Mothers' experiences with young children in mathematics: A narrative analysis of forces shaping identity and engagement

By

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Abstract

U.S. society has persistent expectations of what it means to be a mother or a mathematician. However, the voices and experiences of mothers who do mathematics with their children is not factored into these expectations. The purpose of this study is to use a mother-centered perspective to investigate how mothers engage with their children in teaching mathematics at home. The study responds to the following research questions: How are mothers positively engaging with their children and mathematics? In what ways does their previous experience support or contradict this activity? How does current engagement and past experience of mothers reflect gendered and racialized perspectives of motherhood and mathematics? Using identity theory, this work critiques existing limited norms of motherhood and mathematics education by focusing on the constructed identities and spaces mothers use to support their children in learning mathematics. Narrative inquiry is used to understand the diverse experiences of the five participants through interviews, observations, and debrief sessions. The findings show the impact of experiences on the participants' mathematical action at a personal and societal level. On a personal level, the participants' past experience with mathematics in school, current feelings about mathematics and their children's interests shape how they see themselves and inform the mathematical activity they engage in. On a societal level, participant stories show a common theme that recognizes institutional whiteness and gendered binaries embedded in the expectations of both motherhood and mathematics. The participants' past experiences in school that shape mathematics as limited to whiteness and masculinity impacts how they see themselves as mathematically capable today and thus choose to interact with their children in mathematical learning.

Dedication

This dissertation is dedicated to all the folks who raised me, shaped me, and mothered me: teaching me the fun lessons and the tough lessons, the big stuff and the small stuff, and most importantly how to be myself.

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Finally, I want to acknowledge little A, the person who made me a mom. Thank you for being my daily writing buddy, and providing cuddles and laughter. Your presence helped ground me more deeply and meaningfully into the work of motherhood and mathematics and helped me let go of the unimportant stuff to focus on the here and now stuff.

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Chapter 1: Introduction

Why Study Mothers in Mathematics?

In conclusion, we need more attention to the lives of particular mothers—to mothers' own voices—and to the lives and voices of diverse groups of mothers (Arendell, 2000, p. 1202)

It's good to talk to someone about it and to stop and think about, of what um, we're doing and hoping that we're doing something positive for our kids' future (Tara, Interview 3)

Over 20 years ago, Arendell (2000) made a call for research that centered the voices of mothers and their experiences. In the past, broad and general statements were made about what mothers should do and who mothers should be, with particular attention to how they raised children. For example, "good" mothers (Dillaway & Pare, 2008) were revered as those who chose to stay at home to dedicate all their time to child development. However, who fits into the ideals of motherhood in U.S. society (both then and now) is very limited and the experiences of what more diverse groups of mothers are doing is often ignored. Arendell's call still stands today with a need across areas of research that relate to mothers and parents but do not center their voices. Mothers' engagement with their children's mathematics is one such area where assumptions are made about what parents are doing (or not doing) without listening to what the parents intend or try to do (Jay, Rose, & Simmons, 2018). What is at odds in areas of research concerning mothers, particularly in mathematics education, is what counts: what counts as 'good mothering' and what counts as legitimate mathematics. There are clear expectations in motherhood and mathematics of what it means to be a mother and of what it means to be a mathematician, but often the voices and experiences of those doing the work of both is not

factored into these expectations. For example, expectations of motherhood have often been limited to the norms of white, middle class families (P. H. Collins, 1987; Dillaway & Pare, 2008), which can characterize Black mothers as poor mothers or not mothers at all for the different actions they take to support their children (Morgan, 2018). The mathematics environment has historically struggled to include women in the field (Hottinger, 2016). Characteristics often associated with masculinity are the features promoted in mathematical environments. Representations through the media show mathematicians as reclusive, hyper-intelligent, white men (Mendick, 2005). What, then, is possible for mothers of more diverse backgrounds engaging with their children in mathematics learning?

The second quote at the start of this chapter comes from one of the participants at the end of the study. Instead of making assumptions about Tara's activity with her children and what she must do to be a "good" mother or teach proper mathematics, her experience and intent was centered. I listened to what she had to say, for what she already did, to draw out not only the *how* but also the *why* in her mathematical activity with her children. This study disrupts notions of who and what is included within motherhood and mathematics expectations that are limiting or unavailable to larger groups of people. I see the tensions that already exist in how Western society understands motherhood and mathematics separately as potential sites to better understand mothers in mathematics, in a more positive way. The purpose of this study is to investigate, from a mother-centered perspective, how mothers engage with teaching mathematics, based on their experiences, to understand additional forms of positive mathematical activity for children at home. The primary research questions I investigate are: How are mothers positively engaging with their children and mathematics? In what ways does their previous experience support or contradict this activity? How does current engagement and

past experience of mothers reflect gendered and racialized perspectives of motherhood and mathematics? These questions allow for the exploration of parents' engagement in mathematics through the gendered lens of motherhood, which contextualizes the expectations of motherhood and mathematics within larger systems of exclusion in Western society.

The choice to study mothers more specifically and not parents in general relates to the divide in expectations for parents, for mothers and fathers, as aligned with gender binaries. Motherhood is associated with that which is feminine and fatherhood is associated with that which is masculine (Wittig, 1992; Paechter, 2006). This divide creates a persisting expectation that women must take care of domestic tasks, must take care of children, because they are tasks associated with the feminine (Odenweller & Rittenour, 2017). While it may be tempting to argue that U.S. society has come a long way and expectations that place the burden of home and child care solely on mothers is a thing of the past, the COVID-19 pandemic shows this to be false. The pandemic highlights the continued expectation that mothers are meant to care for children, even when they are working at the same time, as reflected in studies of the division of labor and children's schooling with the move to remote learning programs (Carli, 2020; C. Collins, Landivar, Ruppanner, & Scarborough, 2020). This is not to say that fathers are not also doing child care work, or that their perspective within parenting and mathematics is unimportant. However, a larger trend shows the disparity in who is expected and ultimately doing the work of teaching children: mothers. If societal expectations see mothers teaching children, this necessarily includes teaching mathematics. As mothers are often viewed as synonymous with women, their actions in mathematics can be drawn into question because of the masculinity of the mathematics field. This study exists within the problem space of tensions between expectations for mothers and mathematics. When mothers are studied in the context of

mathematical interaction and teaching, they experience tensions of inclusion, not only from expectations of motherhood but also those of mathematics in relation to gender, race, and class. Unfortunately, those tensions within motherhood and mathematics often position mothers as doing poorly to support their child's mathematical learning (Boehme, Goetz, & Preckel, 2017). I explore the tensions between inclusive motherhood and mathematics to identify alternative practices of positive mothering through children's mathematical learning.

In the remainder of this chapter I explain what led me to study mothers' experiences in mathematics from what I have witnessed in assumptions of mathematics aversion and lack of capability in others and in research. I explain my own background in relation to mathematics and motherhood to show my positionality within this work. I discuss the use of key terms throughout the study, including motherhood and mathematics, as well as the small distinctions between terms, such as mothering and mother. I conclude the chapter with an outline of the dissertation's organization.

Connections and Interest in Research

I enjoyed mathematics growing up, but I know this was not the experience of many people, particularly other girls. As a high school mathematics teacher, I often had students tell me they were afraid to take algebra because they heard from friends or family members that it was a much more difficult subject. In parent-teacher conferences, mothers asked me what they could do because they were not "math people" and could not help their children with their homework. Initially, I was focused on how so many people in general had an aversion to mathematics. Parents and students alike wanted to avoid the subject.

When I reached the age where other friends were having children, I noticed an interesting gendered response to mathematics aversion. I would often receive a visceral reaction about

people's own trying times in school mathematics when meeting new people or talking with old friends about my work in mathematics education. This most commonly came up with my friends who were mothers, rarely ever those who were fathers. These friends freely shared horror stories about making it through an entire mathematics course without understanding anything from the teacher and the fear of being called to the board to show their work. Even more curious, was the number of mothers who expressed worry over what they would do when their own children would need help on their homework.

