a strong foundation for the rest of her students' K-12 experiences.

The vignette above described how Shawna laid the foundation of her mathematics classroom. From the very beginning of school, she created an affirming and joyous mathematics learning environment that was predictable for students and offered Shawna the flexibility to insert new activities during Math Centers, different learning videos during movement time, and eventually district curriculum lessons during minilesson time. Before getting into the official district curriculum, Shawna's goal was to set the tone for how the rest of the year would go. The predictable learning structure had already paid off, with students reciting numbers up to 20 and exploring A-B patterns by the sixth day of school, all of which target kindergarten standards. Shawna said her students were going to be successful. I believed her. I saw her bringing it about using her own teaching materials and teacher expertise. My study of Shawna's mathematics teaching became a question of "Why?" Why were Shawna's 14 students going to finish the year ready for first grade? Below I explore the essence of Shawna's mathematics teaching practice, I begin by exploring how her lived racialized experiences shaped her mathematics teaching stances.

Shawna's Lived Racialized Experience

Shawna strongly identified with being a Black teacher. She had a wisdom about her as she spoke of the profession, though she was in her mid-20s. Black feminist scholar Patricia Collins (2000) explains the important difference between knowledge and wisdom, "For most African-American women, those individuals who have lived through the experiences about which they claim to be experts are more believable and credible than those who have merely read

or thought about such experiences" (p. 257). Shawna grew up in the same metropolitan area where she taught and attended racially and ethnically diverse Title I schools serving middle and lower-class families. Though not many Black people live in the Pacific Northwest, we do boast a cultural mosaic of people. Shawna valued the diversity in her schools, saying, "I love being surrounded by people who look like me, but I also just love being surrounded by people of color, too" (Interview 1, June 9, 2022). Some people may believe Title I schools to be lacking. Shawna viewed attending a Title I as a plus because of the diverse student body and the opportunities to learn from diverse peoples. However, Shawna poignantly recognized *never* having had a Black teacher and wished that she had.

> Cedar Elementary was Title I and it really shaped me wanting to be a teacher, at that school specifically, because I was able to interact with a very diverse group of kids. But I noticed that the staff were not diverse at all. It was all white teachers. I can't remember any teachers of color. I do remember the librarian. She was an African American female. So that was pretty cool to see. But I didn't have someone teaching me who looked like me. I always wished that I would, even in my middle school, high school, college. Never. (Interview 1, June 9, 2022)

Shawna carried a sentiment that many Black children have in this country: the desire to have Black teachers teaching them. Anecdotal evidence from Black families, friends, and strangers concur that Black parents' desire to have their Black children taught by Black teachers is profoundly high. In my conversations with Shawna, phrases such as "representation matters" and "becoming the teacher I wish I had" and "having someone that looks like them" were common responses as to why she became a teacher.

In high school Shawna decided to become a teacher because of her part-time job at a daycare. She loved babies and preschool aged children and found them a joy to be around. In summers, elementary students attended her daycare, and she helped them stay sharp on their academics. She envisioned turning those summer experiences into a career.

> That's when I was like, "Okay, I don't only love kids, I think it's really fun to teach them." So that's where I got the idea that teaching would be for me. When I thought more and more about growing up, I always wanted that representation. And I'm like, I can be that Black teacher I always wished to have. I mean, there was nothing wrong with the teachers I had. They were great. I liked school. But there's just something about seeing someone who looks like you leading, you know? So that's how I was driven to do that. (Interview 1, June 9, 2022)

Shawna's decision to enter the teaching profession stemmed from recognizing she enjoyed teaching young children. Furthermore, teaching was an opportunity to become the representation she desperately craved as a student. She felt an affinity towards Black students in schools who never experienced the joys of having a Black teacher. Likewise, Shawna recognized she could enter a profession where she felt joy, too.

Shawna's Lived Racialized Experiences in Mathematics

As a student, Shawna excelled in K-12 schooling and took advanced mathematics classes. She started middle school with Geometry because she "tested up," which placed her in Algebra III/IV her freshman year of high school. High school mathematics for Shawna required memorizing and deciphering formulas, which caused her love of mathematics to lessen.

> That year is when I was like, yeah, I don't know what's happening. My math teacher, she was really great. She was very knowledgeable of the content. I just didn't get what she

was talking about. And she didn't really explain it that well, in my opinion. (Interview 1, June 9, 2022)

Although Shawna passed, she chose to retake Algebra III/IV in her sophomore year to receive a better grade. The new teacher, Shawna felt, taught the content better. She went to office hours regularly and earned a better grade. But she still did not fully grasp what was being taught. In her junior year, she entered Running Start, a national program for high school students to earn college credits by attending college level classes at local higher education institutions. Shawna enrolled in college-level Calculus I at a local community college. Again, she struggled to understand the mathematics taught and attended office hours regularly. After her junior year, she decided "that was enough math." When she graduated from high school, she earned a high school diploma and an Associate's Degree. She transferred from community college to a local four-year private institution for her Bachelors in Interdisciplinary Liberal Studies with a K-8 teaching focus. Her K-8 teaching focus required an additional mathematics course. Shawna, thinking that the Elementary Math for Teachers course would be easy and applicable for her career, discovered it was "the hardest math class" for her undergraduate degree. "I was like, this is what we're teaching kids these days?!" (Interview 1, June 9, 2022). She took a similar course for her master's degree while student teaching in kindergarten and found more immediate applications to teaching mathematics in the classroom.

In sum, Shawna excelled in mathematics in earlier grades, but struggled once mathematics became a set of formulas and disconnected procedures. Shawna worked hard to learn mathematics, going to office hours for extra assistance. However, the subject lost its appeal for her. In my experience as a mathematics teacher educator, I have encountered many people like Shawna who struggled with mathematics and now are responsible for teaching mathematics

to young children. I became interested in how Shawna's mathematics teaching differed from that of her predominantly white teachers and attuned to how she described herself as a teacher. As an example, I provide an excerpt from a conversation we had about what Black women teachers offer in education.

> Elzena: If you went somewhere else and saw another Black woman teacher, what would you expect their ideals and values to be?
>
> Shawna: There's just that cultural responsiveness that's happening with every Black female teacher. Also, the accountability piece, high expectations of the kids. I think that's something that we as Black women do, even though we're not trying, because we expect them to do their best. And we want them to do their best. Because we know that it makes a difference in every year to come in their learning.
>
> Elzena: It's kind of what teachers should be doing.
>
> Shawna: Exactly. It's what it should be for everybody. But I think it more naturally happens with us. I don't know if it's just because of life experiences. That probably is a big piece of it, and not always being privileged, wanting our kids to be privileged in any way they can. Part of that would be them having an education and making sure they get what we're teaching. (Impromptu Interview, June 28, 2023)

Though the above conversation occurred the last day I observed Shawna's kindergarten mathematics class, it mirrored sentiments she had expressed during her first interview one year prior and during our post lesson impromptu interviews. As I spoke more and more with Shawna, I realized what she *did* for students in her mathematics practice stemmed from her alternative knowledge about teaching mathematics, which contrasted with what other teachers *did not do*. Shawna's alternative knowledge about teaching mathematics entailed *high expectations*,

accountability, and being a *culturally responsive* teacher. Shawna possessed high expectations for her students and held her students accountable to meeting them. Shawna enacted culturally responsive teaching practices that reflected the cultures of her predominantly Black student population. She found that these asset-based stances were taken up by many other Black women teachers, other teachers of Color, and according to Shawna some "woke" white teachers. Yet, Shawna thought that for her, acting on her alternative knowledge was "something that we as Black women do, even though we're not trying, because we expect them to do their best." Shawna's decision to become the Black teacher she wished she had had was a racialized act of a politically conscious teacher to give students what she missed in her own education experience: a Black teacher who cared and dedicated herself to Black children's success. Shawna had an insistence that all Black children receive the best education, not because of privilege, but because it is owed to them.

Shawna's Black Woman Pedagogy

Given Shawna's desire to impact Black children and her asset-based alternative knowledge to bring accountability, high expectations, and cultural responsiveness into her teaching, she naturally gravitated towards Black Woman Pedagogy. I located Black Woman Pedagogy in Shawna's mathematics teaching in her interviews and conversations about teaching mathematics as she thought aloud about her mathematics teaching during lessons. I analyzed these conversations to understand how Shawna enacted an ethic of care, identity work, and a Black cultural ethos in her mathematics practice. Shawna's Black Woman Pedagogy closely intertwined with her identity and lived racialized experiences in Black girlhood and as a Black woman teacher. I delve further into the connections Shawna has to Black Woman Pedagogy elements below.

Shawna's Ethic of Care

An ethic of care in teaching is a deeply held responsibility rooted in Black women's commitment to care for and about others in their communities. Black teachers' caring is that "of concerned adults, who command respect, are respectful of pupils, and who through caring require all students to meet high academic and behavioral standards" (Foster, 1994, p. 213). An ethic of care is a deep concern for your students' wellbeing academically, socially, and mentally. Shawna enacted an ethic of care by setting high expectations for students, holding herself accountable to student learning, and othermothering students (explained below).

High Expectations. "High expectations" is a term ubiquitous in education. The idea is predicated on the notion that if teachers believe students are capable of succeeding, then they will, like a "self-fulfilling prophecy" (Rosenthal & Jacobson, 1968, p. 20). In essence, if you believe children to be capable, then they will be capable and succeed. These ideas have been discussed broadly in teacher education programs and districts with high percentages of Black and Brown students. And yet, the idea of all teachers holding high expectations for all students is elusive, particularly for Black and Brown students. Black Woman Pedagogy adopts a different interpretation of high expectations in the literature. It is axiomatic that Black children are more than capable of success (Siddle Walker, 1996; Ladson-Billings, 1994). The difference lies between stating that you have high expectations and actually having them engrained in your ethic, giving you the drive to make sure those high expectations are met.

Shawna connected to Black Woman Pedagogy's interpretation of high expectations and held them for her students and herself to ensure her students succeeded. In fact, Shawna recognized that her definition of high expectations differed from the "high expectations" definition used more commonly in the profession. In Shawna's first interview, she discussed a

new district initiative for Black boys to achieve higher standardized test scores by third grade. In her eyes, the initiative targeted third graders but offered no lead-up support in kindergarten. Furthermore, the initiative labeled Black boys as having “deficits” rather than setting the high expectation as a district to teach more responsively. Shawna illustrated her point further:

> Obviously, there's an opportunity gap and achievement gap. This district talks about Black boys and wanting them to achieve. Well, it goes beyond just the little goal that you said. There’re certain actions that have to happen. They're always like, "By third grade, all Black boys will be reading at level." That’s not going to happen if they're not doing that in kindergarten. You’ve got to lead up to that and set them up for success. Also, don't just label them as, "Oh, they're going to be this way, or they're going to be that way." Be culturally responsive. That’s the piece I think that I've done well as a teacher. Although a lot of the kids, our skin color, we're the same. We don't have the same background. There's a lot of Somali students. So, I've gotten to learn about that culture. There's a lot of Muslim students. I've gotten to learn about that religion. I think it just takes time getting to know the population of students you're working with. I don't know if people see it as important if they're not a person of color, if they see how strong of an impact that has. (Interview 1, June 9, 2022)

Shawna named her frustration with initiatives that expected Black students to succeed with no realistic plan of effective support. She considered opportunity and achievement gaps a creation of the district and many white teachers’ lack of cultural responsivity. Shawna believed that her district, particularly educators, needed to do the work of getting to know their Black students so that they could achieve. She suggested building deeper connections with Black communities in the area. She praised herself on her work to be more responsive to her Black

students' need so that she could teach more effectively. For example, the Muslim Somali population and African American population were both considered "Black" according to her school census, but she took time to learn the differences and similarities between the two communities. Because Shawna was a culturally responsive teacher and did the community work of building relationships with different Black populations, in this case Somali families, she could use what she knew about her students to guide her teaching.

Shawna also took issue with district's declaring that an entire racial group of people were "deficient" and needed the district to remedy their deficits in ways which ultimately did not serve the community's needs. Shawna defined these declarations as racist and racialized practice, because "I don't know if [white] people see as important if they're not a person of color, if they see how strong of an impact that has" to get to know different Black communities rather than declaring them deficient.

Personal Accountability. Personal accountability is a tenet of Black feminist epistemology. It means that a Black woman is accountable to her word (Collins, 2000). In the Black community, your word is your bond and speaks to your integrity. When Shawna stated she had high expectations for her students, she committed herself to her students' learning. In mathematics teaching, Shawna held herself accountable for knowledge of curriculum, how to assess students' needs, and how to adapt the curriculum. Accountability in Shawna's mathematics practice included paying close attention to students' mathematical learning needs throughout the year. For example, Shawna intentionally chose Math Centers activities each day based on student learning needs. As students were assessed and their learning needs shifted, she changed out the activities or adjusted their difficulty, such as adding within five to working

within 10 for addition games. Shawna's personal accountability resulted in highly successful students because of the fast pace at which she assessed and modified curriculum for students.

As another example, in January, four months into the school year, Shawna shared that her students were working on counting and recognizing numbers from one to 40. This happened because Shawna condensed the official curriculum units to target many kindergarten learning goals by January instead of waiting until the end of the year to meet all the learning goals. Meanwhile, Shawna's student teacher commented that mentor teachers of some kindergarten classes in her teacher education program were still teaching numbers from one to 10. Shawna explained how she paced herself through the same district curriculum.

> We worked a lot on decomposing in fine and then memorizing number identification. Counting is always so big, because if they can't count, they can't count. We've been doing well, too. I go back and forth between, and in and out [of the official curriculum]. I skipped topics. We finished Topic Three right before [winter] break. And then I skipped past Topics Four and Five. I skipped those two parts because they're ready for more. Like, we don't need to just keep looking at colors and pictures. Of course, writing numbers is important. And they'll get better and better at it. But they'll also get that practice when doing Center rotations. (Impromptu Interview, January 17, 2023)

Shawna's students exceeded kindergarten expectations in mathematics, based on what other kindergarten teachers were presenting and where the official curriculum placed them after four months of school. Shawna found that "they're ready for more" than counting objects in workbook pages. Because of Shawna's predictable and effective set up of her mathematics classroom, she could easily substitute standard material with lessons and activities students were ready to learn. Furthermore, her discernment for interpreting curriculum and her students'

learning needs was a testament to her personal accountability to ensure that her students are more than prepared to excel in mathematics.

Othermothering. Shawna strongly connected to "othermothering" her students. Othermothering is a Black feminist teaching tradition of mothering Black students while parents are away. Teachers do not supplant parents. Rather, they ensure the psychological and physical wellbeing of children who are away from parental care (Case, 1997; Collins, 2000; Dixson, 2003). When Shawna reflected on her teaching, she considered how she was like her own mother who held her accountable to high behavioral and academic standards in school. Shawna connected her biological mom's mothering to the mothering Black women often embody as teachers.