I knew distaste for the subject was not uncommon. Was there something in particular about mothers and mathematics, or did my friends who were mothers simply feel more comfortable airing their feelings on the subject? The literature indicates that a large concern is placed on the impact parents' mathematical anxiety would have on their children (Boehme et al., 2017; Maloney, Ramirez, Gunderson, Levine, & Beilock, 2015; Vukovic, Roberts, & Green Wright, 2013). Much of that research is concerned about the impact mothers in particular have on the mathematical performance of their children (Else-Quest, Hyde, & Hejmadi, 2008; Soni & Kumari, 2017). Themes indicate that "specific parental behaviors have negative effects on test anxiety" for children (Boehme et al., 2017, p. 12). Mothers are concerned about helping support their children through school mathematics and researchers are concerned that mothers would negatively impact their children's feelings around mathematics. The framing from my experience and themes across literature on mothers and mathematics provides further reason to investigate mothers' interactions with children in teaching mathematics, from a mother-centered perspective. What is missing across my conversations with mothers and in the literature is an understanding of why mothers are still hesitant with the subject, how their experience is specifically impacting

the mathematical interactions with their children, and the gendered and racialized implications of Western norms within motherhood and mathematics.

Autobiographical Connections

I frame here my own experiences with mathematics and motherhood in context to set the stage for centering the stories of the participants. I look to my own story to recognize initial elements of hesitance in mathematics, implications of gendered expectations and how my narrative does not speak for the experiences and actions of the participants. I grew up in mostly suburban areas in Virginia and Illinois. Music was the epicenter of my life growing up; everything was connected to it: listening, appreciating, making or practicing music. My mother stayed at home after my younger sister was born, but taught piano lessons out of the living room. My father worked with extensive music collections at nearby museums or universities and taught guitar on the weekend. For my parents, everything was connected to music; my dad said all music had color and playing is like painting a picture, my mom pointed out how rhythms, time signatures, even the symbols for notes were just mathematics in disguise. We lived in spaces that always had opportunity in music. The motto seemed to be, if you love something (like my parents loved music), surround yourself in it and work hard at it.

Learning music was about education and my family was committed to education through schooling. Homework and practicing were the two things expected of you before you could hang out with friends. While both my parents encouraged studying hard and focusing on education, it was my mom that I often turned to when I needed help with a mathematics problem. When I was stuck on a problem, my mother would ask me what I knew about it, what I did not understand, and if there was anything in my notes that I might have missed that would help. Similar to practicing a hard piece of music, learning mathematics had a flavor of working at it with the

resources you had or could find and eventually you would get it. Years later, as I reminisced on how much my mother had helped me in learning mathematics, she commented that she did not feel like she did anything to help me. She often felt the problems I was working on were well above her head, she had no idea how to solve them. But I would talk out loud and she would ask me questions so she could try to understand what I was doing.

The feeling of support from parents and the help I got from my mother in mathematics was encouragement to continue with the subject. I always felt that I was capable of doing mathematics, but it was okay if it took time to figure it out. When I was a child, I simply thought with the repeated mention of connecting music and mathematics that my parents were mathematical experts. As an adult, seeing that they were not always comfortable or knowledgeable of mathematics showed me how that did not negatively impact my ability to be able to learn or like math.

My own experience with my parents and mathematics had a tinge of uncertainty around being able to do mathematics and yet I was able to learn and excel in the subject. There is a contradiction between my own experience and what some of the literature destined as the likely outcome for children in households with mathematically hesitant parents. Mothers seem to carry more of the stress and blame for the mathematical and educational outcome of their children. In exploring this contradiction, the research on Black mothers and children illuminates a disruption in the narrative of mothers' failing to support children in learning (Jackson & Remillard, 2005; Leffall, 2017; McGee & Beale Spencer, 2015). The research of celebrating Black mothers' action and the experience of my mother interacting with mathematics fueled my desire not just to investigate but to disrupt the fixation that mothers would primarily inhibit the mathematical education of their children.

While I have stepped away from making music as I have gotten older, I still enjoy listening across genres. I also still love exploring mathematical ideas in a variety of contexts today, most often through board games and card games with friends. This becomes a simple way that I engage with mathematics outside of school and with others. In regards to connecting with children of my own and mathematics, I am a new parent, becoming a mother just after the data collection process. Stories of my own place in motherhood are thus sparse in comparison to the study's participants. More details in relation to my current experience in parenting and connection to participants is present later in the chapter.

Becoming a Mother

During the data collection process, I was not yet a mother, both in my own eyes and in traditional definitions of what counts as a mother. For several years I was in the process of working towards adoption. As such, my experiences with becoming a mother were quite different than what others experienced and provided further inspiration to recognize how mothers act in different ways. Weller (2019) argues that "mothers in adoptive families perform different mothering behaviors, hold different mothering beliefs, and express their concerns using different terminology" (p. 278). While this applies to myself as a new parent through adoption and my experiences, I recognized how differences in beliefs and activities is what I was arguing for in doing this research that centered mothers' experiences. Mothers come with their own perspectives and experiences that shape their activity and beliefs about teaching children. There is not a set way all mothers do this. Mercer (2004) describes that "only the mother can provide data about her perceptions of self as mother and of her infant" (p. 229). I recognize on a theoretical and personal level the importance of centering mothers' voices in how they raise and

educate their children, to show that they are being listened to and that their perspectives are valued.

Experience and Intentionality

From the narrative I shared above, there are five major elements that establish a particular experience for myself in relation to parenting and mathematics: location, class, parent careers, parent availability, and promoted identities. My experiences with mathematics and the relationship with my parents around the subject were largely positive. These experiences are not meant to represent what every person has growing up. Additionally, the conditions of my own upbringing do not represent an ideal, or even what I expect across other mothers and their interactions with children and mathematics. This section describes the elements of my perspective, intentionality in recognizing differences and nuances between participant and personal narratives, and further assumptions of motherhood expectations.

I grew up in areas that were diverse in opportunity, with options for activities in many areas that would support child development (such as music programs, sports, and clubs). Additionally, my family was solidly middle-class for most of my life, meaning access to these activities was almost always possible. My parents' eventual careers and time spent with the family created extensive opportunity for learning and support. For example, my mother had more flexible employment for most of my childhood, meaning she was in a position to be at home and available to offer some assistance with homework. While this at-home mother image fits U.S. society's expectations of 'good mothering' (Dillaway & Pare, 2008) it does not represent the experiences of other children and their parents. Finally, my parents' focus on music, practicing, and support of mathematics promoted identities such as 'hard worker' and 'mathematician' in me from a very early age. The experiences I had as a child, particularly around mothering align

with society's norms of motherhood (Dillaway & Pare, 2008) as well as norms of the middle-class and whiteness. However, my experiences in mathematics as a woman are the opposite of typical interactions women have in the field (Mendick, 2006). The alignments and diversions of my experience around mothering and mathematics indicate the necessity to pay attention to differences as valuable in parenting and struggles for women in mathematics as typical for the field.

Definitions

As I make further connections between mothers, interactions with children, and mathematics, it is important to establish my use of terms in relation to these areas. In this subsection, I describe my use of the terms mathematics, parent involvement and engagement, woman, mother, mothering, and motherhood, lived experience, and the terms associated with my methodology of narrative inquiry. How I use each of these terms is important because it informs how I write about them, which does not always parallel the norms of their use in current research in mathematics education and motherhood studies. My perspective and use of these terms align with the theoretical framework elements of identity theory, recognizing self-definition and negotiated meanings across individuals and communities.