> We're firm to a point. I'm not a Black mom, but I've noticed as I do this more and more, I'm a lot like my mom in how I talk to kids. I think there's something about how Black women are with kids that makes a difference in the classroom. (Interview 1, June 9, 2022)

Shawna connected firmness with how her mother raised her and how she teaches students. This firmness to a point also allows for joy when with students, to being a warm demander (Bonner, 2014; Ware, 2006). One memorable experience demonstrating Shawna's warm demander demeanor came on the 100th day of school, a celebratory day in many kindergarten classrooms. That afternoon at the start of class, Shawna walked in briskly and announced "We have lots to do. If we don't do this, then you are sitting out from the party." One student, Patrick (Black), simply replied, "Okay," as if speaking for the whole class (Class Observation, March 6, 2023). I was blown away by her sternness on such a celebratory day. Still, Shawna insisted that

academics came first. Needless to say, everyone attended the 100th day celebration because the students worked hard on their mathematics, as usual.

Othermothering is a shared responsibility among teacher and parents and family members. It works best when both teacher and families share the same expectations for students. Shawna recounted to me the benefit one parent enjoyed when partnering with Shawna. During a report card conference, a former student's East African parent stopped for a chat.

> She told me, "Wow, you always say such good things about my kids. I don't hear that from the other teachers. They always talk about all the bad things that my son does. I asked my son why he only listened so well with you. He said, 'It's because you're Black. I have to treat her well—like you, Mom!'" (Gathering 2, June 6, 2023)

The student insisted that he behaved for Shawna because she was Black, just like his mother. Shawna and the parent likely held similar expectations for the student around academics and social behaviors. What really helped students' succeed was that Shawna's values aligned with those of their parents, and she knew this truth by getting to know the student, their families, cultures. She noticed students strengths and made them public. Furthermore, Shawna offered praise for students when they met her expectations and genuinely thought about them not just academically but behaviorally and socially. Shawna built relationships with her students, which supported her ability to motivate students to succeed in her class.

Shawna as an Identity Worker

Identity work in Black Woman Pedagogy centers on developing positive racial, academic, and social identities. Part of Shawna's role as an identity worker was developing her kindergarteners' mathematics identities while maintaining their racial, cultural, and social identities. This was important given that school institutions are formed through the lens of white

middle class values, which greatly influence all facets of schooling for students. Since Shawna's students were primarily representative of the African Diaspora, it was important for students to maintain a relevant Black identity in all its diversity while existing in a white institutional space (Ladson-Billings, 1994). One element of Shawna's identity work on behalf of students was, as she noted earlier, being the Black teacher she wished she had. This was not to say being Black would automatically support students' racial and cultural identities. For Shawna, however, "being the Black teacher" meant being fully committed to her students, demonstrating that a teacher embodying Blackness can lead and be successful in life. Her example was powerful in a classroom with many students from the Black diaspora, where her leadership as a teacher presented a Black feminist endeavor connected to the historical leadership of Black women educators in Black communities (Collins, 2000).

Shawna's racial and cultural identity work stemmed from having grown up in diverse schools. As a child, Shawna appreciated learning about groups of people different from her own African American family. For example, Shawna loved her high school because "that setting was where I experienced the most diversity to this day. There were so many different ethnicities present there. It was just so fun to learn from everyone" (Interview 1, June 9, 2022). Shawna's appreciation for diversity transferred to her teaching context. She valued getting to know the array of cultures and identities shaping her students and their families. Shawna welcomed, accepted, and appreciated the racial and cultural identities that students brought with them every day of school. Acceptance of students, true acceptance, is a component of Black Woman Math Pedagogy that protects students from racialization in mathematics (McKinney de Royston et al., 2020) given that so many structures in schools compel students to conform to whiteness. Simply allowing students to just *be* in mathematics class led to continuous academic development.

Mathematics Identities. Shawna attended to students' mathematics identities by having clear expectations of what students should do in mathematics to be successful. Their mathematical success was not contingent on them getting right answers, which is typically how people develop positive or negative mathematics identities. Shawna's mathematics expectations encompassed group collaboration, how to work independently, and how to participate in learning. Her students rose to these expectations and experienced success, receiving feedback from Shawna that let them know they had done well, such as "Way to go!" Praise was awarded based on finishing a task or at least trying. Any teacher could use these words. The difference was the sincerity Shawna radiated as she praised her students. She showed an unequivocal faith (Gay, 2000) that her students would be great in mathematics, knowing she could push them academically in mathematics "because they're so capable" (Impromptu interview January 17, 2023).

The significance of Shawna's supporting students' mathematical, racial, and cultural identities was that she protected those intersecting identities in her mathematics class. Pushing her students academically countered stereotype threat (Steele, 1997) for Black and Brown students. Outsiders with negative beliefs about students at Water Brook Elementary, a Title 1 school with a large Black population, posed such a threat. Shawna resisted negative racialized identity narratives of "what they say about our kids" knowing that "kids up north" in more white, affluent areas were always going to be successful in mathematics (Gathering 1, March 18, 2023). Shawna recognized how deeply entrenched were the racist biases against her students based on what they looked like and where they lived. These narratives exist in and are reproduced within education systems. Shawna actively resisted racist narratives by empowering her Black and Brown students to learn and do mathematics and achieve success.

For example, Shawna recalled an undergraduate education diversity course. The instructor assigned readings making sweeping generalizations about African American and Asian students and failed to describe the potentially different learning needs of each cultural group. In class, she spoke out against the stereotypes.

> As I went into teaching, there's all these things that would come out in the courses that really did bother me. I'll never forget. One of my professors gave us an article of what African American kids are like, and they gave us an article of what Asian American kids are like. It basically was just all stereotypes in my eyes. I said to the professor, “I don't agree with anything in this article. In my opinion, there's a deeper issue here. Kids are not having teachers that understand that as students of color, they have different needs. You’re gonna have to interact differently with them than your typical white students. There are different situations that the kids have gone through. There's less privilege typically with kids of color.” So all of those things, I called out in that class, and I'm like, it's ridiculous. I'm in the teaching program, and I’m having to say this. (Interview 1, June 9, 2022)

Rather than stereotyping racial groups, preservice teachers should get to know the local communities. In Shawna’s view, her education program not only taught stereotypes of racial groups, it also failed to discuss privilege—who has it and who does not. Furthermore, rather than discussing stock cultural backgrounds, Shawna wanted the professor to offer ideas about teaching students from diverse backgrounds, particularly in a predominantly white education program catering to white pre-service teachers. Students’ “having different needs” for learning means teachers should adapt lesson structures, how concepts are taught, or consider which representations or situations are best suited to teaching mathematics based on the cultural and

community funds of knowledge students bring with them. In mathematics, a subject traditionally structured for white and privileged students to excel, teachers need to know how to navigate teaching, learning, and diverse students' identity development. Because Shawna had political consciousness, she recognized that she understood better than her white peers how to resist negative identity narratives about Black and Brown students.

Shawna's Black Cultural Ethos

The final element of Black Woman Pedagogy is using a *Black cultural ethos* when teaching. Black culture is multifaceted and can be represented in a multitude of ways. Since Shawna identified as a culturally responsive teacher, I focus on how she brought Black culture into her curriculum. I draw from Gay's (2000) conception of culturally responsive teaching to conceptualize how Shawna used a Black cultural style to teach with and through Black culture. In other words, I explore how Shawna's mathematics teaching demonstrated teaching *with* and *through* Black culture as curriculum as it relates to a cultural congruity that aligns Black learning styles with ways Black children best learn.

Teaching With a Black Cultural Ethos.

> Elzena: What does it mean to be a Black woman teaching mathematics at [Water Brook Elementary]?
>
> Shawna: I'd say being aware of your students and who you're teaching –your student body—and making their work reflective of them and what they enjoy. I think it should be fun, to be honest. Especially at kindergarten, everything you do should be fun. So if they're not having fun, I feel like it's not happening as it should be. Because if they're enjoying what they're doing, they'll want to do more of it, and then they'll continue to grow and learn. (Impromptu Interview, June 28, 2023)

Shawna identified as a culturally responsive teacher by making the curriculum fit the interests of her students. She affirmed in this and many other interviews that learning should be enjoyable. Fun is often relegated to the kindergarten years and fades over time, typically transforming into the sit-and-receive banking model of education (Freire, 1970), especially in mathematics. Fun in kindergarten comes from engagement, hands on activity, laughter, and the freedom to explore. All these elements contradict an authoritative teacher modeling format, which is dull, abstract, quiet, and bounded. Shawna questioned the success of this format, and urged teachers across grade levels to make learning more engaging. Because of her commitment to more engaging curriculum for her Brown and Black students, she used Black cultural knowledge within her curriculum structures.

Shawna used what Gay (2002) refers to as "societal curriculum," which reflects knowledge, ideas, and impressions about racial and ethnic groups. In mathematics, this translates to what music is played, which racial characters and hypothetical situations are portrayed in student mathematics workbooks images, and who is shown on classroom walls, which in Shawna's classroom displayed images of Black historical figures like Malcolm X and Harriet Tubman. I return to Shawna's quote pertaining to her frustration with the district's focus on Black boys and lack of cultural responsiveness. Specifically, Shawna wanted the district to think about how teaching could be improved in culturally responsive ways in kindergarten, first, second, *and* third grade so that students would find learning fun and see that their cultures and ways of being (dancing, playing, participating) were valued in learning spaces and by their teachers.

Another way Shawna taught with a Black cultural ethos was to reference curriculum around familiar contexts for her predominantly Black students. In personal observations, I have

noticed that many teachers substitute their students' names in to replace hypothetical children in word problems. This practice is a shallow attempt at cultural responsiveness and often creates an invasive, artificial context for students that fails to connect to their lived experiences. Shawna, by contrast, intentionally created word problems that reflected the lived experiences of her students. In one interview, she discussed how her students loved becoming a word problem. For example, "'Mahmood has 7 soccer balls, and he gave 4 to his friend Xavier.' They get so excited just looking at that and saying their names. Because those two boys, they play soccer together after school every day. So just getting to know them and what they're doing and bringing it into their academics is really fun" (Interview 1, June 9, 2022). Shawna believed her flexibility in easily adapting curriculum was her strength "because I can just mold it to their likes, their interests, and bring in more culture to it. [That's better] than just some curriculum you're flipping through."

Teaching Through a Black Cultural Ethos. Shawna thoughtfully structured mathematics activities that allowed for a predictable, joyous, community-oriented learning environment—all elements of teaching through a Black cultural ethos. For Shawna, joy and learning in mathematics went hand in hand. She created mathematics minilessons and Math Center activities based on what she found her students responding to well. She also considered the quality of each learning task and the level of enjoyment that students found in the activity. For example, music in mathematics occurred daily. Throughout the year, Shawna used YouTube mathematics videos for children to support students learning mathematics concepts such as subitizing, counting to 100, adding and subtracting within 10, and two- and three-dimensional shapes. The songs were rap, hip hop or pop songs that students clearly enjoyed, learning the lyrics and dancing while also demonstrating their learning.

Community-oriented learning activities encouraged a lot of student participation and fun in Shawna's mathematics classroom. For instance, Shawna recognized that teen numbers were typically difficult for kindergarteners to master because they break from the number naming pattern found in most of our number system. Knowing this, Shawna created a game early in the year for students to provide a fun opportunity to engage with teen numbers.

> We did a teen number lesson where they each were a different teen. So we'd say, "You're number 12." And then they got to talk about who they are as the number 12. They can make up any story they wanted. We all sat in a circle and then they got to call out the next number they wanted to see—we had a chant. And they just got a complete kick out of it. It's a super simple game, but they were in a circle just having a blast. And it really helped them with identifying their teen numbers. (Interview 1, June 9, 2022)

The teen number game was a simple but humorous activity for kindergarteners, developmentally appropriate yet far more joyous than curriculum workbook pages. Because Shawna drew on Black cultural ethos in her mathematics lesson, she achieved variety in her teaching that supported student learning and enjoyment of mathematics.

In sum, Shawna incorporated Black Woman Pedagogy into her mathematics teaching practice by creating a learning environment where students engaged in mathematics learning in community-oriented activities with a teacher who held them to high expectations of success. Shawna fostered positive academic, racial, and cultural identities within the mathematics classroom by allowing students to simply be and to celebrate learning together. Shawna's stances on teaching mathematics are race-conscious practices that refuse and resist racialized notions that deficit Black and Brown children.

Shawna's Black Feminist Math Pedagogical Content Knowledge

In this section, I first examine Shawna's mathematics teaching through *Black Feminist Math Pedagogical Content Knowledge,* or Black Feminist Math PCK. An essential component of Black Feminist Math PCK is that Black women use their alternative knowledge in their day-to-day teaching of mathematics to transform mathematics into a liberatory experience. Shawna's alternative knowledge centered on becoming the Black teacher she wished she had had growing up. Her alternative knowledge stemmed from lived racialized experiences in schools where teachers failed to hold Shawna accountable to high expectations, hold themselves accountable to Shawna's learning, and to use cultural responsiveness in their teaching. Specifically, Shawna used her alternative knowledge around maintaining high expectations for her students, holding herself personally accountable to students' learning mathematics, and practicing culturally responsive teaching in mathematics as asset-based stances for teaching mathematics. Next, I apply my Black Feminist Math PCK construct to capture Shawna's knowledge of her individual students, knowledge of students' mathematical thinking, knowledge of mathematics content and teaching, and knowledge of mathematics curriculum.

Shawna's Knowledge of Students and Students' Mathematical Thinking

Given her deep knowledge of mathematics content and curriculum, Shawna structured her mathematics classroom to open many opportunities to learn about her students, assess their mathematical strengths, and develop individual student learning goals. In addition to possessing strong content knowledge and curriculum writing, Shawna made use of fast paced assessment practices that effectively pinpointed student strengths and growth areas in her scope and sequence guide for kindergarten learning. Rather than recording long assessments of students' mathematics learning, as was typical in the district, Shawna frequently conducted rapid

assessments on all her students by focusing on a few end-of-kindergarten goals at a time. For example, in March during a 30-minute Math Center rotation, Shawna assessed all her students on counting to 100 and writing numbers from one to 20. Accordingly, she determined how to structure the minilesson and Math Centers the next day.

Shawna's Black Feminist Math PCK attended to positive mathematics identity development and positioned all her students as capable. During one class observation in late January, Shawna assessed Alexa (mixed-race Black), a frequently absent student, on number writing and recognizing teen numbers. The assessment took less than five minutes and was conducted during Math Center rotations. As Shawna explained her assessment procedures to me, she noted of Alexa, "She didn't say the numbers right, so will keep working on it" (Class Observation, January 25, 2023). "Working on it" included keeping Math Center activities with teen numbers in rotation, choosing videos that featured teen numbers, and paying close attention to how Alexa counted during these group activities. Notably, counting to 100 was an end-of-year kindergarten standard, while the unit for recognizing teen numbers was designated for March. Shawna's assessments tracked end-of-year kindergarten goals, noted progress over time, and adapted lessons based on student progress. This approach contrasted sharply with many elementary teachers' method of tracking students' mathematics progress at the beginning and end of a unit. The difference arose from Shawna's Black Feminist Math PCK ideas on gathering information about her students' strengths and needs and adjusting her mathematics teaching to suit them. Shawna knew where all her students were holistically as mathematical learners, rather than in snapshots as units and formal curriculum assessments were checked off in the official curriculum.