(School) Mathematics

I consider mathematics as including counting, spatial reasoning, and arithmetic; concepts which are usually reserved for very early learning. However, some scholars view mathematics as only more advanced or abstract topics (Hacker, 2016) or place a separation between school mathematics and real mathematics (Watson, 2008). School mathematics is often viewed more narrowly than other views of the mathematical discipline, with attention limited to algorithms and rigid problem structures (e.g. Civil, 2002). As L. Martin and Gourley-Delaney (2014) argue,

"school mathematics is circumscribed by various standards documents…[which] are narrowly defined by design, and thus offer only a limited view of mathematics as broad human activity" (p. 596). How I define mathematics as a whole and the tensions that exist in understanding of school mathematics highlights the challenges for participants in understanding what counts as mathematics. I agree with Stevens' (2013) observations about mathematics, "that the forms and functions of 'mathematical' activity...don't often directly resemble those of school math" (p. 75). Stevens' statement shows how mathematics in the everyday occurs but looks different from what happens in the classroom. I argue that both forms of activity should be seen as mathematical. While I plan to address the perspective of what counts as mathematics by scholars later in the dissertation, my perspective of a more inclusive mathematics frames how I will recognize broader interactions of mothers with the subject as mathematical.

Parent Involvement vs. Engagement

In discussions of mothers' interactions with children in mathematics, there are many parallels to their connections in the school environment. More broadly, this is understood as parent involvement or engagement in education. El Nokali, Bachman, and Votruba-Drzal (2010) see parent involvement as including "parents' behaviors in home and school settings meant to support their children's educational progress" (p. 989). However, most research and attention is placed on school, as opposed to home, settings. The distinction I make between parent involvement and engagement is based on Barton, Drake, Perez, St. Louis, and George's (2004) work. They argue that parent involvement has frequently focused on school-centric forms of parents and education, whereas parent engagement considers the work at home and community as meaningful forms of interaction for families in learning. Wider expectations in school mathematics of parents most often desire parent *involvement*, but recognition of parent

engagement shows additional and positive ways that parents can interact with their children in mathematics. Simply put, discussions of parent involvement are focused on how parents support education from a school perspective, whereas parent engagement relates to a wider array of ways parents can interact with children to support their learning. In this study, I use parent involvement to discuss expectations of parents in school-based settings and parent engagement to refer to broader parental support in children's learning.

Woman

As parent involvement often has assumptions that the involved parent is the mother (Posey-Maddox, 2017), there are implications for a divide of roles and expectations for mothers and fathers, along femininity and masculinity. Western society creates a divide between understandings of masculinity and femininity (Wittig, 1992). The expectations of acting as a woman often necessitate displays of femininity. Such expressions create a specific feminine identity that frequently confines women to the categories of wife, mother, and caregiver (Dillaway & Pare, 2008; Nilliasca, 2011). In order to push back on the limitations of behavior and actions thus meant for women, and mothers, I work from a definition of woman that supports how individuals see themselves. Paechter (2006) describes this concept of self-definition within gender, such that it "is thus centrally concerned with who one considers oneself to be, not how one appears to others" (p. 259). If someone states that they are a woman, then they are a woman. This aligns with feminist perspectives of identity that honor self-definition (Cervantes-Soon, 2017; Dillard, 2012). How I challenge gendered expectations of women in mathematics and roles of motherhood, as well as select participants operate from this definition of woman. I further unpack the role of gender binaries and expectations of masculinity and femininity in Chapter 3, focused on identity theory.

Mother, Motherhood, and Mothering

Within the context of self-definition of woman is a divergence in the literature's definition of mother. Societal conceptions of mother are strongly correlated with expectations of women. Mother is an identity that is expected for most women to attain, where "all women are socially defined as mothers or potential mothers" (Roberts, 1993, p. 10). Mother is often associated with a particular population (women) and location (home) (e.g. Dillaway & Pare, 2008). Who is accepted as a mother is often those who fulfill certain physical characteristics and actions, such as white middle class, stay-at-home women (e.g., P. H. Collins, 2000; Dillaway & Pare, 2008). For the remainder of this study, the terms woman and mother are used to refer to how individuals describe themselves as well as classifications by researchers of the broader societal identification of woman and mother. Because of these societal expectations of what counts as mother, self-identification is limited, and understanding the terms mothering and motherhood is important. There are small but important distinctions between mother, motherhood, and mothering. Table 1 shows the distinctions I make between these terms as a way to honor diverse forms of motherhood.

Definitions of mothering that center action over identity provide space for more diverse understandings of motherhood. In adoption communities, terms for mother and motherhood develop meaning from their use by birth mothers and adoptive mothers. As Weller (2019) argues, "motherhood is socially constructed by the language we choose to describe mothers in everyday vernacular, thus, there are multiple visions of motherhood" (p. 268). In this study, I consider how these multiple visions can consider diverse concepts of mother, mothering, and

Table 1

Definition Distinctions

Word	Key Distinction	Definition
woman	person	An identification, informed by self and society
mother	person	An identification, often associated with woman, informed by self and society
mothering	action	The actions and activity of raising children or caring for others
motherhood	role	Self-identification and actions of mother and mothering

motherhood. Mothering is about social interactions (Arendell, 2000) and the actions involved in raising children (Mora, 2006) or caring for others (P. H. Collins, 2000). People that do the work of mothering may not be defined as mothers by larger U.S. society. Motherhood occupies the space between mother (limited in definition and acceptance) and mothering (referring to broader activity of care). Motherhood makes room for more diverse definitions of mother, as defined by individuals. Rothman (1994) talks about what this view of motherhood affords as it:

> shifts our focus from who the mother is to what she is doing. Who she *is*, who she feels herself to be, is deeply gender based: she is a woman, a mother. What she is *doing* is not gender based: the similarities in their situations, in the demands they face from their children and from their societies, than it has to do with the similarities in the women. And so the person engaged in this discipline of motherhood need not be a mother, need not be a woman, to engage in these activities, this way of thought and practice that is mothering (p. 155)

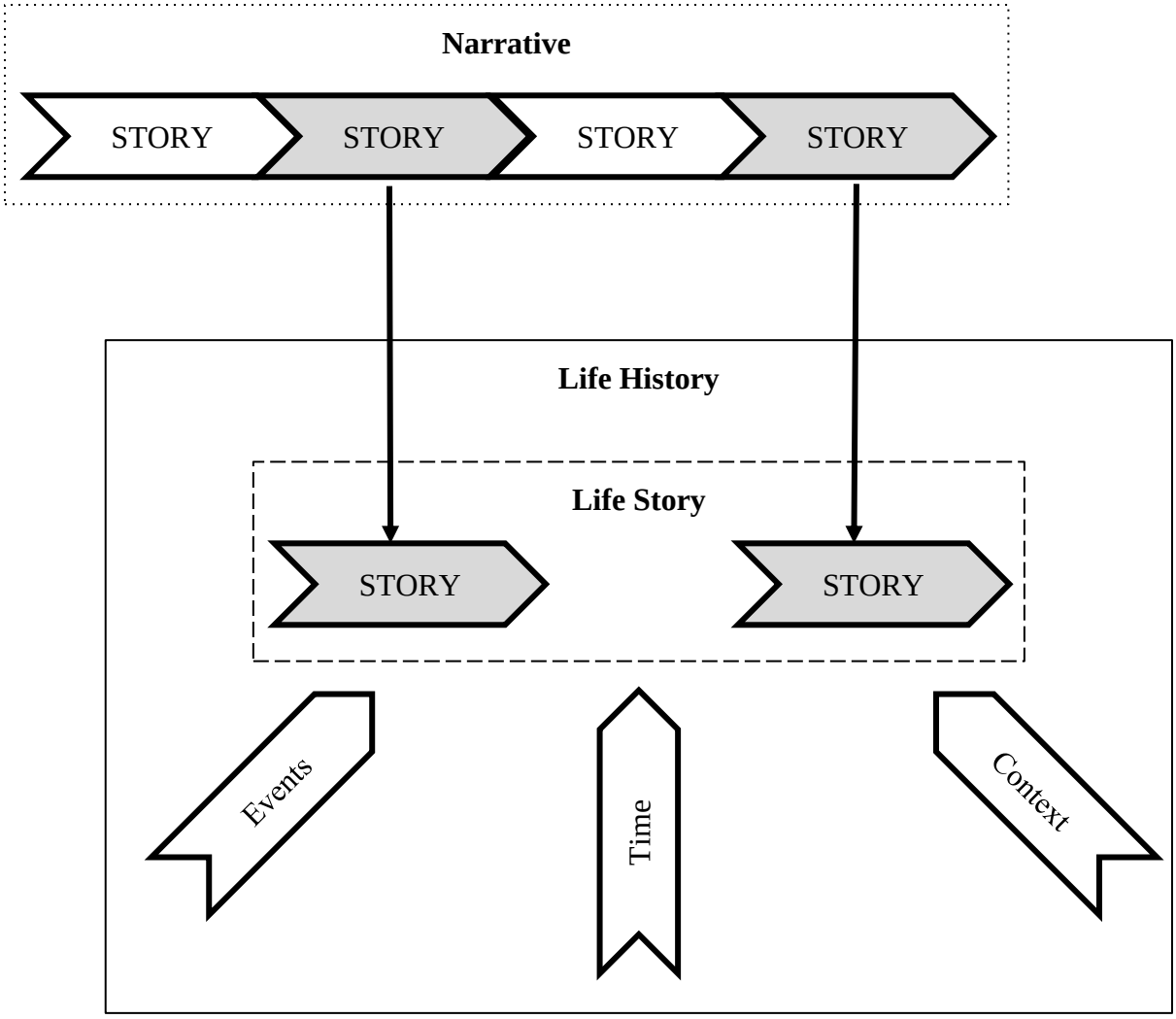
Activity and action in mothering and motherhood create a foundation for self-definitions of mother. A person can connect their personal actions in caring for others (raising children or