The beauty of Shawna's assessment strategies was that, while schools easily assess students through built-in formal and informal assessment structures, most teachers struggle to adapt whole group instruction writ large. Shawna's method offered a great alternative model. Her micro-assessments and subsequent lesson adaptations benefitted students like Alexa because each continued to participate in mathematics with their peers, showed growth over time, and could enjoy being a member of a mathematical community where everyone was working toward a similar goal. This stands in contrast to the typical method of continuing to teach new mathematics content but pulling any students still processing the material out of regular mathematics class activities for "intervention." The latter often results in sorting students into one group to receive new mathematics instruction and another group that needs remedial "intervention" instruction. Because intervention means time away from the class's main mathematics learning activities, it cuts off students like Alexa from grade level learning and cycles them into a need for more and more support as they miss out on main instruction, forfeit time to practice and acquire new skills, and harm students' mathematics identity as they feel constantly "behind."

Instead, Shawna axiomatically positioned all students, including Alexa, as capable mathematical doers and thinkers. Because of Shawna's mathematics class structure, even students frequently absent like Alexa would benefit from multiple opportunities to participate in mathematics built into the natural structure of the classroom, growing their skills over time. Even in our private conversation, Shawna positioned Alexa positively rather than sinking into a common education narrative that casts frequently absent children in a negative light.

In sum, Shawna enacted Black Feminist Math PCK through her knowledge of students' mathematical thinking broadly, and knowledge of her individual students as children with lots of

potential. All her students were recognized as highly capable. The needs of students like Alexa were met within the typical classroom structures. Because of her knowledge of her students, Shawna was able to constantly adjust her teaching based on quick-paced assessments and knowing exactly what each student's learning needs were.

Shawna's Knowledge of Mathematical Content and Teaching

Shawna possessed a deep knowledge of kindergarten mathematical content that enabled her to write and revise curriculum as needed to suit lessons to her students' mathematical needs and interests. "I know the content standards like the back of my hand" (Gathering 2, June 7, 2023), as she put it. Her teacher learning had started under the tutelage of an innovative kindergarten mentor teacher during her Masters in Teaching preservice work followed by six years of refining her skills in her own kindergarten classroom. Shawna's mentor teacher coached her on writing, executing, and reflecting on mathematics lessons. Of note was that Shawna's mentor teacher was a white woman in her last year of teaching before retirement. Having the high quality mentorship she provided was key to Shawna's professional development and ability to incorporate her own alternative knowledge into her lesson planning. She described her mentor teacher's guidance during one of our Gatherings:

> My first week, my mentor was like, "What area would you like to start learning first?" I was like, "Not math. I don't like math. How about reading?" So then she's like, "I'm sorry, I'm going to make you start with math. I know you just said not math. But that's what we're going to do." Okay, fine. So she'd be like, "Okay, you need to create a lesson for this." I don't know how to do that! So it would just be me Googling and trying to figure it out. I'd show her—which irritated me, but it was very helpful—and she would be like, "How about you try it?" So I tried it, and she was the one that really made me

> reflect, which I didn't like. Now I do, but anyway. Every single lesson I would completely break apart because, I mean, they were really bad lessons. The kids weren't learning. That really got me to start thinking about, "Oh wait. I got to not only teach it, but make sure they get it." So as much as I was like, "This is irritating that you're doing this to me," I appreciate it now. (Gathering 2, June 7, 2023)

Shawna's experience illuminates the importance of Black women developing their Black Feminist Math PCK though mentorship. In my own experiences with pre-service teachers, it is rare to find an innovative mentor teacher who encourages novice teachers to build mathematics lessons that are culturally responsive. Fortunately, Shawna's white mentor teacher was a warm demander (Bonner, 2014; Ware, 2006) who made decisions about Shawna's learning experiences that were in Shawna's best interest. Her mentor recognized that, as a novice teacher, Shawna needed to develop mathematics teaching knowledge. Though Shawna admitted that her mentor teacher's insistence that she practice teaching mathematics "irritated me" she later appreciated her insistence. Shawna took responsibility for students learning – "to not only teach it, but make sure they get it." If her Black and Brown students did not learn, Shawna viewed herself, not the children, as the one who had failed. Shawna's stance to make sure students understood what she was teaching came from the ethic of care she brought to her novice teaching experience.

Shawna's early teaching experiences were guided by her alternative knowledge that she must hold herself personally accountable to student learning. Becoming the Black teacher she wished she had had meant not only teaching well, but teaching mathematics in culturally responsive ways. For example, Shawna admitted her first preservice teaching lessons "were really bad lessons." This honest humility contrasts with common racialized teacher practices to blame Black and Brown students for a given lesson's ineffectiveness. When creating high quality

lessons, Shawna considered not only the mathematics learning target, but what children would enjoy and the activity's effectiveness for meeting the learning goal. Over time, Shawna strengthened her knowledge of mathematical content and teaching to become a skilled and thoughtful mathematics lesson designer. She built a mathematics curriculum consisting of activities to be used in Math Centers and as minilessons. To illustrate the extent to which Shawna designed curriculum materials, when I asked Shawna about the curriculum she used for mathematics, she responded, "That filing cabinet over there is nonstop math activities" (Interview 1, June 9, 2022). A five-shelf industrial filing cabinet was filled with folders of mathematics activities spanning the kindergarten standards. Many of her materials she had found online for free, while others she has created by hand. However, Shawna was strategic about what she chose to incorporate into her curriculum. From a culturally responsive perspective, she first thought about what her own students would enjoy and needed to learn by using materials for a lesson.

A few years into her teaching tenure, Shawna and her grade level team developed their own scope and sequence teaching plan for kindergarten based on Common Core Math Standards and the district's report card. Shawna used her knowledge of mathematical content and teaching to create class structures and lessons around the kindergarten scope and sequence plan, including a Calendar routine, counting, minilessons, mathematics educational videos, and Math Centers activities that varied depending on student assessments. Shawna considered which standards and learning goals she was targeting as she chose materials that matched the standard. She also considered what would be visually appealing to students and have high entertainment and engagement value. Over time, she learned which structures worked well time and time again,

such as incorporating movement and music throughout the lesson, creating opportunities for students to work together, and doing interactive minilessons.

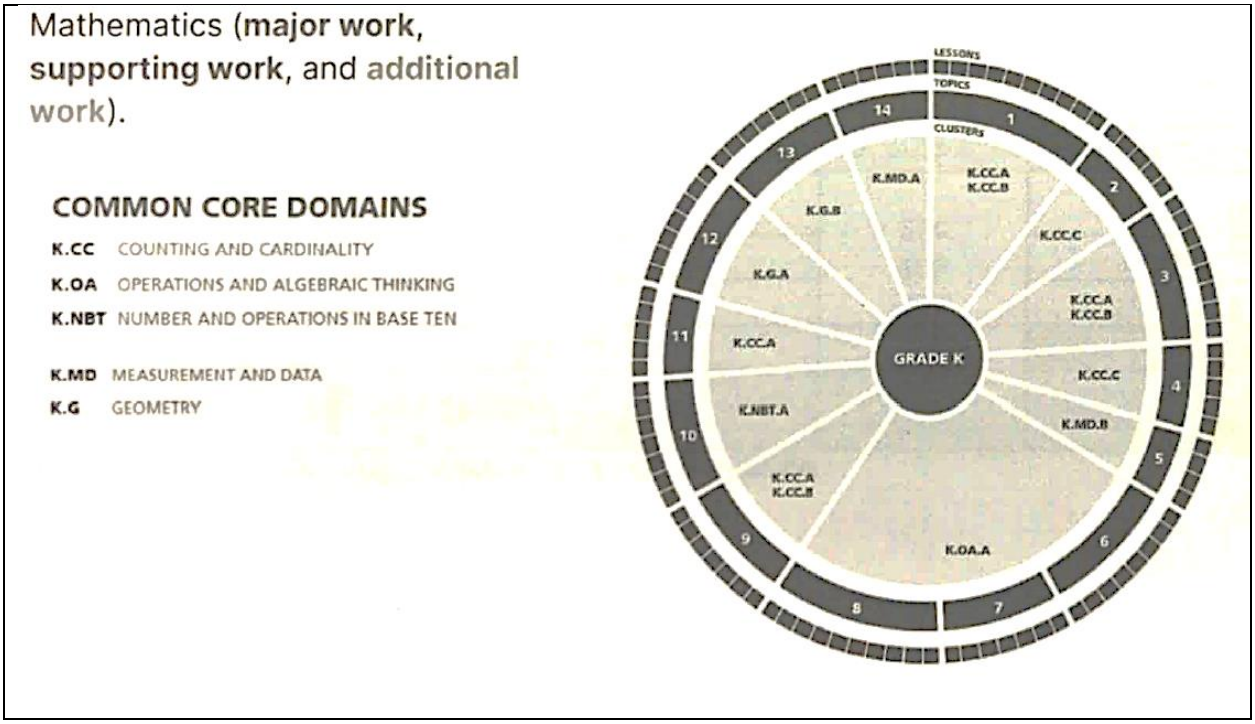
Shawna's Knowledge of Mathematics Curriculum

Knowledge of mathematics curriculum consists of the official curriculum, additional curriculum materials a teacher uses in her teaching, and knowledge of how mathematics standards are met through curriculum. Above, I described how Shawna used assessments to inform her knowledge of students' mathematical thinking. Below, I describe how Shawna's knowledge of mathematics curriculum impacted her day-to-day mathematics teaching. I describe Shawna's process of thinking through the officially-adopted curriculum and how she implemented her own mathematics curriculum based on her pedagogical expertise. I further elaborate on how Shawna leveraged her knowledge to teach students beyond the mandated curriculum.

Teaching the Official Curriculum. During the school year when I observed Shawna, the district adopted a new elementary mathematics curriculum. The principal in Shawna's school wanted teachers to use this new curriculum but allowed them some leeway to adapt the curriculum based on what they thought best for students. Throughout the year, Shawna weaved in and out of using the official curriculum based on her professional judgement. The official curriculum started off with a heavy focus on K.CC Counting and Cardinality (28 lessons) before moving into K.OA Operations and Algebraic where students investigated addition and subtraction (Figure 8). During the first Counting and Cardinality units, Shawna tried teaching one lesson per day, but then decided to jump ahead to more challenging content, skipping several lessons or units altogether. Her pedagogical decisions were firmly grounded in student assessments, both the formal rapid paced assessments gauged during Math Centers and

Figure 8

Official Kindergarten Mathematics Scope and Sequence in Shawna's District



the informal observations made as students played in Math Centers. Indeed, because of Shawna's personal mathematics curriculum in Math Centers, students surpassed the curriculum's early kindergarten expectations for counting and cardinality four months into the school year.

By mid-year, Water Brook Elementary grade level leaders reported to the principal that teachers disliked much of the curriculum. Shawna, the kindergarten team leader of five teachers, reported that the kindergarten work was actually easy but on its own failed to advance kindergarteners to mastery of concepts. Simultaneously, the lesson structure was ineffective, even when carried out by such an expert such as Shawna. The curriculum's heavy reliance on teachers reading directions aloud and pointing out to students they were to write answers, Shawna found, was unnecessarily complex for kindergarten level. At the beginning of the year, Shawna tried teaching workbook pages in whole group with students at their desks but found it

too complex and time consuming to simply practice writing numbers. She already had better curriculum materials in her Math Centers to practice number writing. Additionally, Shawna herself found the official curriculum lessons dull and rote, stating, “The rule that I go by in my teaching is if I’m not having fun, they’re not having fun” (Gathering 2, June 7, 2023). Weeks into the year, she started collaborating with Theresa, the K-1 Math Interventionist and a veteran Black woman elementary teacher of 22 years, on how to maximize student learning opportunities during class time. Because the official curriculum was mandatory, the Shawna and Theresa decided Shawna would teach the official curriculum’s whole group minilessons, then Theresa would come in during Math Centers to conduct small groups during which students completed the workbook pages with more support. Theresa led heterogeneous groups through the workbook pages, reading the directions and pointing out where students should write their answers, until every student completed the workbook practice pages. This freed Shawna to monitor and assess students during Math Centers. Interestingly, Shawna was the only K-1 teacher in her school to collaborate with Theresa and tap into her professional expertise. Quite possibly, Shawna was the only teacher who did not mind sharing power with another, meaning Shawna’s stance, informed by her Black Feminist Math PCK, caused her to value collaborating with colleagues and sharing power to co-teach mathematics to support students’ success in mathematics.

During many impromptu conversations during my observations, Shawna drew on her knowledge of mathematics curriculum to critique the pros and cons of the official curriculum in comparison to her own. As she moved into Operations and Algebraic Thinking units in March, after five units on Counting and Cardinality (Figure 8), she became concerned that lessons focused more on exposure to concepts versus mastery of them. Because Shawna viewed addition and subtraction as crucial concepts to learn in kindergarten, she was especially concerned with

how the curriculum merely skimmed over these concepts instead of having students master how to add and subtract. For example, only one lesson discussed noticing patterns when subtracting, and only three had students practice subtraction using manipulatives, rather than providing students multiple points of practice with writing equations, using a wide variety of manipulatives to physically demonstrate subtraction, and drawing concrete and abstract representations of subtraction. Furthermore, Shawna found that the official curriculum pacing guide did not align with report cards, let alone kindergarten standards needed in preparation for first grade.

By early spring, Shawna had reached a point of frustration with the ineffectiveness of the new curriculum. After months of seeing the curriculum fail to serve her students, she decided to directly assess its effectiveness: she would first teach the official subtraction unit as written, then "teach subtraction my way" and "do what I want to do" (Impromptu Interview, March 6, 2023). In other words, Shawna was going to compare the effectiveness of the official curriculum's subtraction unit to the effectiveness of her own mathematics subtraction unit, which she had used successfully for many years. This test period of Shawna's teaching subtraction both ways naturally provided me an opportunity to document in detail Shawna's Black Woman Math Pedagogy through the day-to-day pedagogical decisions.

Shawna's Mathematics Teaching: A Unit Example of Black Woman Math Pedagogy

In this section, I provide a representative example of Shawna's teaching from mid-March to mid-April during the 2022-2023 school year in order to explore Shawna's Black Woman Math Pedagogy. During this period, Shawna taught a subtraction unit from her district's official mathematics curriculum, followed by a subtraction re-teach period using her personal curriculum materials and pedagogical expertise. I explore how Shawna's alternative knowledge asset-based stances, which centered high expectations for students, personal accountability, and cultural

responsiveness, influenced her Black Feminist Math PCK. Given the predictability of Shawna's mathematics lessons and routines, I detail one representative official curriculum lesson example that captures Shawna's mathematics teaching and describes her pedagogical decisions. I then give an overview of her re-teach unit, contrasting it to the official curriculum subtraction unit. From these examples, I highlight how Shawna's teaching connected to Black Woman Pedagogy and Black Feminist Math PCK, which synergistically illuminate her Black Woman Math Pedagogy. For the purpose of attending to power, criticality, and knowledge production dynamics, as well as how Shawna dismantled racial scripts (Gholson & Wilkes, 2017) that typically structure poor learning opportunities for Black and Brown students, I provide the racial category of each student throughout the transcripts.