otherwise) as a form of mothering, allowing for personal identification with the term mother. My definition of motherhood ultimately honors the conception of 'othermothers' doing the work of mothering (P. H. Collins, 2000; C. W. Cooper, 2007). The identity of mother may not be assigned to every mother (Littlefield, 2007) or include all forms of mothering (Morgan, 2018) in the eyes of U.S. society. However, separating and defining woman, mother, mothering, and motherhood as I have, provides access to those who see themselves as mothers, do the work of mothering, but are not recognized within motherhood by the expectations of Western society. Within the study itself I refer to participants interchangeably as mothers as a way to further legitimize their activity and identities as mothers.

Stories, Narratives, and Life History

Just as I give particular attention to the distinction of terms related to motherhood, I must make distinctions of terms related to stories because of my methodological use of narrative inquiry. Participants tell stories that show their identities as mothers, as people who do mathematics, influenced by factors of their past and current societal expectations. Different storied elements refer to different grain sizes of experiences shared. Figure 1 represents the relationship between the terms: story, narrative, life story, and life history. The smallest unit refers to a story, which details a particular experience (McAdams, 1993). Different stories of similar experiences or on a particular theme create a larger narrative (Clandinin & Connelly, 2000), perhaps contributing to how someone frames a feature of their identity. Stories that are related to who the storyteller is or who they are becoming, represent components of life story. Life history is a life story (or life stories) in context, looking at the defining stories of becoming

Figure 1. Mapping of Narrative Inquiry Terms



within the historical and external influences of the person's life, other experiences that shape how the story is told, and change over a lifetime (Creswell, 2007).

Lived Experience

As I focus on centering the voices and experiences of the participants of this study, I frequently refer to honoring their lived experiences. In this context, "lived experience responds not only to people's experiences, but also how people live through and respond to those experiences" (Given, 2008, p. 490). Lived experience becomes part of one's identity (Dillard, 2012). Experiences shape future actions and how people see themselves. In the stories of their lives, participants share about who they are, framing themselves through what they have

experienced and their current actions. These elements are part of their lived experiences, and listening to them addresses the purpose of this study, finding the why behind their interactions in mathematics, related to past, present, and societal expectations.

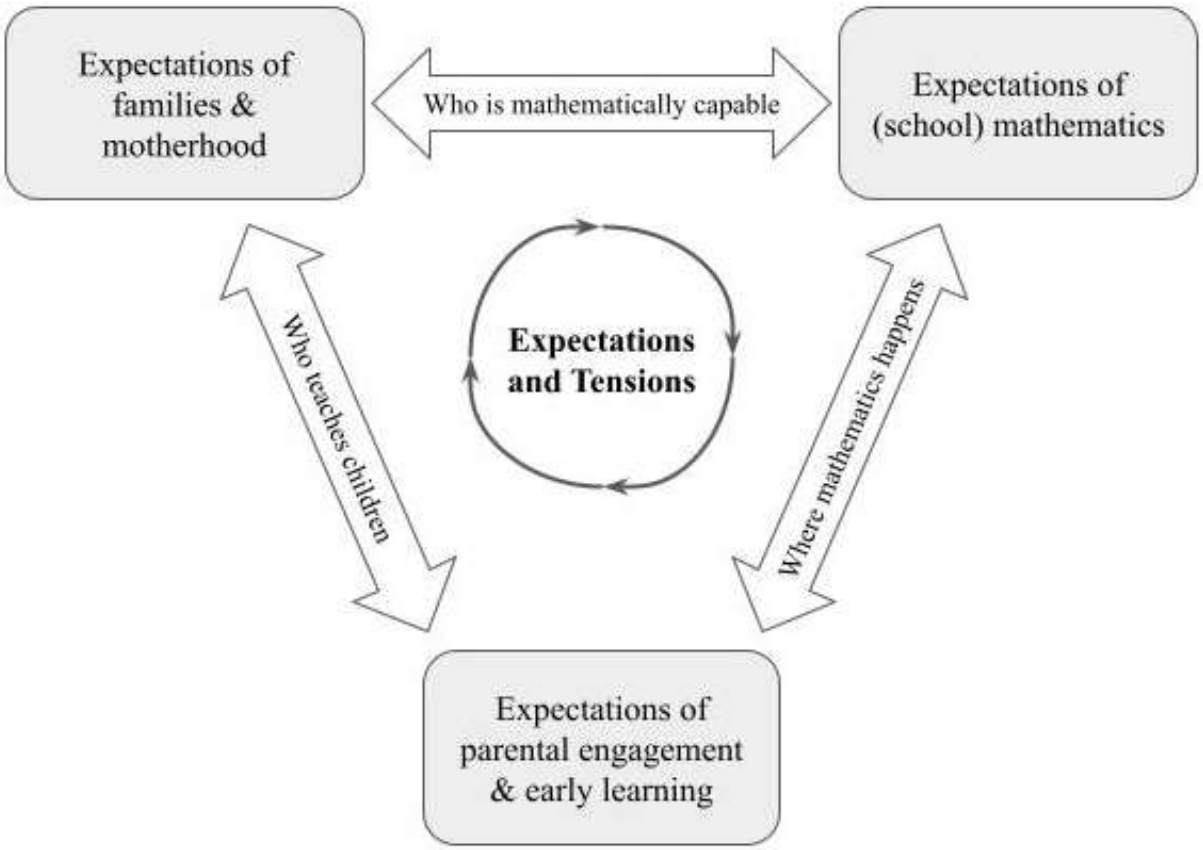
Organization of Chapters

In this chapter, I have highlighted why a study of mothers' experiences with children in mathematics is necessary to disrupt notions of what counts as acceptable motherhood and mathematical engagement. Chapter 2 addresses the existing literature around the research questions, focusing on expectations within motherhood, school mathematics, and parental engagement in early childhood learning. I consider the tensions between these three areas of expectations through how gender roles come into context in parenting and mathematics. In Chapter 3, I outline my use of identity theory to frame the lived experiences of the participants and what it means within the assumptions of a strict masculinity and femininity divide. I detail the design of the study using a narrative inquiry methodology in Chapter 4. Chapter 5 through Chapter 7 detail findings from the participants, focused on the larger narratives for each participant, understanding their experience as individuals, and understanding their experience within existing societal structures. The final chapter discusses the implications of this work and recommendations for future research based on the findings.