I provide two perspectives that demonstrates Shawna's Black Woman Math Pedagogy. The first perspective describes how Shawna taught one minilesson from the official curriculum using Black Woman Math Pedagogy. Table 6 details how Shawna's mathematics teaching practice connected to Black Woman Pedagogy by identifying how she connected to an ethic of care, identity work, and a Black cultural ethos. Under the header Black Feminist Math PCK, I summarize how Shawna's stances that stemmed from her alternative knowledge influenced her knowledge of students, knowledge of students' mathematical thinking, knowledge of mathematics content and teaching, and knowledge of mathematics curriculum. The second perspective offers a broader view of Shawna's Black Woman Math Pedagogy when she taught a mathematics unit using her own curriculum materials. Table 7 highlights how Shawna drew on Black Woman Pedagogy and Black Feminist Math PCK over the course of a 10-day subtraction reteach unit.

Table 6

Shawna's Black Woman Math Pedagogy: Lesson Overview from the Official Curriculum

	Black Woman Math Pedagogy	
	Black Woman Pedagogy • Ethic of Care • Identity Work • Black Cultural Ethos	**Black Feminist Math PCK** Shawna's stances that stem from her alternative knowledge (e.g., power, criticality, knowledge production) o Hold high expectations for students o Maintain personal accountability o Teach with cultural responsiveness Shawna's alternative knowledge influenced her: o Knowledge of students o Knowledge of students' mathematical thinking o Knowledge of mathematical content and teaching o Knowledge of mathematics curriculum
Subtraction Unit Lesson 7-6 *Goal: Use patterns to develop fluency in subtraction*	**Ethic of Care**: Held self personally accountability to ensure students experienced mathematical success with a mathematics task **Identity worker:** Allowed for multiple interpretations of mathematical thinking, which contributed to	**Alternative Knowledge** Held self personally accountability to ensure students experienced mathematical success with a mathematics task **Knowledge of students** • Positioned all students as capable doers and thinkers of mathematics **Knowledge of students' mathematical thinking** • Applauded all mathematical thinking given while making sense of a challenging problem • Anticipated student conceptions of a representation **Knowledge of mathematical content and teaching**

	positive mathematics identity development **Black cultural ethos:** Facilitated a community collaboration about mathematical thinking Celebrated student thinking with applause	• Acted on student conceptions to encourage deeper mathematical conversations about patterns • Adapted lesson plan to create a more successful conversation while grappling with a high cognitive demand mathematical problem **Knowledge of mathematics curriculum** • Drew on experienced with difficult mathematical representations in curriculum • Decided learning how to discuss subtraction problems was the mathematical goal "use pattern" as a smaller component of learning how to subtract numbers • Maintained focus on main learning goals when not aligned with curricular lesson. Explored the learning goal "use patterns" while working towards targeted kindergarten goal to master subtraction

Table 7

Shawna's Black Woman Math Pedagogy: Shawna's Reteach Unit Overview

	Black Woman Math Pedagogy	
	Black Woman Pedagogy • Ethic of Care • Identity Work • Black Cultural Ethos	**Black Feminist Math PCK** Shawna's stances that stem from her alternative knowledge (e.g., power, criticality, knowledge production) ○ Hold high expectations for students ○ Maintain personal accountability ○ Teach with cultural responsiveness Shawna's alternative knowledge influenced her: ○ Knowledge of students

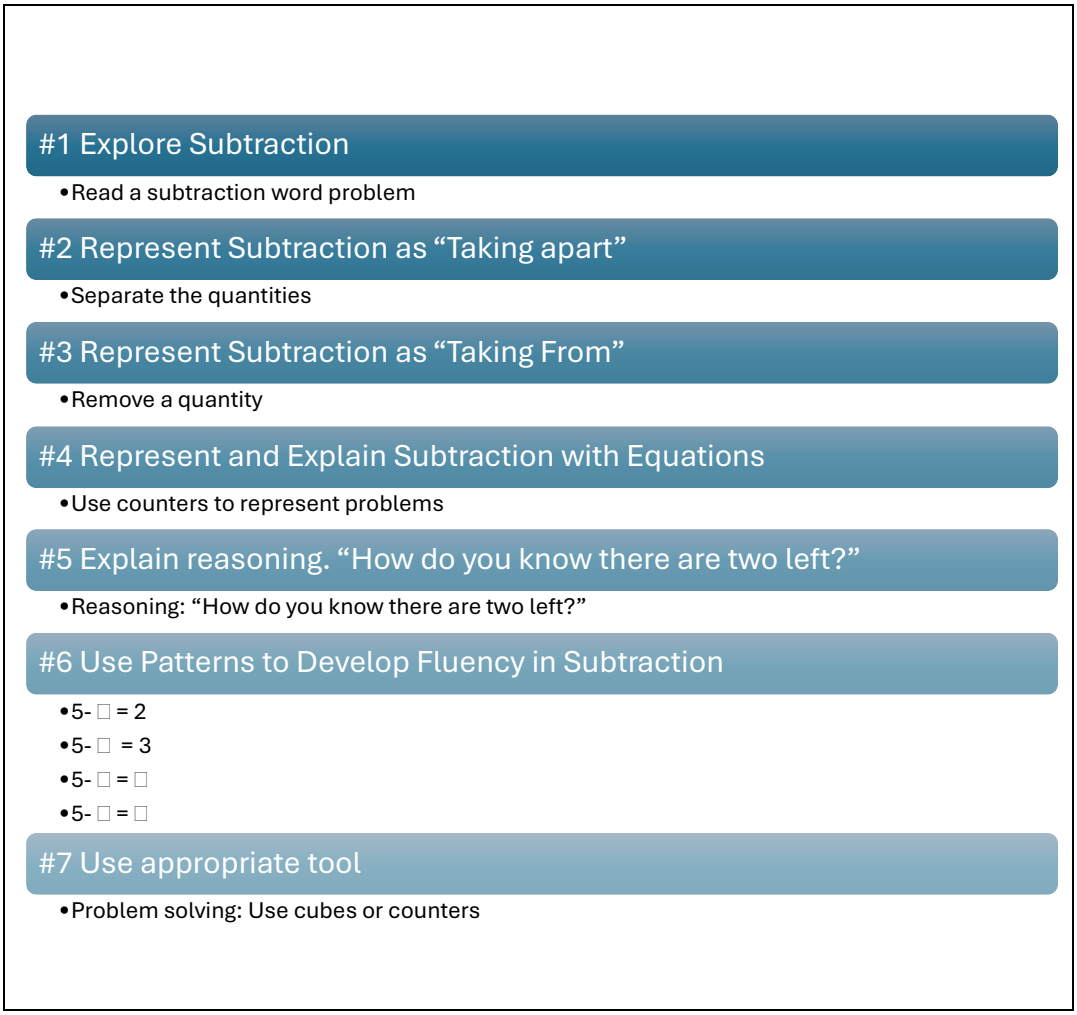
		○ Knowledge of students' mathematical thinking ○ Knowledge of mathematical content and teaching ○ Knowledge of mathematics curriculum
Shawna's Subtraction Reteach Unit *Unit Goals: Represent subtraction equations and word problems using manipulatives, drawings, and writing equations.*	**Ethic of care:** Held students to high expectations to master subtraction before moving on to other topics **Identity worker**: Conducted experienced subtraction reteach as a community activity rather than as remedial work for some **Black cultural ethos:** Included all students in the subtraction reteach Infused a Black cultural ethos into curriculum with enjoyable activities	**Alternative Knowledge** Discerned the official curriculum failed her students, which she would not permit Understood and acted on students' need to meet subtraction goals before moving on to new content **Knowledge of students** • Built relationships with students and families • Created word problems based on their everyday lived experiences **Knowledge of students' mathematical thinking** • Anticipated sticking points for students writing and acting out subtraction problems **Knowledge of mathematical content and teaching** • Demonstrated sophisticated knowledge of teaching mathematics and Common Core Math Standards • Incorporated varied hands-on activities to support students learning • Facilitated explicit conversations about the attributes of a subtraction equation **Knowledge of mathematics curriculum** • Adjusted curriculum quickly based on assessment • Brought fun to mathematics learning via curriculum choices

Shawna Teaches the Official Curriculum's Subtraction Unit

Shawna taught the official curriculum's subtraction unit for about two weeks in mid- to late March, 2023. The unit focused on K.OA.A.1, 2, and 5 under the umbrella "Understand …subtraction as taking apart and taking from," K.CC. A.3 "Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20," and K.CC.B.5 "Count to answer "how many?" questions about as many as 20 things…" (CCSSM, 2014). The flow of the subtraction unit was as follows in Table 8. First, the teacher reads aloud a subtraction problem

Table 8

Flow Chart of Official Curriculum's Kindergarten Subtraction Unit



and students determine how to subtract using manipulatives. The next two lessons focus on separating result unknown problem types. The fourth lesson requires students to use counters to represent a problem by moving counters from a starting amount. Lesson five presents a subtraction scenario and solution. Students use reasoning to describe why the solution is true. Lesson 6 explores patterns in subtraction equations given in sequential order, such as 5-2=3, 5-3=2, 5-1=4, 5-0=5. The final lesson asks students to use an appropriate tool to solve a subtraction problem.

Below I analyzed how Shawna taught *Lesson 6 - Use Patterns to Develop Fluency* using Black Woman Pedagogy and Black Feminist Math PCK. The curriculum's lesson objective was K.OA.A.5 "Fluently add and subtract within 5" and Standard of Mathematical Practice 7 (MP7): Look for and make use of structure (CCSSM, 2014). I chose this lesson because it lent itself to evaluating Shawna's Black Feminist Math PCK, specifically how Shawna attended to the curriculum's use of a difficult representation for young students to interpret, students' partial understandings due to the curriculum lesson's design, how Shawna facilitated learning opportunities for students by keeping the lesson open, and how Shawna used her teaching expertise to support student learning. Additionally, she brought in her alternative knowledge pertaining to culturally responsive mathematics teaching and transformed a dry curriculum lesson into a community conversation and celebration of students thinking around number patterns and subtraction.

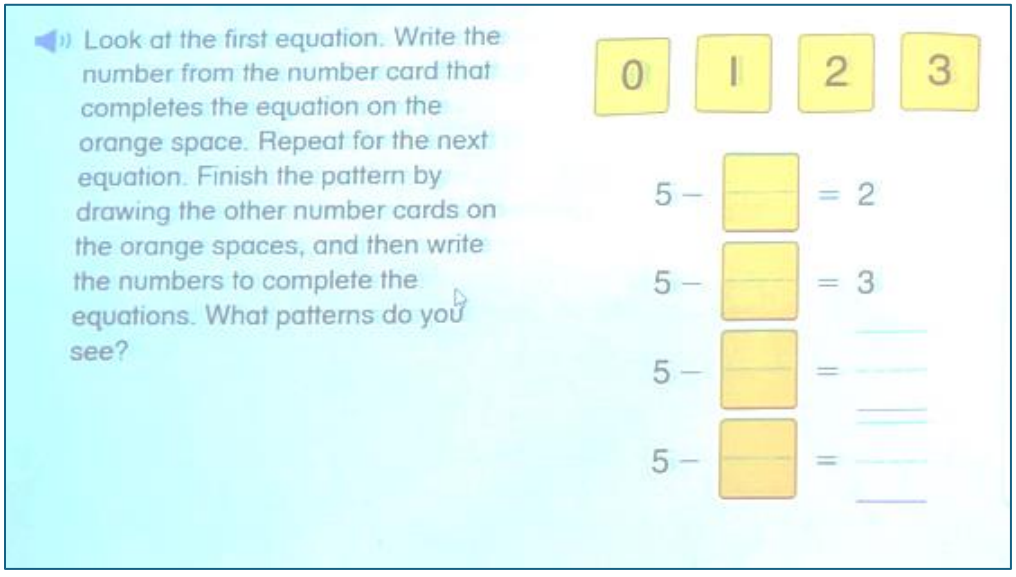
Lesson 7-6 Minilesson

Students entered the classroom and sat down on the carpet. Shawna briskly walked in after the last student and promptly started the usual Calendar routine: determine the date, change the calendar, add one additional Base 10 cube to represent the number of days in school thus far. Then she started the official curriculum minilesson. Shawna began by bluntly telling students, "We're not going to do the workbook today. If I'm being honest, I don't like the way that it's written. We're going to do it together up here." Patrick (Black) responded, "Okay" and everyone else waited for instructions. The minilesson problem of the day appeared on the project screen (Figure 9). Shawna clicked the audio prompt, and everyone heard the question read over the speakers.

> *Look at the first equation. Write the number from the number card that completes the equation on the orange space. Repeat for the next equation. Finish the pattern by drawing the other number cards on the orange spaces, and then write the numbers to complete the equations. What patterns do you see?*

Figure 9

Lesson 7-6 Minilesson Prompt, Kindergarten



After replaying the audio, Shawna asked students to turn and talk to figure out which numbers to use. She listened to two boys of African descent, Samil (Somali) and Issac (Ghanian), before counting down from five to call everyone back to attention. She then asked, "Do I have anyone who would like to share their thinking? Are there any patterns you are recognizing?" The official curriculum's objective was for students to count down the column of orange cards—the subtrahend—3, 2, 1, 0—and count up the difference—2, 3, 4, 5. However, that was not the patterns students initially noticed, a fact that Shawna had anticipated. Thus, Shawna was prepared to praise students for *any* pattern noticings and support a discussion in which they could eventually fill in the equations together. Shawna's preparedness with the curriculum created multiple opportunities for her Black and Brown students to shine in mathematics with a lesson that could have ended in confusion and frustration.

Osman, another boy of African descent, started off the conversation. He walked up to the screen with a pointer stick and pointed out the fives—the minuends—in a vertical column.

Shawna: Oh, you're noticing the fives are a pattern? That's a good noticing. Can you give him a round of applause? (*everyone claps*) Brian, what are you thinking?

Brian (white): I'm thinking that 5, 2, 5, 3, 5, 2, 5, 3.

Shawna: Ok, so you're thinking that maybe we'll have the same numbers here and here [for the difference?] What are you thinking, Sterling?

Sterling (Black): I think that 5 – 2 equals 5.

Shawna: Does it?

Students: No.

Shawna: Oh, I'm not talking to anyone but Sterling. Hold up 5. (*Sterling holds up 5 fingers*.) Take away 2. (*Sterling puts 2 fingers down.*) How many are there?

Sterling (Black): (*Shows 3 fingers to Shawna*.)

Shawna: Hm-hmm. So if we know that, where can we place 2?

Sterling: (*Points to the third empty card where 1 would go*) Here.

Shawna: You said 5 take away 2 is?

Sterling (Black): 3 (*Sterling points to the top orange box*).

Shawna [to everyone]: So where can we place a two?

At this point, Shawna opened the conversation back to the whole group to assess if students were following Sterling's thinking. Osman and Brian had previously noticed and predicted number patterns, and Sterling proposed the equation 5-3=2 to satisfy the first empty orange card. From his carpet spot, Samil (Somali) pointed to the third and fourth empty orange cards. Other students were looking at the screen, pointing at the screen, or sitting perhaps waiting for someone else to raise their hand. Shawna decided to move the conversation along and call on Samil. Samil's thinking helped the class notice a pattern emerging with the equations.

Shawna [*to everyone*]: I want you to think about it. I see some people thinking about it. 5-3=2 do you see a place to put it? He [Sterling] just said 5-3=2. Is there an equation up there?

Samil (Somali): (*Raises hand*.)

Shawna: Do you see it Samil? (*He nods.*) Can you show us?

Samil (Somali): (*Walks to screen. Points to where the 2 should go, the second empty card. Then switches to the first empty card*.) 3.

Shawna: Why does it make sense to put 3?

Samil (Somali): Because it won't make sense to put a 0.

Shawna: Would it make sense to put a 1?

Samil (Somali): No.

Shawna: Would it make sense to put a 2?

Samil (Somali): No.

Shawna: So you're saying that if you wrote 5 minus 3 (*writes in 3 on the computer projection*). Is that equation true if I write that? Do we agree?

Students: Yeah.

Shawna: I agree. So we know that 5-3=2 and 5-2=3. And our job is to use these cards. I'm going to cross out these cards. (*X's out cards 2 and 3.*) So we have 0 and 1 that needs to go somewhere. Where can we put them?

Samil (Somali): (*Points to the two remaining empty cards*) Put 1 here and 0 (*points*).

Shawna: How do you know that, Samil? How do you see that happening? You are correct.

Samil (Somali): It's counting down.

Shawna: It's counting down.

Gina (white): It's a pattern!

Shawna: It's counting down. You are correct, Gina. It *is* a pattern. Let's give Samil a round of applause. (*Students applaud Samil*.)

Now that the equations 5-3=2 and 5-2=3 were completed, Shawna looked for students ready to solve the rest of the task through reasoning. She spotted Howe, a white student who typically did not raise his hand, using a counting strategy on his fingers. She used the opportunity to highlight his mathematical thinking and positioning him positively.

Shawna: Let's read the equation.

Everyone: 5 minus 1 equalssss? (*Shawna spots Howe using his fingers*.)

Shawna: Howe, can you come up here and show us what you did?

Howe (white): (*Stands next to Shawna. Holds up five fingers, tucks his pinky in his palm.)* It's four. (*Shawna writes the number 4.)*

Shawna: Give him a round of applause. (*Everyone claps. Howe walks back to his seat smiling.)*

Shawna: And you know this one? [5-0] You can all say it. (*She smiles*.)

Students: Five!

Shawna: (*Shawna writes in 5.)* You all started off with the 5s, and then you found the pattern with Samil's help. 3, 2, 1, 0 (*pointing*). And over here, it's (*She points to the differences and everyone reads)* 2, 3, 4, 5. It's counting up… Good work.

Interpreting Shawna's Black Woman Math Pedagogy in Lesson 7-6 Minilesson

This lesson segment showed that students found great mathematical patterns to notice. However, they did not naturally see the pattern the curriculum lesson intended for them to see, indicated with red numbers below:

- 5- □3 = 2
- 5- □2 = 3
- 5- □1 = □4
- 5- □0 = □5

The lesson wanted students to decipher a counting by one's pattern. Rather than making students feel bad about misinterpreting the problem, Shawna anticipated the representation would be problematic to interpret. Instead, she led the class in a conversation where they collaborated on how to solve the problem.

Though it is not necessary for Black Woman Math Pedagogy to have overlapping elements, many elements of Shawna's Black Woman Pedagogy were interwoven with Black Feminist Math PCK (see Table 6). For example, personal accountability appeared both as an ethic of care and as alternative knowledge for Shawna, demonstrating that a Black feminist ethic of care about the role of teaching does impact Black women's mathematics teaching. Another example was how Shawna's knowledge of students' mathematical thinking aligned with her personal accountability to her students' success. Because she maintained an asset-based stance on teaching students—an element of her personal accountability to herself as a teacher—she contributed to building positive mathematics identities for her students. Identity workers such as Shawna positively and powerfully position their students as mathematically competent and lay the foundation for students to achieve mathematics success. Because Shawna anticipated that students would struggle reading the representation in lesson 7-6, she allowed them to notice any patterns and eventual arrive at noticing what number would satisfy 5-□= 2. Samil, a Somali student, demonstrated Black excellence by reasoning how to start filling in the missing numbers. Shawna's intentional lesson support allowed Samil and other students like Osman, Brian, and Howe to shine in mathematics. The overlap with Black Woman Pedagogy and Black Feminist Math PCK elements is fascinating, considering the subtly of Shawna's pedagogical decisions in the transcripts. An observer who had not consulted with Shawna during lesson planning and reflection might have missed the multitude of ways Shawna supported students' mathematical learning and identity development.

After this minilesson, Shawna sent students to Math Centers featuring subtraction games. She debriefed that she disliked having her students, who were still learning subtraction, suddenly have to focus on missing numbers in the curriculum's unit. The same subtraction lesson structure

occurred during the addition unit, with missing addends and sums. Because Shawna found the lesson goal inappropriate, she used her knowledge of mathematical content and teaching to adapt the lesson. She opened the discussion to notice any patterns. Students then made predictions about the missing numbers, some of which were inaccurate. For example, Brian thought that the pattern was 2, 3, 2, 3, 2, 3 for the missing difference. Brian's thinking made sense, considering that, earlier in the year, the class had learned about A-B repeating patterns. Shawna chose not to correct Brian's prediction, but instead kept the conversation open to more noticings. This was a sound pedagogical decision, because Brian's thinking did make a pattern, just not the pattern the curriculum wanted. Shawna supported students by showing them a strategy for keeping track of problems with multiple variables, which was crossing out the orange cards 0, 1, 2, 3 at the top as they solved the problem. Though the curriculum's problem was inappropriate for kindergarten level, she nonetheless created an opportunity to praise and uplift student thinking while maintaining a steady focus on the main learning goal of mastering subtraction. Her stance—to anticipate student thinking ahead of time and attend to the lesson standards while providing rich conversation and positive engagement—demonstrates Shawna's Black Feminist Math PCK knowledge of students' mathematical thinking and knowledge of mathematical content and teaching.

"My Way of Teaching": Shawna Reteaches Subtraction

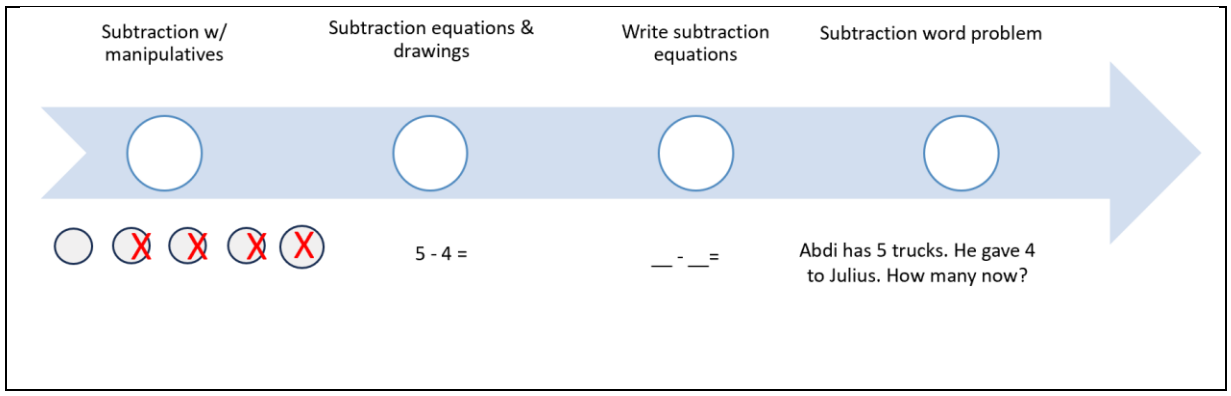
Shawn's critique of the K.OA Operations and Algebraic Thinking units of the curriculum was that they moved too quickly. After one last textbook lesson, Shawna paused before moving on to a new curriculum unit. Instead, she dived deep into a conceptual understanding subtraction. During the official curriculum's subtraction unit, students struggled to solve subtraction equations during their independent Math Centers rotation. Therefore, Shawna decided to start

"my way of teaching" just as she would any subtraction unit: from the beginning. Granted, Shawna used the term "reteach" when she started subtraction her way. She did not consider the need to reteach the fault of her students. Rather, her alternative knowledge asset-based stance identified the official curriculum as having failed her students.

Shawna's main objective was for students to understand what subtraction meant, physically, visually, and in the abstract. Her first activity focused on subtraction using manipulatives, the next on writing equations using manipulatives for support, followed by solving equations using abstract representations (drawings), and finally on solving subtraction word problems (Figure 10). Her minilessons involved counters, cubes, and whiteboards, which Shawna knew her students liked. During her reteach, Shawna incorporated her knowledge of mathematics content and teaching strategies that, as she pointed out, the curriculum unit failed to suggest: have an explicit conversation about the subtraction sign; have a conversation about what the equal sign means in a subtraction equation; offer lots of hands-on opportunities with different

Figure 10

Shawna's "Way of Teaching" Subtraction



types of manipulatives modeling subtraction; draw subtraction with circles and tallies; and finally, use simple kindergarten sight words to create easy-to-read word problems that draw on students' everyday experiences.

Shawna started Day 1 of her reteach with an explicit conversation about the subtraction sign. Every day after the reteach, Shawna asked, "What does subtraction mean?" and students would yell, "Take away!" In whole group minilessons, she began reviewing the methods for subtraction with manipulatives and writing subtraction equations explored during the official curriculum lessons. Her reteach Math Centers featured the game, Feed the Frog. Students started by picking a written subtraction equation on a card, such as 10-3=7 or 6-4=2. Students wrote the equation down, then used beads to act out the frog subtracting "flies" on a lily pad into his stomach. Once students wrote the difference, they picked another equation card. At students' desk, the independent center was a double-sided worksheet with subtraction equations within five. Students were encouraged to draw circles or tally marks before writing the difference. When done, students worked on subtraction equations on a district-approved website via individual student iPads. On the carpet, students reviewed Counting and Cardinality and recognizing numbers. They worked together or independently to count objects on a card then placed a clothes pin on the correct number out of three choices.

During Math Centers, Shawna closely watched students working at the subtraction centers, assessing their mathematical thinking by patiently watching them work and encouraging them to fill up a page with subtraction problems before time ran out. She sat next to students at the Feed the Frog center, making sure they wrote their equations and counted correctly. Then she monitored desk workers who were independently answering subtraction problems on worksheets. At the end of the mathematics lesson, Shawna reviewed their individual work and

incredulously declared, “it’s like they never learned subtraction” (Impromptu Interview, March 14, 2023).

Shawna’s deep knowledge of mathematics curriculum gave her insights into how the curriculum had inadequately taught students subtraction. Days later, during Gathering 1, Shawna explained her frustration with the official curriculum’s failure to meet the needs of her students. She stated with frustration, “My day one to reteach was the exact same as my day one every single other year of teaching subtraction in general. So I'm like, we just wasted how many days for them to learn nothing?!” (Gathering 1, March 18, 2023).

Shawna reasoned that the official curriculum spent too much time on number recognition and too little on Operations and Algebraic thinking, which she typically taught simultaneously. After Day 1, I asked Shawna how long she would take to conduct her reteach. She responded, “For as long as they need it. It depends on the students” (Impromptu Interview, March 16, 2023). The needs of the students dictated how long Shawna spent teaching subtraction. She commented that they were already ahead in the curriculum so there was time to spare.

Shawna followed Day 1 with nine more days of teaching across four main ideas until students showed mastery in subtraction with manipulates and writing and solving equations in Math Centers. Of significance was that all students participated in the subtraction reteach unit, rather than only a group selected based on their inability to do subtraction. From what I observed, no visible hierarchy of ability or power dynamics emerged in the class around who could or could not perform mathematics. Every student participated in enjoyable activities and none were singled out for not learning, which contributed toward positive student mathematics identities. Furthermore, every student was assessed, and every student participated in the same mathematics activities. For example, after three days of students reviewing Counting,

Cardinality, and number recognition, Shawna assessed students on these mathematical goals. Because students successfully recognized and could write out most numbers up to 20, Shawna shifted the carpet center to Subtraction Bowling. For Subtraction Bowling, students had two opportunities to bowl and knock down nine bowling pins. During each turn, group members counted how many pins were at the beginning of the turn, subtracted how many pins were hit, and recorded the difference. Students patiently waited to take a turn at bowling and excitedly jumped around when they hit pins. These student behaviors were typical in Shawna's mathematics classrooms because of the Black cultural ethos she had established. Shawna's warm demander demeanor was bolstered by the strong relationships built with her students. Students, in turn, knew there was time for work and play in mathematics and acted accordingly.

On Day 5, after students had demonstrated mastery with solving subtraction equations at their desks, Shawna switched to subtraction word problems using kindergarten sight words, student names, decodable words, and referring to culturally responsive experiences that students actually experienced and enjoyed, such as playing ball or collecting flowers. For example, Shawna typed out in large print a problem about the first-grade teacher across the hallway and a snack food that many students enjoyed, "Ms. Rhodes has 5 bags of Cheetos. She eats 1 bag." In smaller print, Shawna typed out, "How many does she have now?" Students had an extra-large box in which to show their work and a small box in which to write their answer. Using this template was a pedagogical decision based on her knowledge of kindergarten students' needs. Her template allowed students lots of space to show their thinking and made it less likely that they would need repeated adult help to read the word problem because problems consisted of familiar people, contexts, and easy words which supported students' access to the mathematical work.

After 10 days of reteaching subtraction, Shawna assessed students to confirm that all successful at writing out and solving the majority of subtraction equations given to them. Following her reteach unit, Shawna integrated addition and subtraction equations and word problems into her minilessons and Math Centers. Exploring addition and subtraction was the next unit in the official curriculum, but by this point she trusted her way of teaching for the past few years over the official curriculum's.

Interpreting Shawna's Black Woman Math Pedagogy in the Subtraction Reteach Unit

In sum, Shawna's reteach unit presented subtraction the same way she had done before the new curriculum adoption, when there was no official mathematics curriculum used in her school. She exhibited elements of Black Feminist Math PCK by relying on years of creating Math Center games, quick assessment tools, knowledge of mathematics standards, and what she knew about kindergarten students in general and her present individual students to guide the length of her reteach unit. She enacted Black Woman Pedagogy by exhibiting an ethic of care to create curriculum around her students' needs and interests, and made mathematics enjoyable while building mathematical knowledge. Shawna possessed a sophisticated understanding of teaching kindergarten mathematics and a strong sense of coherence across kindergarten mathematics standards that qualified her to assess a curriculum for its strengths and weaknesses. Having found many weaknesses in the official curriculum, she exhibited a deep knowledge of mathematics curriculum by adapting or even replacing lessons and units so that her students could learn the skills needed to be more than prepared for first grade.