Chapter 2: Literature Review

This chapter details the literature on expectations of motherhood, mathematics, and parental engagement (particularly in early childhood learning). These three branches of literature address the context of the current study: how mothers engage their young children in mathematics and how past experiences inform their interactions. Looking at these expectations in the context of Western society and in tension with each other speaks to the influence of matrices of domination (P. H. Collins, 2000) which I discuss as an analytical tool in the next chapter. Expectations of motherhood, mathematics, and parental engagement in conversation with one another illuminate the gendered assumptions of expected parental engagement, the masculine environment of mathematics that frequently excludes women (and mothers), and the assumption of what parents must do to prepare students for early schooling. Figure 2 shows the connection between these branches and the tensions that emerge between them. I begin the chapter by describing the historical precedence that connects motherhood to childcare, the more modern-day expectations of motherhood, and the association of mothers to children's education. By emphasizing how Western society expects mothers to act, we can identify the limitations these expectations place on mothers in supporting education. I will then discuss the expectations surrounding school mathematics and its influence on mathematical identity. The historical expectations of mathematics further show a privileging of white, male, and middle-class norms that create tensions in how women and mothers are recognized for their mathematical ability and activity. The final section discusses the expectations of parents in supporting children's learning and the emerging tensions in gendered expectations of parents and parents supporting mathematics. Describing the existing literature in these three branches as well as their limitations when considered together draws attention to the limitations for mothers' engagement with young

Figure 2. Major Areas of Literature and Their Tensions



children in mathematics. Such attention will help show what research may consider as other forms of effective mothering and supporting children's mathematical education.

Expectations of Families and Motherhood

Western construction of families has defined rigid expectations for mothers and fathers that continue to impact parents today. As Rothausen-Vange (2004) states:

> Our society tends to define being a good wife and mother as being continually available for emotional nurturing...assuming primary responsibility for the physical and developmental care of dependents, and being warm and welcoming, whereas our concept of a good husband or father is someone who provides economic goods to the family (p. 55).

In Rothausen-Vange's description of expectations, the traditional role of the mother is within the domain of the home, where that of the father is outside. It is assumed within this description that the parents in a family are a mother and father, assumed again as women and men, with particular pre-designated roles. The divide of expectations of mothers and fathers functions to reaffirm boundaries for mothers relating to domestic work. Even with the move of more mothers working outside of the home, traditional expectations of who should raise children and maintain the home remain in place (Duxbury & Higgins, 1991; Zhao, Settles, & Seng, 2011). Tensions arise in families trying to balance work and the constraining gendered expectations of parenting.

The separation of roles in families and the tensions it creates is an extension of the binary divide between men and women. Binary differences between men and women stem from early Greek philosopher's classification of opposites that defined Being and non-Being along with gender: "For Being is being good, male, straight, one, in other words, godlike, while non-Being is being anything else (many), female" (Wittig, 1992, p. 51). What makes men, or fathers, is opposite to what makes women, or mothers. This divide in expectations and being persists today, not only in gender and familial role, but race as well:

> One part is not simply different from its counterpart; it is inherently opposed to its 'other.' Whites and Blacks, males and females, thought and feeling are not complementary counterparts--they are fundamentally different entities related only though their definition as opposites (P. H. Collins, 2000, p. 77)

Gender and race are defined in binary opposites, where motherhood is inherently tied to women and fatherhood to men. As Odenweller and Rittenour (2017) identify, the common stereotypes currently associated with stay-at-home mothers (loving, caring, interested in child development) are rooted in gendered expectations of women and their role.

The division of labor and expectations for mothers from the past have evolved over time to add even more responsibilities. Increased expectations of mothers' labor are documented across the literature (e.g. Duxbury & Higgins, 1991; Rothausen-Vange, 2004; L. Story, 2005). As Zhao and colleagues (2011) argue, "traditional thinking assumes that women should do a greater share of household labor and childcare, and mothers may be particularly overloaded compared to fathers and women without children" (p. 725). The added expectations of mothers to work outside of the home and continue domestic labor further speak to the binary of expectations for men and women, aligned with fathers and mothers. The historical and small shifts in expectations specifically for women in motherhood are detailed in the rest of this section.

Historical Motherhood Expectations

The inherent connection between biological mothers and their children became more prevalent in the 9th century, with literature of the time suggesting a mother's milk was necessary for an infant's survival (Sommerfeld, 1989). "A mother who nursed her own children was seen as the ideal mother, one with virtue and piety, who dutifully accepted the burdens and responsibilities and was devoted to the spiritual development of her children" (Sommerfeld, 1989, p. 16). Exclusions present themselves in this image because of its implications for a certain type of mother. Overall, however, the association between mothers and their children has remained in place, with only minor variations, since the 9th century. Into the 19th century, the cult of motherhood expected mothers "to spend their days at home, so going out to work, whether full-time or for odd days at washing or cleaning, was immoral, even selfish – not provident, self-sacrificing, and necessary for the survival of the family as a group" (Davin, 1978, p. 53). Women were and are expected to be and enjoy being the caregivers of children. However,

this is more than purely because caregiving is expected in mothering. It is because women are viewed as "destined to be mothers and nurturers" (Austin & Carpenter, 2008, p. 380). As P. H. Collins (2000) claims, "for many, becoming a biological mother is often seen as a significant first step toward womanhood" (p. 212). I interpret Collin's claim here as intricately linking motherhood and womanhood, which parallels other literature that identifies links between womanhood and motherhood (Arendell, 2000; Roberts, 1993). In this way, women are expected to produce children and spend all of their time raising them because Western society believes that is part of their nature as women, to have and nurture children. Often, women who resist the expectation or desire to devote their lives to raising children, instead working towards other endeavors, are viewed in Western society with suspicion.

The association between women, motherhood, and child-raising has established societal expectations for how mothers are meant to behave in current Western society. Often, policies and representations of mothering in media "[have] reinforced the dominant ideologies of the good mother, promoting, in the process, a particular view of appropriate women's roles" (Arendell, 2000, p. 1200). These particular expectations and ideals of being a mother are also rooted in white, middle-class ideals (Dillaway & Pare, 2008; Roberts, 1993) which can create further challenges for acceptance and recognition for more diverse mothers. Some of these expectations attached to Western society include thoughts that the ideal mother cares for her children exclusively (Dillaway & Pare, 2008), mothering is a sacrifice of self (Maher & Saugeres, 2007), and that well-behaved children are a sign of good mothers (Austin & Carpenter, 2008). As Sousa (2011) characterizes these expectations, "today's American mothers are expected to devote limitless time, energy, and resources to their children's development while disregarding any self-interest that may conflict with children's needs and desires" (p. 220). These expectations of

motherhood function to support a static picture of mothers, while also subsuming any other identity of a woman into only that of mother.

Time dedicated to child care is associated with what is considered ‘good’ mothering. That is, if a mother is truly ‘good’ at mothering, she is able to spend her time looking after and directly caring for her child (Christopher, 2012) and is intensely focused on child rearing (Maher & Saugeres, 2007). “Today’s ‘good’ mother is not only physically at home with her children, but also she is spending physical and psychological ‘quality time’ with them to ensure their ‘proper’ development” (Dillaway & Pare, 2008, p. 441). Dillaway and Pare’s (2008) mention of proper development is a nod towards expectations of mothers and their children’s education, which I will return to later in this chapter. Gorman & Fritzsche (2002) describe how the expectation of time extends even to the mother working outside of the home, where U.S. society views happy working mothers as less dedicated to motherhood than mothers dissatisfied and working outside of the home. From Gorman and Fritzsche’s perspective, if a mother could not stay at home spending all of her time raising her children, she was expected to desire to do so.

Implicit within devotion of time and support of a child’s education are expectations about mothers’ self-sacrifice and raising good children. Mothers are “required to be unconditionally available” (Maher & Saugeres, 2007, p. 6) in caring for their children. In all areas, motherhood is expected to come first, including before taking care of yourself. In Garey’s (1995) study, this meant mothers working the night shift would sacrifice sleep in order to support their children’s school or extracurricular activities. Sacrifice of self for the sake of raising children has strong ties to identity theory where a sense of self is part of one’s identity (e.g., Stryker & Burke, 2000; Appiah, 2006), which I unpack further in Chapter 3. However, these expectations of motherhood

assume mothers give up or sacrifice other features of who they are in order to be fully available to their children, to act solely as mothers.