At Gathering 1, Shawna went into depth describing her experiences with teaching subtraction and talking with her curriculum coach, a person who supported teachers with learning how to teach the new curriculum.

> We have somebody coming in once a week, from [official curriculum name]. And it's funny. We were in a meeting, and I was telling her, this is not good in any way. This is not good. Like the way that it jumps from strategy to strategy to strategy every single day. There's no mastery happening. There's a lot of exposure, which is great. But are they actually getting any of this? To me, this whole subtraction situation is proof in the pudding that they didn't get any of it. I was kind of blown away when I brought it up to her. And a bunch of different grade level teachers are saying the kids aren't mastering it. She's like, "Well, we're not worried about mastery. We just want them to see there's different strategies." But if we have to teach the standards, teaching these standards involves them *mastering*. So we're confused here. Yeah, I don't know what's going on with the curriculum. (Gathering 1, March 18, 2023)

I connect Shawna's comments regarding her curriculum coach to her earlier comments about the district not making culturally responsive decisions on behalf of Brown and Black students. For example, the curriculum coach stated that her lesson went well although students lacked opportunities to engage with the lesson in depth. Shawna, by contrast, upheld high standards for herself to get students to achieve mastery by facilitating deep engagement of mathematical concepts. Shawna was astonished at the curriculum coach's comments that ignored the inequity playing out in Shawna's district. Recall that Shawna spoke to racialized narratives regarding "what they say about our kids" in Title 1 Black and Brown schools, which contrasted to that of "kids up north" in more white, affluent areas who more easily experienced success in mathematics with any curriculum (Gathering 1, March 18, 2023). The district coach's comments lacked personal accountability for all kindergarteners to meet high academic standards. Though Shawna expressed political consciousness to recognize the racist and racialized forces occurring

within mathematics education, coupled with her commitment to refuse and resist low expectations for students (e.g. exposing to multiple strategies rather than invest time in learning and practicing strategies deeply—i.e. mastery) by using her own curriculum materials, she still experienced amazement when encountering ignorance about the failures school systems foist upon Black and Brown students.

Discussion

In this chapter, I described and documented Black Woman Math Pedagogy in Shawna's kindergarten mathematics teaching practice. Shawna's Black Woman Pedagogy intertwined with her alternative knowledge asset-based stances stemming from her racialized experience of never having had a Black teacher. Shawna's stances—high expectations of students, personal accountability to student learning, and culturally responsive teaching—came from her resolve to become the Black teacher she wished she had had. Shawna drew on Black Woman Pedagogy and her alternative knowledge stance to hold herself personally accountable to students' learning mathematics and meeting grade level standards. She also connected to a Black cultural ethos by making the mathematics classroom a place of enjoyment within a learning community, which was also tied to Shawna's stance as a culturally responsive teacher who brought students' lived experiences into mathematics and as an identity worker who let her Black and Brown students just simply *be* in mathematics.

I explored Shawna's Black Feminist Math PCK in day-to-day mathematics teaching. Shawna demonstrated exemplary assessment practices that allowed for swift curriculum adaptations based on her knowledge of students and their mathematical thinking. She developed a deep knowledge of mathematics content and teaching and the necessary knowledge of

mathematics curriculum to adapt entire units based on student needs that were grounded in her high expectations.

To demonstrate her Black Woman Math Pedagogy, I explore how Black Feminist Math PCK and Black Woman Pedagogy synergistically led her Black Woman Math Pedagogy to make instructional decisions during a subtraction unit. She enacted her Black Feminist Math PCK by creating a consistent lesson structure that allowed her to adapt her mathematics teaching, using both the official district materials her own curricular materials and as needed to ensure student success in kindergarten mathematics. Rather than settling for the district curriculum's one-size-fits-all approach, Shawna considered how she would hold herself personally accountable for ensuring her students reach mastery by using her Black Feminist Math PCK to produce mathematical experiences that held students to high expectations to meet kindergarten mathematics standards.

Using my Black Woman Math Pedagogy framework, I investigated the complexities of Shawna's mathematics practice during a subtraction unit and identified what made her such a successful teacher who resisted racialized narratives of Black and Brown students in her district. In the 7-6 subtraction lesson, Shawna modified a problematically composed curriculum lesson, allowing a rich conversation to emerge from her students about patterns and subtraction equations. A highlight was Samil, a Somali student, who with Shawna's support showcased his Black excellence in mathematics by using mathematical reasoning to determine patterns in a series of subtraction equations and elaborating on his thinking whenever Shawna pressed for justification.

Shawna's live racialized experiences gave her alternative knowledge, a Black woman's perspective, for how to lead her own students to have different schooling experiences than those

she had. Shawna wanted to become a teacher who, unlike her own teachers, held students accountable and cared for their learning. This stance manifested in many ways in Shawna's mathematics practice. For Shawna, teaching curriculum with a Black cultural ethos was critical to successful student learning in mathematics. High expectations and accountability were other aspects of the assets Shawna brought into her Black Feminist Math PCK, stemming from lived experiences with teachers did not show her the same ethic of care she gives her own students. Shawna did identity work by giving recognition and appreciation of her students' complex identities, which contributed to students growing their social and mathematical identities in her classroom. Additionally, Shawna perceived that being a Black woman in a leadership position as a teacher was impactful for her students' own identity development. Because she grounded herself in the wisdom of Black women teachers, her example impacted how students could view themselves racially, ethnically, socially, and mathematically while in her care.

Giving teachers like Shawna the freedom to use their Black Woman Math Pedagogy is critical to step toward more liberatory mathematics teaching. In many instances when mathematics curriculums are adopted, teachers are instructed or feel pressured to abide by the curriculum exclusively. Shawna, however, possessed the political consciousness focused on concept integrity to resist the district curriculum when it failed to serve her students' needs. Years of successful teaching had qualified Shawna to recognize when her students were being underserved well by the official curriculum. Shawna's Black Woman Math Pedagogy was a political act to, as she said, teach students "my way." She held herself personally accountable to meeting the learning needs of her students. Shawn's Black Woman Math Pedagogy resisted the narrative that blamed students for shortcomings in learning mathematics, and instead placed the onus on a schooling system that never considered the educational lives of Black and Brown

students at the heart of its choices. Had she been blocked from using her natural asset-based stances, her students might have struggled through learning kindergarten mathematics.

Significantly, by the end of kindergarten, Shawna reported that *all* of her students were ready for first grade. At the beginning of this case, I posed the question "How can that be?" Yet her prediction had been proved accurate. Above, I have supplied many examples of how Shawna supported student learning through the totality of her Black Woman Math Pedagogy. In Shawna's words, it was "because they're so capable."

Chapter 6: Discussion

I began this work to understand *Black Woman Math Pedagogy*, the pedagogical expertise of politically conscious Black women mathematics teachers. From a Black feminist perspective, Black Woman Math Pedagogy is the dialogical relationship between politically conscious Black women mathematics teachers' thoughts and actions about their day-to-day mathematics teaching. In Chapter 2, I laid out the theoretical underpinnings of Black Woman Math Pedagogy. I drew on Black feminist epistemology to interpret the legacy of politically conscious Black women teachers and constructed the framework Black Woman Pedagogy. To help me interpret Black women's mathematics teaching, specifically, I used a Black feminist lens to form a critical interpretation of conventional pedagogical content knowledge constructs for mathematics. I created Black Feminist Math Pedagogical Content Knowledge (Black Feminist Math PCK) to interpret how Black women's lived racialized experiences impacted their mathematics teaching practice. Using Black Woman Pedagogy and Black Feminist Math PCK synergistically illuminates elements of Black Woman Math Pedagogy in Black women mathematics teachers' practices.

Chapters 4 and 5 illustrated this theoretical framework through the case studies of two teachers—Leslie, a fourth-grade teacher, and Shawna, a kindergarten teacher—who enacted Black Woman Math Pedagogy. Importantly, both teachers worked in different contexts, grade levels, and had different lived racialized experiences. And yet, the instructional practices of both teachers reflected Black Woman Pedagogy and Black Feminist Math PCK, which combined to form Black Woman Math Pedagogy. The cases generalize to the theory of Black Woman Math Pedagogy.

Below, I discuss what Leslie and Shawna's cases offer for interpreting Black Woman Math Pedagogy. I discuss similarities and differences in how Leslie and Shawna enacted Black Woman Pedagogy and Black Feminist Math PCK. Then, I discuss the contributions that this dissertation offers to the literature pertaining to Black women mathematics teachers, as well as how Black Feminist Math PCK broadens the ways we conceptualize mathematical pedagogical content knowledge. I end with implications for future research with Black women mathematics teachers.

Black Woman Pedagogy

To understand what Black Woman Math Pedagogy entailed, I first established how Leslie and Shawna enacted Black Woman Pedagogy in their mathematics practices through an ethic of care, viewing themselves as identity workers, and using a Black cultural ethos.

Both Leslie and Shawna enacted Black Woman Pedagogy through an *ethic of care* for the wellbeing of Black and Brown students and a deep commitment to becoming effective, knowledgeable teachers on their behalf. Though care has been studied in mathematics by examining teacher-student relationships (Bartell, 2011; Maloney & Matthews, 2020), Leslie and Shawna enacted a Black feminist ethic of care that was unconditional for every one of their students. Leslie enacted an ethic of care by engaging in professional development, growing her mathematics teaching knowledge to provide the best possible education for her students. For Shawna, an ethic of care appeared as high expectations for every student and viewing each as capable.

Each teacher enacted an ethic of care that refuted the deficit-focused racialized practices common in their schools and districts. Leslie and Shawna's critical perspective defied research trends that have indicated the more ethnically, racially, and linguistically diverse a classroom, the

less likely students are to encounter a teacher who has productive views of students or who strive to adjust their practices to meet students' needs (Wilhelm et al., 2017). Instead, Leslie and Shawna enacted Black feminist care practices in their teaching by positively positioning students, especially Black students. Leslie and Shawna enacted mathematics instruction worthy of Black students because they refused and resisted violence in mathematics and instead gave Black students care and celebrated their brilliance (Martin, Price, and McGee, 2019).

Each teacher was an *identity worker* who attended to students' racial, ethnic, academic, and social identities. Although student interviews about identity development falls beyond the scope of this research, both Leslie and Shawna fostered identity development in ways backed by research that attends to humanizing mathematics, distributing power and intellectual authority, increasing mathematics success, and cultivating student belonging (J. Aguirre et al., 2024; Gutiérrez, 2013a, 2018; Nasir & de Royston, 2013; Zavala & Aguirre, 2024). Across cases, both teachers built strong relationships with their students, which has been linked to positive student identity development. In such relationships, each teacher demonstrated genuinely liking her students through joking and laughing with students and instilling a sense of belonging through community. Strong relationships with teachers and teachers' acceptance of students' cultural and racial identities contributes to students' sense of belonging and success in mathematics to support their mathematics participation and identity development in the classroom (Birky et al., 2013; Johnson et al., 2013; Leonard, 2019).

Another way Leslie and Shawna fostered identity development was by intentionally grouping students in heterogenous or randomized groups. Research on cooperative learning in mathematics finds that peer groups can support positive identity development in mathematics. Esmonde's (2009) review of cooperative mathematics learning research concludes that

cooperative group structures have the opportunity to positively support students identity development and increase equity in opportunities to learn in mathematics classrooms. In Math Centers, Shawna's students were given the choice to work together or independently, which offered students flexibility in how they engaged with mathematics. Leslie frequently adjusted group structures in her classroom and attended to group dynamics that would encourage learning. Early in the year, Leslie structured homogeneous groups to encourage students to use their strengths to support one another. By the end of the year, she experimented with randomized grouping and everyone taking a turn at writing down mathematical ideas, which further disrupted status and power structures around mathematical abilities.

Aguirre and colleagues (2024) conclude that when teachers are intentional about the structures of their classroom activities and maintain productive views around what counts as mathematics—for instance, a focus on mathematical thinking instead of speed—they can influence their students' positive mathematical identity development. This influence is evident in Leslie's resistance to labels that designated some of her students as "advanced learners" based on narrow views about standardized test performance mattering more than critical thinking and explanation skills. Shawna likewise refused her district's initiative that labeled Black boys as having "deficits" by providing her own mathematics curriculum that cultivated opportunities for all students to master kindergarten standards. Furthermore, all students in Shawna's classroom had access to the same task, disrupting hierarchies that could appear with being perceived as "smarter" or "at-risk." Aguirre and colleagues emphasize the importance of teachers recognizing and honoring the multiple identities students bring into the mathematics classroom. Leslie and Shawna's commitment to prioritize mathematical thinking and to let students just *be* in their full humanity while learning mathematics is a powerful way to foster students' multiple identities

and create mathematical spaces welcoming to Black and Brown students, who are typically marginalized.

Finally, each teacher enacted Black Woman Pedagogy by using a *Black cultural ethos* in their mathematics teaching. A Black cultural ethos encompassed building a learning community that included joy, elevating Black excellence, and shared success through collaboration. Interestingly, these elements are typically illustrated in Black women teacher literature to demonstrate how Black women teachers support Black student learning (Acosta, 2019; Foster, 1994; Ladson-Billings, 1994). The current research expands that finding by demonstrating that ethnically, racially, linguistically, and economically diverse students all benefit from Black Woman Pedagogy. This fact is significant giving that many studies of Black teachers have focused on the impacts they have on Black students specifically. Milner (2006) for example, found that Black teachers create positive learning environments, are role models, have culturally informed relationships with Black students, and use these knowledge bases to create optimal learning environments for their Black students. Leslie and Shawna positioned Black students to shine through Black excellence in racially diverse classrooms. I argue that the teachers' non-Black students who witnessed Black excellence in their peers *and* their teacher benefited from liberatory, anti-racist work in the mathematics classrooms.

A noteworthy example of Black cultural ethos benefitting diverse learners can be seen in how Leslie and Shawna enacted joy within their mathematics teaching. This component looked different for each teacher, as is fitting given the age difference in their students. Leslie enacted a Black cultural ethos by allowing and enjoying jokes within the mathematics lesson, such as with *the Enchilada Problem* when Dora, a white student, spoke of a pan of 4/6 enchiladas cooked with 2/6 brownies. Both teacher and students laughed at the absurdity of the image. Shawna's

stance was that learning should be fun, that joy should be an integral part of a child's education, starting with kindergarten. Shawna enacted a lively joyous lesson, for example, when she recounted a culturally responsive mathematics lesson in which each student took on the persona of a teen number to give students practice with remembering them. Shawna's enjoyable lesson drew on students' mathematics knowledge and creativity to imagine what a teen number's personality and attributes might entail.

Focus on enjoyment when learning mathematics is no trivial side dish. Shawna's stance connected with hooks' (1994) notion of a pedagogy of freedom that allows students and teachers to pursue ideas and find enjoyment while teaching and learning. hooks' wrote that her earlier years as a young girl in all-Black schools consisted of joyful learning. In contrast, in integrated schools led by white teachers, she was left bored and unfulfilled. I compare this image of being bored and unfulfilled with Leslie's stance that humanizing school experiences was important. Indeed, bringing joy, play, connectedness, and emotions into mathematics is an act of humanizing mathematics (Gutiérrez, 2018; Parks, 2015; Zavala & Aguirre, 2024).

Black Feminist Math PCK

Though much was learned using Black Woman Pedagogy as a construct to explore Leslie's and Shawna's Black Woman Math Pedagogy, I needed a construct by which to interpret their day-to-day mathematics teaching. Missing from conventional PCK research is a Black feminist perspective and a perspective centering Black women teachers. I created Black Feminist Math PCK, a Black feminist PCK construct that describes how Black women's lived racialized experiences contribute to asset-based alternative knowledge about teaching and learning mathematics.

Alternative Knowledge. I investigated how each teacher's lived racialized experiences informed their asset-based stances about teaching and learning mathematics. For Leslie, who turned her traumatizing schooling experiences into teaching stances, alternative knowledge about teaching mathematics led her to 1) humanize students, 2) make mathematics more accessible for students, and 3) bring socioemotional learning into mathematics. In contrast, Shawna, who had experienced successful schooling, wanted to become the Black teacher she wished she had had. Shawna connected with emulating her Black mother and developed alternative knowledge that connected with stances described in Black teacher literature: 1) hold students to high expectations 2) hold herself personally accountable to student learning 3) use culturally responsive teaching in mathematics.

I want to reiterate that each teacher shared similar stances in their mathematics practices. For example, both Leslie and Shawna made mathematics more accessible to their students and held themselves personally accountable for their students' learning. The listed stances for each teacher were the most salient themes from their alternative knowledge, which was a driver for how each teacher attended to power, criticality, and knowledge production when interpreted through Black Feminist Math PCK. Below I review what each teacher's practice revealed about Black Feminist Math PCK.

Knowledge of Students. Knowledge of students offers a new interpretation of PCK. Conventional PCK constructs do not explicitly attend to what teachers know about their students and how this knowledge informs not only their mathematics teaching, but how they position students to foster positive mathematics, social, and racial identities. Knowledge of students connects to Black cultural ethos and Black excellence, particularly. Both Leslie and Shawna highlighted Black students and supported students by adding ideas or restating their brilliance in

front of their peers. Across cases, teachers used their knowledge of students to push other students' thinking and conceptions of mathematics. For example, in each of Leslie's three mathematics lessons, she pressed many of her students, Black, Brown, and white students to shift how they thought about being successful in mathematics, from giving right answers to explaining their mathematical thinking. Leslie used her knowledge of students to build more robust mathematical identities that considered deep mathematical thinking as a sign of being mathematically successful.

Knowledge of Students' Mathematical Thinking. Attending to students' mathematical thinking entailed student engagement with content. High engagement was a norm in each teacher's classroom. Though each teacher facilitated student engagement differently, such as with flexible or assigned groups, or classroom discussions versus modeling minilessons, many opportunities arose in each classroom for students to express their thinking through talk, collaboration, hands-on activities, and computer programs. Teachers used their knowledge of students' mathematical thinking to plan effective lessons that maximized participation and created many opportunities to honor student thinking. For instance, Leslie used her knowledge of students' mathematical thinking to restructure the enchilada problem and open up a quandary for deeper mathematical thinking. Shawna modified a poorly constructed lesson positively to powerfully position her students to shine in their mathematical thinking while still meeting all official mathematical learning goals.

Knowledge of Mathematical Content and Teaching. Both teachers had sophisticated knowledge of mathematics content and teaching but differed in how they taught and ways their stances influenced their teaching. Both teachers drew from a broad repertoire of mathematics activities including representations, hands-on tools, and collaborate group structures. In Leslie's

case, giving her students agency to participate in their mathematical learning was key in her teaching practice. She continued perfecting her Black Feminist Math PCK by trying out new teaching strategies, such as the Slicing Cake lesson that facilitated critical thinking and creativity among her students through an open task and randomized groups. Shawna's affirming and joyous learning environment was foundational for encouraging students to work hard and participate in mathematics lessons and Math Centers. Shawna, in turn, enacted personal accountability by continuously monitoring student progress and swiftly modifying minilessons and Math Center activities to support students in meeting her high expectations.

Knowledge of Mathematics Curriculum. Interestingly, this study occurred during the first year of a mathematics curriculum adoption in Leslie and Shawna's district. Though critiquing curriculum was not within the original scope of this study, I found it enlightening to witness the day-to-day tensions both teachers experienced while navigating a new curriculum mandate, interpreting how to teach with the official curriculum, and making pedagogical decisions to transgress and leverage their own pedagogical expertise to create more meaningful mathematics learning experiences. The fact that Leslie and Shawna had to grapple with sticking to a pacing guide and using their resources to increase student learning allowed me to perceive how both Leslie and Shawna used the entirety of their knowledge of curriculum: the official mathematics curriculums that they had taught in the past, the district's adopted curriculum during the year of the study, and personally owned or designed curriculum materials. My research offers detailed findings about how mathematics teachers making daily decisions around planning and enacting mathematics curriculum. It expands ideas about the importance of having "political knowledge" (Gutiérrez, 2013b) to navigate decisions about teaching Black and Brown students

that maintain asset-based views of students, establish high cognitive demand, humanize students, cast mathematics as enjoyable, and meet the learning goals.

Teachers working in urban schools with high numbers of Black and Brown students are often closely monitored about how they teach because of who they teach, leaving teachers to feel pressured not to deviate from an official curriculum that, in fact, does not serve their unique students (Gutiérrez, 2013b). This tension applies especially to Leslie and Shawna, given that Black women are often closely scrutinized for deviating from the white norms of being a teacher in schools, such as how they discipline, speak, and interact with students (Acosta, 2019). Leslie, for example, often felt that she stood out because her view of teaching differed drastically from that of her white colleagues. Shawna, on the other hand, felt supported by her racially diverse staff and colleagues to take liberties in deviating from the curriculum when necessary. However, her curriculum coach and principal still required that Shawna teach the official curriculum. Though Leslie's and Shawna's deviation from the official mathematics curriculum was at times subtle, it nonetheless connected to the history of Black women teachers' subversive teaching, which resisted and deviated from white normative teaching on behalf of Black children (N. R. Davis et al., 2021; J. Givens, 2021; Mirza & Reay, 2000; Perlstein, 1990).

Black Woman Math Pedagogy

Black Woman Math Pedagogy offers a pathway to study Black women mathematics teachers' liberatory teaching practices. What my findings reveal is the intricacies of Black women's mathematics practices and their knowledge constructs. We already know that politically conscious Black women teachers were effective at teaching broadly, but this research provides evidence on how politically conscious Black women effectively teach mathematics to students from diverse backgrounds. When looking at two politically conscious Black women

teachers, we see commonalities like having high expectations of students, cultivating student agency and creativity, powerfully positioning Black students in mathematics spaces, and showcasing Black excellence. Differences across each case indicate that some elements of Black Woman Math Pedagogy will likely show up in some Black women's mathematics classroom and not others. This variation is to be expected in Black Woman Math Pedagogy because Black women mathematics teachers are not a monolith. We all have different lived racialized experiences, styles of teaching, classroom contexts and students. Therefore, politically conscious Black women's mathematics teaching will be different, and yet, the elements of Black Woman Math Pedagogy will still be visible.

Empirical Contributions to Black Women Mathematics Teacher Literature

I undertook studying Black Woman Math Pedagogy because, outside of Joseph's Black Feminist Math Pedagogies (2021) framework, the literature lacked a robust analysis of Black women's liberatory pedagogies in mathematics. Much more potential to interpret Black women's mathematics teaching through Black Woman Math Pedagogy remains because the framework reveals the complexity of Black women's mathematics practices. Many instances arose in Leslie's mathematics teaching when her Black Feminist Math PCK and Black Woman Pedagogy overlapped to support students. Leslie aimed to build students' positive mathematics and racial identities through a Black cultural ethos while teaching mathematics. What stood out in Leslie's case was her truth-telling. She had explicit conversations about the inequities of the schooling system toward students, particularly Black students, and how racism operates broadly within our society. This truth-telling about inequity occurred during her mathematics class and could influence not only students' own racial and mathematical identities, but how they interpret the identities of their peers and others with differing racial backgrounds as theirs.

I find Shawna's mathematics teaching fascinating because of how tightly her Black Woman Pedagogy and Black Feminist Math PCK were interwoven. Shawna's alternative knowledge asset-based stances were to hold students to high standards, which she supported by also holding herself personally accountable to her students' mathematical success. In turn, she held herself personally accountable to making lessons culturally responsive for her students through enjoyment of learning and community-oriented learning activities. When teaching and calling on students to share their thinking, Shawna aligned knowledge of students' mathematical thinking with identity work that supported building students' positive mathematical identities. The entirety of Shawna's mathematics teaching practice could appear simple to some observers. However, using Black Woman Math Pedagogy to interpret her mathematics teaching uncovered multiple nuanced ways that she intentionally supported students.

Both Leslie and Shawna's cases extend what we know about Black women mathematics teachers and their liberatory pedagogy in their day-to-day teaching practice. This work extends research on Black Woman Pedagogy by analyzing how Black women draw on their lived racialized experiences and the intentional choices they make when teaching their students mathematics. These cases also revealed the complexities and the nuances of Black women mathematics teaching, about which too little is known. Often when research is undertaken, it focuses specifically on Black women's trajectories into the field, racialized experiences, beliefs, and practices (Birky et al., 2013; Clark, Frank, et al., 2013; Frank et al., 2018, 2021; Frank, View, & Williams, 2019; Leavitt, 2010; McVicar, 2024) and not the connections between these elements.

My previous research (McVicar, 2024) connected Black women mathematics teachers' racialized mathematics experiences with their beliefs about teaching mathematics, concluding

that liberatory stances of care, personal accountability, and the desire to be a role model for students impacted how Black women thought about teaching mathematics. The dissertation extends my previous research on two fronts. One, care and personal accountability appeared as stances across both case studies, further indicating that an ethic of care and personal accountability to student learning is common in Black Woman Math Pedagogy. Second, this research confirms that the stances of Black women mathematics teachers directly impacts pedagogical decisions made in their mathematics teaching practices. Research has already connected that teacher beliefs impact their practices (Mapolelo & Akinsola, 2015). Black Woman Math Pedagogy allows for an analysis of how multiple focal points relate to Black women's mathematics teaching positively support student learning. Much more remains to be uncovered about the liberatory teaching of Black women mathematics teachers. Given that Black women may be deterred from using their pedagogical expertise and that their expertise continues to be overlooked in education research, the education field must take the opportunity to learn more from Black women mathematics teachers.

Theoretical Contributions to Conceptualizing Mathematics PCK

My framework shows that lived experience impacts how politically conscious Black women interpret PCK. In Black feminist epistemology, the use of lived experience as a criterion of meaning supplies a valid way for Black women to build knowledge about the world around them, including mathematics. Black women's lived racialized experiences create knowledge about mathematics teaching and learning that becomes beliefs about teaching mathematics. Teacher belief literature shows that beliefs inform teachers' mathematics teaching (Mapolelo & Akinsola, 2015). Black women mathematics teachers with political conscious bring this knowledge base grounded in lived experience into their mathematics teaching. In Black Feminist

Math PCK, Black women's alternative knowledge about teaching and learning mathematics intertwines within their pedagogical content knowledge.

Black Feminist Math PCK pushes the boundaries of how we define PCK. It is not enough that PCK includes knowledge of curriculum, knowledge of students' mathematical thinking, and knowledge of teaching mathematics. Black Feminist Math PCK attends to who holds power in the mathematics classroom, critiques white normative ways of teaching and learning mathematics that privilege some and acknowledges multiple ways to demonstrate and produce mathematical knowledge. This critical PCK construct also insists on intentionality about teaching mathematics for Black and Brown children. Martin (2007) critiques PCK research that does not speak on behalf of educating Black children, which often leads to missionary work from teachers. Martin found that "Rarely, if ever, in studies of mathematics content knowledge and pedagogical content knowledge is there any mention of who the teachers are as people, beyond knowing they do or do not have a deep understanding of mathematics" (p. 14).

Conventional research on pedagogical content knowledge focuses on teaching, not teachers, and "is concerned with the tasks involved in teaching and the mathematical demands of these tasks" (Ball et al., p. 395). Conversations about teaching mathematics to support student learning based on PCK are narrow in focus when taking up this construct, such as determining how to increase the pedagogical content knowledge of teachers (Depaepe et al., 2013). Though this conventional PCK framework helps the mathematics field articulate the knowledge needed to teach mathematic content, it can be strengthened by considering teachers' knowledge bases stemming from lived experiences that also support an avenue for teaching mathematics that attends to power, criticality, and knowledge production in mathematics. Furthermore, we must account for teacher views of teaching mathematics to Black and Brown students. Teacher views

impact how they enact their PCK knowledge, which can work toward or against liberation and joy for Black and Brown students.

We must not assume that, because a teacher has robust pedagogical content knowledge, they can successfully teach mathematics. Though I agree that mathematics teachers need opportunities to develop their mathematics PCK, we must consider how teacher's stance about teaching mathematics to Black and Brown students impacts their pedagogical content knowledge and their mathematics teaching practice. While studying a Black woman mathematics teacher who uplifted Black and Brown students as she taught, Leavitt (2010) realized the implication of teacher education programs graduating preservice teachers simply because they met the requirements. As Leavitt explains, "a teacher is more than someone filling a place to teach mathematics lessons by following a script. She is more than someone who has passed the requisite coursework and implemented strategies for teaching" (p. 149). Furthermore, Martin (2007) concludes that the field needs more thoughtful criteria about what it means for a teacher to be qualified to teach Black students. Mathematics education must look beyond a teacher's ability to teach content knowledge and pedagogical content knowledge. My study sparks further dialog about how mathematics education can conceptualize pedagogical content knowledge that works in service of Black and Brown students by considering how all teachers can refuse and resist anti-Blackness in mathematics by using asset-based stances to teach it. In a Black Feminist Math PCK construct, asset-based stances came from Black women's alterative knowledge, which interrupted white institutional business as usual with Black and Brown students. Both Leslie and Shawna created ways to highlight Black excellence in their classroom and to build positive mathematics, racial, and cultural identities.

Only a handful of researchers bring a Black feminist lens into mathematics education. Leonard (2019) used Black feminist thought along with critical race theory in her theoretical framing of culturally specific mathematics pedagogy. However, Leonard does not make explicit connections to Black feminist theory beyond the scope of her theorizing. Joseph's (2021) Black Feminist Mathematics Pedagogies uses theories of Black feminist thought and Black girlhood to create a pedagogical framework that centers Black girls and their identity development in mathematics classrooms. Building on this previous work, my research uses a Black feminism lens to interpret the teaching and scholarship of Black women teachers to create Black Woman Pedagogy. I also center Black feminist thought to critically interpret the relationship between Black women mathematics teachers' lived racialized experiences with their pedagogical content knowledge, thus constructing Black Feminist Math PCK. Leonard, Joseph, and I all bring a critical lens into theorizing about teaching and learning within mathematics education that provides new insights when centering Black women teachers and Black girls.