The efforts of time and self-sacrifice were also expected to produce good children. U.S. society wants women mothering such that their children are well disciplined, otherwise the women are viewed as "poor" mothers (Austin & Carpenter, 2008). Good children are well behaved and grow into successful adults and good citizens. In their study of mothers with children that have ADHD, Austin and Carpenter (2008) claim that "no matter how diligently [the mothers] work to embody the habitus of good mother, their children are not good…These women's success as mother[s] cannot be measured by the success of the child" (p. 389). As Garey's (1995) and Austin and Carpenter's (2008) work shows, tensions exist in the expectations of what motherhood should be and how mothers struggle to fulfill them. The expectations of time, dedication of self, and production of 'good' children frame mothers as in charge of "proper development" (Dillaway & Pare, 2008) of children.

Historically, the most respected people and practices within motherhood have been associated with middle-class white women (P. H. Collins, 1987; Davis, 1983; Dillaway & Pare, 2008). Motherhood is even revered for those that fit within the expectations described above (dedication of time, self-sacrifice, and well-behaved children) as long as that mother is white (Oka, 2016; Morgan, 2018). The alignment of motherhood with white middle-class ideals often means Black mothers are viewed as failures in mothering, or not mothers at all (Littlefield, 2007). Davis (1983) highlights the dichotomy of revered motherhood in the 19th century where

> Black women came to be increasingly appraised for their fertility…[but] this did not mean, however, that as mothers, Black women enjoyed a more respected status… Ideological exaltation of motherhood—as popular as it was during the nineteenth

> century—did not extend to slaves. In fact, in the eyes of slaveholders, slave women were not mothers at all; they were simply instruments guaranteeing the growth of the slave labor force (p. 7)

Black women may produce children but in the eyes of the powerful, they did not receive equal status as mothers. Narratives today about Black women as mothers continue similar trends of not seeing them as 'good' mothers because their activity does not align with the expectations of the white, middle-class.

Several stereotypical images persist that show Black mothers failing in 'good' mothering. For example, Black mothers who act as the breadwinners for their household are viewed as matriarchs, dominating and emasculating patriarchal ideals of family (Rosenthal & Lobel, 2016). The images of ideal motherhood from a white perspective have shut out how Black communities care for children, with different environments that do not always allow for childcare to be centered in the nuclear family and the need for some mothers to work outside of the home (P. H. Collins, 1987). With the conceptions of motherhood as fitting norms of white middle-class women, the assumption is that Black mothers must not be meeting those expectations, and are thus failing to raise children. More detail on the assumed whiteness within motherhood and its impact on mothers of color is discussed in the context of identity theory and Collins' (2000) matrices of domination in the following chapter.

The expectations of what mothers should do or what society thinks mothers are doing are full of assumptions that may not consider the complexities of what mothers are actively trying to do. Through analysis of mothers' stories, research finds the ways mothers put in efforts others do not see in order to fit society's expectations or create alternative pathways of success that are not understood as success from the outside. Garey's (1995) study of mothers who work the night

shift, explores how they make tremendous additional effort to do the same things that may be expected of stay-at-home mothers, often by sacrificing sleep and self-care. “Mothers who perform these activities are therefore downplaying the incompatibilities between the structure of employment and cultural definitions of good mothers” (p. 423). Without exploring the experience of these mothers, it would appear they are easily completing tasks of mothering expected by society. However, as Garey’s analysis shows, the mothers are going to extremes to help with school projects, bake sales, and extracurricular activities. Chase (2018) and Austin and Carpenter (2008) show how mothers challenge narratives about themselves, as teen mothers and mothers of children with ADHD, respectively, and prove they can be successful. Again, without the attention to the stories of the mothers in these situations, the larger societal narratives would simply see teen mothers as failures, and mothers of children with ADHD that act out as not trying hard enough. Attention to stories, through narrative inquiry allows for context into the lives of mothers and how they aim to be successful, in motherhood and in their lives. I return to the use and impact of narrative inquiry in the context of this study in Chapter 4. The centering of mothers and their experiences further supports my use of feminist identity perspectives that consider who one is from how they define themselves (Cervantes-Soon, 2017) that is not captured through a single representation of an identity (Young, 1994). I describe my use of identity perspectives in greater detail in Chapter 3. This study offers a complex perspective of mothers in mathematics through stories, that has not been fully addressed before.

Fortunately, some shifts in the role and responsibility of motherhood are happening that expand what counts as mothering and who counts as a good mother. Ideals from 19th century constructions of (white) motherhood saw mothers as merely for procreation (Littlefield, 2007) whereas more current models explicitly indicate a move beyond biology with mothers defined by

activity (Arendell, 2000). Defining mothers by activity aligns with how I previously defined mothering. The move of mother as biological relation to consideration of activity widens who is understood as a mother, or doing the work of mothering, aligning more with this study's definition of motherhood. One of the shifts in views of motherhood supports the delegation of child care instead of direct care (Christopher, 2012). Other shifts involve framing one's mothering and character as positive (Chase, 2018) or different forms of love in motherhood as politicized care (K.A. Story, 2018). These collective features of shifting motherhood in small communities act as a push to be more inclusive in what counts as mothering, supporting the ideals and actions of mothers who are not white or from the middle class.

High stakes are placed on raising and educating children. But the stakes are particularly high for mothers. However, expectations of a mother dedicating all of her time to child-rearing (e.g., Maher & Saugeres, 2007), that successful motherhood is only clear if the children raised are good (Austin & Carpenter, 2008), and norms of motherhood aligned to white middle-class ideals are not possible for mothers in various circumstances. As P. H. Collins (1987) argues in her discussion of an Afro-centrist meaning of motherhood, "African and African-American communities have also recognized that vesting one person with full responsibility for mothering a child may not be wise or possible" (p. 5). Not all mothers have the opportunity or desire to be a stay-at-home mother, or the sole care provider, which is in conflict with the expectation that women naturally want to nurture and that mothers should be dedicating all of their time to childrearing. Odenweller and Rittenour (2017) argue that "the idealized motherhood revealed here is not just detrimental to mothers; it undermines all women" (p. 68). Women are expected to be biological mothers and the expectations of motherhood are constraining, setting many women up to be viewed as failures, whether they chose not to become mothers or if they become

mothers but act outside society's expectations. However, people outside of these expectations have been mothers and raised successful children. The tensions between expectations of motherhood and those who are mothers create space to explore alternative forms of mothering, of raising children. By focusing on motherhood and success from the perspective of the mothers themselves, research can begin to disrupt the core expectations of what ideal mothering must look like. I used this as a frame for how I analyzed the narratives of mothers and their experience in mathematics. By unpacking the participants' interactions with children in mathematics and how they raise children, I center the efforts of these mothers that are successful but not always aligned with ideal expectations of motherhood.

Expectations of (School) Mathematics

How mathematics and mathematics education research determined what counts as mathematics and who mathematics is for is based on systems that have privileged particular norms of white, middle class men (Rousseau Anderson & Tate, 2016). The interpretation of mathematics as an important and challenging subject (Ernest, 2018) makes it easier for Western society to recognize mathematics as an elite subject meant for only a select few (Joseph, 1987). Tensions in mathematics have been present for a long time in relation to what mathematics is, what mathematics people should learn, and who should be doing mathematics. For example, the issue of reform in the 1990s created a clash between the traditionalists, who saw mathematical learning as based in memorization, and the reformers who saw it as based in problem solving (Schoenfeld, 2004). Even with these tensions, there was agreement among researchers that mathematics was important. As Ernest (2018) argues, "mathematics plays a central role in normalizing instrumental and calculative ways of seeing and thinking. From the very start of their education children are schooled in these ways of seeing and being" (p. 197). Even with

clashes in what these ways of thinking should be is a thought that mathematics should be learned in a specific way. What has remained most prominent within mathematics is a promotion of mathematical elitism (Watson, 2008) which has resulted in the normalizing of white, middle class, and masculine ideals.