Implications for Practice and Teacher Education

This research answers the question what does the day-to-day teaching of mathematics look like for politically conscious teachers? Black Woman Math Pedagogy can influence how we think about educating preservice teachers and providing professional development to inservice teachers. It is a mathematics pedagogy that centers Blackness, identity work, and Black feminist ethic of care within mathematics teaching. No previous work exists at the nexus of these ideas. Black Woman Math Pedagogy gives teachers who want to work toward liberatory pedagogy a model for undoing injustices in mathematics education. A practical contribution is to think about creating learning spaces for Black women pre- and in-service teachers to study the history of their forebearers' pedagogical expertise, how political consciousness can be used, or is already

used, in their mathematics teaching practices. Understanding their pedagogy and giving a name to ideas is powerful. Understanding Black Woman Pedagogy, Black Feminist Math PCK, and how they work together as Black Feminist Math Pedagogy is empowering.

Another implication for Black women teachers' practice is for stakeholders to evolve a more in-depth understanding of the liberatory work that Black women mathematics teachers undertake that refuses and resists "business as usual" practices that perpetuate inequities for Black and Brown students. As an observer who spent many hours in Leslie and Shawna's classrooms, I recognized how incredibly complex and nuanced many of their Black Woman Math Pedagogy practices were. I unearthed those complexities by watching them teach mathematics, interact with students, and listen to their deep reflections around power, identity, and knowledge production. It makes me think of teacher observations with administration and the importance of letting teachers discuss the moment-to-moment decisions they make in service of their students. Otherwise, it may be easy to miss their pedagogical expertise.

Implications for Future Research

In 2024, at the time of this writing, little research in mathematics education specifically takes into account how teachers' racialized experiences shape their teaching. We need a new perspective on teachers, especially Black women teachers like Leslie and Shawna, whose lived racialized experiences hugely impacted how they taught their students. Their narratives highlight the benefits of research spaces that (re)affirm Black women's work. Future mathematics equity work should continue looking at Black women in mathematics and how they use their Black Woman Math Pedagogy. Centering Black women in mathematics students will move the field towards more equitable practices and begin dismantling racism, patriarchy, and oppression in mathematics education.

Though Leslie and Shawna represent only two cases, they represent the Black women and girls found at the margins of mathematics research. First and foremost, it is important to recognize that findings about Leslie and Shawna's work add to only a handful of cases in mathematics education that specifically focus on Black women teach mathematics. Anyone who works in mathematics education—educators, researchers, practitioners, and policy makers—must take into account how Black women's mathematics teaching can differ so greatly from that of other teachers in ways that allow for joy, empowerment, and inclusion. Using a Black feminist lens in this research offered 1) understanding Black women's mathematics experiences in the classroom, and 2) understanding Black women's assets to explore humanizing mathematics practices.

So little research captures Black women mathematics teachers' pedagogical expertise. My conceptual framework for Black Woman Math Pedagogy is yet in the nascent stage of development. From a study that took place over the course of one academic year, I present a snapshot of two socio-politically conscious Black women teachers' Black Woman Math Pedagogy. However, teaching is dynamic and changes over the lifetime of the teacher. While I present Leslie and Shawna's teaching over one year as a fixed point in time, it is important to acknowledge that their Black Woman Pedagogy, their Black Feminist Math PCK, and their overall Black Woman Math Pedagogy will possibly change over time. Thus, more research must be conducted about how Black Woman Math Pedagogy develops for Black women mathematics teachers. This dissertation is only the beginning of developing a construct to considering the pedagogical expertise of Black women mathematics teachers. Further work is needed to explore how politically conscious Black women teach mathematics over time.

Further research to extend this framework beyond the elementary context and determine what Black Woman Math Pedagogy may look like at the secondary or higher education levels will be valuable. Another avenue of pursuit is to produce empirical studies of Black Woman Math Pedagogy that capture the experience of students within the classrooms working with such teachers. This work will support understanding the effectiveness of Black Woman Math Pedagogy in mathematics, possibly tied closely to Black Woman Pedagogy or Black Feminist Math PCK.

Conclusion

My work responds to the conversation about the demographic and democratic imperative of having more Black teachers (Achinstein, 2002; Frank et al., 2018). Typically, the desire for Black teachers comes from a perceived demographic imperative, that Black teachers are needed to teach Black children. Many issues with the state of schooling for Black students arise from this demographic imperative, including acknowledging the systemic harm Black children experience in white institutional spaces. My study speaks to the democratic imperative that Black women teachers are pedagogues, and their expertise is sorely needed in an education system where equity in mathematics education remains elusive (Barajas-López & Larnell, 2019; Martin, 2003). I studied the pedagogical expertise of two Black women mathematics teachers who successfully taught students from diverse backgrounds. Teaching mathematics is complex, and understanding the reasons why and how critical mathematics pedagogies such as Black Woman Math Pedagogy are taken up is crucial to teaching mathematics for liberation.

For far too long, Black women's mathematics pedagogical expertise, both theoretically and empirically, has remained hidden. As we continue exploring our Black Woman Math Pedagogy, Black feminist epistemology must stay at the heart of consideration because it

necessitates a focus on Black women. Black women must remain at the center of this theorizing. Our ways of interpreting the world and taking action serves not only us, but all those who standing in interlocking oppression. We Black women mathematics teachers come from a long lineage of Black women teacher excellence. That expertise, like Black Woman Math Pedagogy, is within us. We need to tap into that expertise and bring it to light—because us Black women are key to our shared liberation.

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Appendix A: Sample Interview 1 Protocol

Math Autobiography Protocol Interview
Adapted from Mathematics Autobiography Protocol, Aguirre et al. 2013

Interviewer Opener:
I'm going to test out my recorder now just to make sure it's working. (State name and date on recorder)

Preamble:
Thanks for meeting with me today! I asked you to write a math autobiography to help us have a conversation about your school experiences learning, and then teaching mathematics. Feel free to reference your math autobiography throughout our conversation.

The purpose of this interview is to learn how your math experiences shaped your math beliefs and teaching practice. It helps me get to know you and help me think about our work moving forward. In this interview I'm going to try to learn a little bit about your personal history, your lived math experiences inside and outside of schools, your current beliefs about teaching math, and how you think about your math teaching practice. It's okay if you don't cover everything today. This is the start of many conversations.

During this interview, you might notice that I am looking at or reading from this sheet, this is just to help me keep track of where we're at in the interview. I'll also jot down some of what we talk about. It would be really helpful if we can talk for 45– 60 minutes about this topic, in the context of your work and experiences with mathematics growing up. Any questions before we begin?

Reminder this is a conversation, not just a one way interview questions.

First I want to capture some demographic information…

Interview Questions	**Question rationale (connection to RQs, conceptual framing)**	**Extra probing Questions:**
PART 1 ***Demographic info:*** Age? Schools attended? Degrees obtained? Schools and grades taught? Current school and grade level? Do you come from a family of teachers? - OR: Who do you consider your teaching community	Gathering demographic info	

(family, friends, relatives, etc.)		
Tell me about your math classroom this year…. Who are the students What are your teaching in math? What curriculums are you using? Any special trainings or building wide math programs supporting your math practice?	Get to know site	
And tell me about your school… What would you tell an incoming fellow teacher about your school? What about a parent?	Getting to know site	
Part 2: ***Read Math Autobiography*** Now we're going to read our math autobiographies. In all fairness, I wrote my math autobiography too. I'd like to share it with you so you can get to know me, too. Would you like to go first or second? **What questions do you have for me?** - Can note comparisons of our experiences, or differences. **Afterward reading autobios…** "Reflect on anything that caught your attention while writing you autobiography, or reading it aloud."	-Lived experiences - Building connection w/ participants	**Probe: Questions missed from autobiography prompt: Tell me more about...** ☐What was learning mathematics like for you in school? ☐Were most students in your math classes of the same race, gender, or socioeconomic background as you? ☐What specific experiences affected your mathematics learning? ☐How did your interest in math vary as you went through school? ☐How was your mathematics learning supported at home and in your community? ☐How has math affected your career path?

Part 3: **"*I'm curious about your thoughts around learning and teaching math…*"** What do you want your students to learn in math? (math knowledge, society, self, empowerment, etc.)? Why? What ideas and beliefs about math do you want to pass on to your students? Why? How does that play out in your current teaching? And your current unit?	-Beliefs about math -criticality → elements of black feminist math pedagogy	Probe: What do you think the purpose of math is? What do you want students to get from you as their math teacher?
Thinking back to your autobiography answers about what math was like for you growing up, what are your thoughts about teaching math? How does teaching math compare to teaching other subjects?	-Beliefs about math -criticality → elements of black feminist math pedagogy	How does teaching math compare to how you were taught math? How do you persevere? How does it compare to other things you teach? What do you like about teaching math?
What are your strengths as a math teacher?	-BFMP elements	
I want you to tell me a story, or give an example, of what your ideal math class would look like. It could be real or imagined.	-BFMP elements	I want to get a sense of what's important to you when teaching math. Tell me some of the elements of a math class that are important to have.
Part 4: Winding Down ***"What have I missed asking that you'd like for me to know?"***		

Appendix B: Sample Interview 2 Protocol (Leslie)

Interviewer Opener:
I'm going to test out my recorder now just to make sure it's working. (State name and date on recorder)

Preamble:
Thanks for meeting with me today! The purpose of this interview is to dig deep into how you make decisions about how you plan for your math lessons. It will help if you talk extensively about this process, to help me understand what and how you teach, and what the field of education is lacking (specifically, how teachers think about planning and then enacting their lessons. Including the on-the-spot decisions that you make in the middle of teaching). It will be especially helpful if you guide the conversation to topics that you feel are important to explore. I'll try to keep my overarching questions as broad as possible to prompt your thinking.

During this interview, you might notice that I am looking at or reading from this sheet, this is just to help me keep track of where we're at in the interview. I'll also jot down some of what we talk about. It would be really helpful if we can talk for 30-45 minutes about this topic. If you have them with you, go ahead and pick out your planner, curriculum materials, assessment papers, anything you think will help guide the conversation.

{EM Notes: Interview topics connected to RQ 1& 2:
- curricular knowledge,

- subject matter knowledge

- pedagogical content knowledge

-knowledge of students

- knowledge of teaching students

- identity impacts BW's math teaching practice?

- draw on lived experience and PCK to teach math?

Interview Questions	**Question rationale (connection to RQs, conceptual framing)**	**Extra probing Questions:**
Guide the Conversation: I'm so curious about how *you* think about planning, Where might be a good place to start?	**BF Methodology**	You might start by talking about your: o Planning notes o Assessment – pre & post o Other starting places? o Curriculum Materials

		○ Reflecting on Planning and Teaching thus far ○
Curricular Materials: Talk me through how you typically consult, or use your materials. Be as detailed as possible. - Is it always/often "first step 1, then step 2, last step 3?" orderly Now let's contextualize this for the unit you're currently teaching - How are you using materials for this unit? Given what you said about X, how do you see that in relation to figuring out how to use curriculum materials? "decentering me as the knowledge giver. I'm not the Knowledge giver, and having them be more autonomous in their learning"	- curricular knowledge, - subject matter knowledge - pedagogical content knowledge	How does that relate to your student, and how you think about yourself as a math teacher I remember you saying X in your interview/classroom. How do you see that here in relation to figuring out what materials you'll use when teaching math?
Reflecting on Planning & Teaching Thus far: How has your approach to teaching math shifted over the year, so far? - Particularly, in regards to your district curriculum, district guidelines, and what you know about teaching this grade level	- subject matter knowledge - knowledge of teaching students - ped. content knowledge	- Talk to me about how you prepared for this fall season of teaching kids? - Hopes and aspirations? - Were they met?
Planning: Talk me through your planning notes? - How do you chunk planning? - Weekly planning? Monthly? Unit? 1. general, tell me about your planning process.	- subject matter knowledge - knowledge of teaching students - ped. content knowledge	-Where do you mark your plans down? - Do you plan solo, or with colleagues? Ex: – can I have you think aloud about what you do during planning – lesson enactment – post. What is your process of making sense of what you're doing everyday? (ex:

2. Can you talk to me about your planning process for this unit 3. Given what you said about your own experience learning math, where you tried to hid during class, how do your own experiences with math figure into how you plan math? For example, grouping children, placing authority in their hands and not the teachers?		assessment guide, planning book, where you put the thoughts in your head to create the actual worksheet for the kids, when you're creating the task) I wanna see this and talk to me about that.
Assessment: Talk me through your assessment processes, and how you make sense of what students know Can you talk to me about your assessment process for this unit Given what you said about X, how do you see that in relation to using assessments? Given what you said about `how big those holes can get and how fast those holes can grow. But still giving students access to the curriculum`, **`how are you thinking about teaching math from an equity perspective?`**	-subject matter knowledge -knowledge of students -pedagogical content knowledge	- share what you use for assessing students. Long term, and intermittent
Foreshadowing Future lessons: Where are you going next in math? Why? What decisions are you considering going into January?	identity impacts BW's math teaching practice? Draw on lived experience and PCK to teach math?	-what's the next unit? What math domains/standards are you anticipating hitting? What do you want students to really get good at in the winter quarter?

Planning Think-Aloud: Please think aloud during planning your next math lesson. - What big ideas are you considering? - What information are you using to guide your thinking for your next lesson? - Where do you see students getting stuck? - What will you do to unstick these students?	- curricular knowledge, - subject matter knowledge - pedagogical content knowledge -knowledge of students - knowledge of teaching students identity impacts BW's math teaching practice? Draw on lived experience and PCK to teach math?	Tell me what your first step is/will be. Then what?
Wrapping up interview What have I missed asking you that I should know?		**What would you share about planning to a new teacher?** **What would you share with a long term sub in your position**
Next steps I want to come in and mic you. To get in your head about how you make spontaneous planning decisions during teaching enactments.		

Moving forward:

Follow Up to Interview - I want to capture the spontaneous planning that you do, on the spot, during math lessons. On the spot. I'd like to mic you, and have you think aloud during a math lesson. To capture your decisions made specific to the situation.

Appendix C: Sample Gathering Discussion Handout

Welcome to our Gathering! March 18, 2023

The primary purpose of this Gathering is to connect with Black women math teachers. Black women rarely have opportunities to get together to talk about teaching. For these next 4 Gatherings, let's be curious about how we teach math. Most critical conversations about math are around access and equity, typically related to test scores. But so much more can happen in math spaces. Joy. Curiosity. Freedom. Liberation.

Norms for our Gathering are inspired by Black Feminist Thought:

1. Black women use our lived experience to make sense of the world.
2. Black women dialog to assess knowledge claims.
3. Black women hold an ethics of personal accountability.
4. Black women hold an ethics of care.

"Abolitionist teaching is built on the cultural wealth of students' communities and creating classrooms in parallel with those communities aimed at facilitation interactions where people matter to each other, fight together in the pursuit of creating a homeplace that represents their hopes and dreams, and resist oppression all while building a new future."

Discussion Guiding Questions:

1. What sections really speak to you?
2. What sections do you have questions about?