While there is still a sense of elitism, and ideals supporting the norms of white, middle class men, school mathematics often has its own specific expectations. School mathematics is often centered around getting the correct answer and working fast, where the instructor has the authority to define what is and is not mathematics (Esmonde et al., 2013). Instead of learning to understand, school mathematics is frequently about memorization and algorithms. "Traditional school mathematics is often characterized by an overreliance on paper-and-pencil computations with little meaning, clearly formulated problems following prescribed algorithms, and a focus on symbolic manipulation deprived of meaning" (Civil, 2002, p. 41). School mathematics may focus on procedure over deeper understanding, where students should know things quickly, without allowing time for others to make sense of the content. Mathematics in this setting is done for the sake of the subject itself, to promote smartness through use of numbers and memorized facts that does not require a deeper understanding or recognition of other activities as mathematical.

Due to the ideas of what counts as mathematics within school settings, students develop particular ideas about themselves and whether they are doing mathematics, and these understandings of mathematics can persist beyond schooling. What is taught in school often takes precedence (both in time and importance) over other kinds of mathematical learning that happens at home (Takeuchi, 2018). The expectations of school mathematics often translates into not recognizing mathematics outside of the classroom as actual mathematics. Esmonde and

colleagues (2013) found this to be the case with students attempting to recognize mathematics at school and at home, claiming that "people depicted mathematics as integrated into their activities, so that they were not always sure it was mathematics" (p. 15). A similar result was found by L. Martin and Gourley-Delaney (2014) in their study of students identifying activities outside of school as mathematical or not, and the students' questions around whether an activity absolutely needed mathematical calculation to be considered mathematics at all. These cases are indicative of the expectations of what counts as mathematics from a schooling standpoint, that privileges the mathematical learning in school as the main or only form of mathematics in which people can engage.

The particular and perpetuating expectations of mathematics within schools, coupled with students' interpretation of mathematics in their lives creates further tensions in what counts as mathematics. Stevens (2013) found in his analysis of the mathematics in people's jobs, was that it does not "often directly resemble those of school math" (p. 75). School mathematics is done for the purpose of doing mathematics, while out-of-school mathematics is often in service of other activities, such as finances and following sports statistics (L. Martin & Gourley-Delaney, 2014). However, it is school mathematics that is privileged as mathematics, limiting understanding of how out-of-school activity may involve meaningful mathematical thought. The distinction between how mathematics is used and understood in and out of school can further shape people's perceptions of themselves and their ability, and continue to emphasize mathematical elitism:

> The belief that mathematics requires innate talent is widespread in our culture, most notably among teachers of mathematics...The importance of this belief is that it rationalizes the notion that only some students will be able to learn school mathematics

> successfully and that math courses distinguish these from the less talented (Douglas & Attewell, 2017, p. 651)

Douglas and Attewell (2017) make the connection between how mathematics is understood in our culture and perpetuated through schooling to support notions of who is and is not mathematical. These attitudes around mathematics, perpetuated by culture and mathematics teachers can shape someone's mathematical identity, believing themselves to not be a "math person" because of the limited expectations of what counts as mathematics within school settings.

The elitism of who is viewed as good at mathematics, in general, and through schooling does much to shape people's mathematical identity. Douglas and Attelwell (2017) claim that school math plays a particular role in how it labels students as smart or not. Their claim suggests that what counts as mathematics in school can shape how individuals see themselves as "smarter" or "less capable" even if these same people are using mathematics in different ways outside of school. D.B. Martin (2000) makes this point clear in his work with African American students and their parents' experience of mathematics:

> Many of those who are often excluded from formal mathematics may be using mathematics in the course of their daily lives and doing so in very proficient ways. However, because of their negative mathematics socializations and identities, they may not believe that their activities are mathematical in nature (p. 47)

D.B. Martin's point has implications for people long after they leave school, indicating an impact on mathematical identity that can persist for parents, like the mothers of this study.

How mathematics education has supported raced, classed, and gendered norms is expressed across many researchers. Rousseau Anderson and Tate (2016) discuss how learning is

racialized and the cycle of mathematics education promotes inequities. D.B. Martin (2003) argues the top-down structure of mathematical reform ignores more diverse populations of students. Harouni (2015) explicitly discusses the divide in mathematical content for learning around class structure, where mathematics for lower classes is associated with a utilitarian approach, whereas mathematics for middle to higher-class groups is advanced and more abstracted. The attachment of who has access or recognition in mathematics creates new expectations of what counts as mathematics. More utilitarian or applied mathematics, like arithmetic, is separated from abstract conceptions of mathematics, both in some modern interpretations (Hacker, 2016) and reforms historically (Clements, Keitel, Bishop, Kilpatrick, & Leung, 2013). Given the ties of particular kinds of mathematics to class and the rejection of utilitarian applications as "real mathematics" an elitist perspective of the subject is maintained, that views certain people as mathematically capable and others as incapable.

Intersections of Motherhood and Mathematics

The expectations of action and behavior in school mathematics as well as expectations for mothers intersects in ways that create a masculine-privileged environment for the subject. The binaries established with regards to gender, that men and women are seen as separate and the roles of mothers and fathers are also distinct, are also present in mathematics, defining who is and is not good at math. These areas overlap in gender that aligns men and masculinity with 'good at math' and women and femininity with 'bad at math' (Hottinger, 2016). Mendick (2006) argues that the delineation of who can or cannot do mathematics via gender is in response to sociocultural norms, stating "that the sociocultural constitution of gender as oppositional, and the connection of this to the series of binary relations through which maths is constructed, makes it more difficult for girls and women to identify as 'good at maths'" (p. 46). A cultural fixation on

binaries and expectations within mathematics assumes that women are generally not good at the subject. This has further implications for mothers, who are expected to be involved in raising and educating children (that includes mathematics) but simultaneously incapable of being good at mathematics because of the association of mothers with women. This section details the intersection of expectations of women and mathematics to understand the historical precedence of a masculine mathematics and how girls, women, and mothers' experiences are understood.

Gendered Perspectives of Mathematics

Historically, mathematics has been viewed as a subject most appropriate for men (Damarin, 1995). Trends in these views have continued in different ways into present day, supported by policy, representation, and even privileged mathematics characteristics. These elements have perpetuated a masculine environment of mathematics that is unwelcoming to women. Understanding how mathematics has been masculinized gives context for the resultant impact that masculinization has on women's experience in the field, and ultimately mothers' mathematical interactions with children. Past understanding of the subject and its perceived audience have assumed that women do not need and should not be part of learning mathematics (Hottinger, 2016). It is a subject that has frequently been categorized as masculine, inherently meant for men but not for women (e.g., Connell, 2010; L.A. Leyva, 2017). The rest of this section details the masculine features often associated with mathematics. The next chapter further details the gender binary that separates men and masculinity from women and femininity.

The masculine characteristics of mathematics that often function to exclude women are maintained through the expectations within the environment of learning and doing mathematics. The more common practices supported in mathematics are people working independently and thinking with logic and rationality (Ernest, 2018). These are traits that U.S. society has

frequently aligned with masculinity and men. Men are often identified as more independent workers, whereas women have been viewed as collaborative and dependent workers (Solomon, 2012). The competitive and isolating nature of mathematics is thus viewed as something more appropriate for men, based on how U.S. society has agreed that men learn. Additionally, the rationality and logic associated with mathematics is not deemed acceptable in the ways that women are expected to act and think (Mendick, 2006). Rationality is associated with the masculine, whereas emotion is associated with the feminine. In this sense "reason…involves the denial of the very characteristics that allow one to be a 'proper' woman" (Hottinger, 2016, p. 16). The features most associated with doing mathematics, like reason, logic, and independence are characteristics deemed appropriate for men but not for women. The delineation along gender lines of who can and cannot do mathematics has further implications for mothers supporting their children in learning mathematics. Perceptions that mothers are women, and a masculine mathematics is not for them, supports the assumption that mothers will struggle with the subject.

The model of a masculine mathematics is perpetuated through the continued thoughts of people that the field is not meant for women and the socialization of younger generations to think this way too. Students have historically been socialized through parents, teachers, media, and school structures to believe that mathematics is incongruous to women (G.M. Burton, 1978). The characteristics previously described as attached to mathematics are continually attached to men as their natural characteristics. Again, the assumption of mathematics associated with masculinity represents a further promotion that separates masculine/feminine and good/bad at math, perpetuated through everyday language and understandings (Esmonde, 2011). As Mendick (2006) argues, "the masculinity of maths is maintained through powerful fictions about rationality and genius; these are both historically rooted and active in contemporary culture" (p.

68). Representation and Western society's collective idea of what mathematics is, has maintained itself for years, limiting recognition of women doing mathematics. "Unless boys as well as girls are convinced that 'real women do math,' efforts toward gender equity in mathematics will encounter obstacles based on stereotyped social roles" (Campbell, 1995, p. 229). While Campbell's statement is not the only obstacle to change the environment of mathematics for women, it does stress that the issue of inclusive mathematics is not about changing women to fit within the problematic system of mathematics today. What requires further exploration is how the stereotyped roles of women outside of mathematics impacts mothers, who may be viewed as both in charge of raising and educating their children but simultaneously ill-equipped to help them with mathematics. Like the suggestions by Campbell, this study aims to highlight that 'real women do math' (where I have argued a 'real woman' is someone who identifies as a woman) in looking at the positive ways that mothers can engage with their children and mathematics.

The changes that need to happen in mathematics to recognize women acting through femininity as contributors and not merely obstacles to the field is supported in the literature with changes happening to the mathematics environment and its teaching. Braathe and Solomon (2015) argue that while individuals have agency to enact some change, there must also be a systematic component of change, including policy, teaching, and representation. For example, Bejerano and Bartosh (2015) make suggestions for changes within college mathematics syllabi to better reflect elements of a hidden curriculum and representations that privilege men over women. "Our efforts need to shift away from changing girls toward changing how mathematics is taught, and how girls are treated when it is" (Campbell, 1995, p. 225). What is missing in the focus of women in mathematics and their forms of resistance is the alternative forms of engagement possible for women, and also mothers. What does it look like for women, for

mothers, to engage in mathematics in ways viewed as equally successful as men? This space for engagement suggests changes in how the literature approaches expectations in relation to mothers in mathematics. While the failure of 'proper' behavior or academic success is placed on the mother, new literature can point to larger systems contributing to what shapes children's behavior or attitude within mathematics. Instead of trying to change mothers to do better in mathematics, my work aims to focus on how the environment of mathematics itself is challenging for women, how that impacts mothers, and what they do to still provide the best opportunities for their children in mathematical learning.

Women's Experiences in Mathematics

Given the allusions made to an elitist (synonymous with masculinist here) and limited understanding of who can do mathematics, it is important to see how researchers have studied women's experience in the subject. Early explorations with women in mathematics were concerned with achievement and the impact of the mathematics environment, often in relation to or in contention of factors of biology. Research concerned with achievement frequently pointed to insignificant differences in overall test scores for men and women in mathematics, to combat against the idea that mathematics is a subject inherently meant for men (Fennema et al., 1998; Fennema & Sherman, 1977). In the research exploring the impact of the environment is a call to see what factors, such as the structure of educational systems, (lack of) support of educational leaders, and limiting instructional methods, are negatively impacting women's experience (G.M. Burton, 1978; L. Burton, 2001; Damarin, 1995). These foundational studies lead to a broader sphere of literature addressing women's experience in a masculinized mathematical environment.

The representation of newer literature on women's experience in a known field of gendered mathematics ranges from how women handle stereotype threat and anxiety (e.g. Spencer, Steele, & Quinn, 1999), to how they make space for themselves within mathematics through the narratives they construct (Allen & Eisenhart, 2017), to how women experience mathematics at the intersection of race and gender (Gholson, 2016). These three primary branches of research suggest that women struggle academically because of the perceived idea that they should not succeed in mathematics, that they make efforts to create a space for themselves, and sometimes even after all of those efforts they can face obstacles in recognition and support because of race and class. How the literature represents women's experience and the trends in what that experience looks like can illuminate the context mothers are coming from with their past in mathematics and their current interactions with children. These contexts may also be informed by matrices of domination (P. H. Collins, 2000) that privilege the norms of white men in mathematics environments.

The literature that considers the impact of stereotype threat on women in mathematics considers how academic achievement is impacted, often in relation to feelings of anxiety. Stereotype threat relates to negative stereotypes about a group of people that influence how a group may perceive themselves (Gresky, Eyck, Lord, & McIntyre, 2005). "Negative group stereotypes are implicitly threats to one's social identity simply because such stereotypes often define one group as inferior to another in a given domain" (Schmader, 2002, p. 195). These researchers argue if the stereotype for women is that they are not meant to do mathematics then that perception is a threat to their academic achievement, such that their participants perform worse on assessments when stereotype threat is emphasized. Women's worry or anxiety, often in connection to this stereotype about their ability, is also found to impact their mathematical

performance (Ganley & Vasilyeva, 2013; Spencer et al., 1999). Tomasetto, Alparone, and Cadinu (2011) make further connections about mothers and their actions in mathematics learning. They argue that the anxiety expressed by mothers due to gender stereotypes are taken up by their daughters. The perspective of the influence of parents, particularly mothers, on children through the transmission of anxiety in mathematics is present more extensively in the literature on parents' involvement in mathematics education (Boehme et al., 2017), which I address in more detail in the next section. What should be emphasized in this line of work is how the environment of mathematics that refuses to see women as mathematical is impacting their emotions and performance in the subject, extending even to future parenthood. Research must be careful to understand the context of women's response to mathematics, recognizing the location of the problem in the structure of mathematics and not within individual women.

While research on stereotype threat and anxiety focus on the impact of environment and resultant emotion in academic achievement, a large group of authors study how women make space for themselves or resist negative stereotypes in mathematics through the stories of their experiences (e.g., Bartholomew, Darragh, Ell, & Saunders, 2011). For example, Solomon (2012) explores how two women describe their mathematics experiences in narratives that contain multiple voices. These voices may still recognize the gendered nature of the subject's environment but also construct ways these women can be part of the mathematics learning. Attention to how individuals construct themselves within the mathematics environment shows parallels to self-verification of identity theory (Stryker & Burke, 2000) as well as the significance of self-authoring within feminist perspectives of identity (Cervantes-Soon, 2017) that I address in more detail in the following chapter. DeGregorio's (2005) study of women in community college emphasizes a similar point in how women can still succeed in mathematics

by creating new strategies or narratives to support themselves. The expected characteristics of someone who does mathematics are limited, but these studies indicate how women can make room for themselves in different ways. My study extends the notion of making space by considering the specific impact of mathematics on mothers.

The stereotypes and experience of mathematics for women in the resultant environment is not uniform across all women. The issues of race and class in mathematics intersect to create complex challenges for girls of color. Girls of color exist in the margins of gender and race in ways that are continually not supported in mathematics. The lack of exploration of girls of color is also present in mathematics research. Gholson (2016) argues that "Black girls and women lurk in the proverbial shadows of inquiry in mathematics education and become visible only briefly to illuminate the status of Black boys and men or White girls and women" (p. 298). In policy, and as Gholson (2016) expresses, in research, Black girls do not get the same attention for their experience in mathematics. Similar to the narratives described in other studies, girls of color construct narratives for themselves in the mathematics classroom that challenge assumptions about gender and race. Gholson and Martin (2014) saw this in elementary school girls that leveraged their interpersonal relationships to create strong mathematics identities. In a high school setting, Allen and Eisenhart (2017) describe how Black girls structured their own narratives about success in mathematics and established positions as strong students as a form of resistance to local school narratives that did not predict their future achievement. The experience of women in mathematics must be understood in the context of the environment, with attention to gendered and racialized assumptions. How women are framed as resisting negative stereotypes in mathematical learning establishes a frame for how research can explore mothers' connection to mathematics. By looking specifically at the experiences of mothers and their forms

of engagement, my research can begin to recognize broader ways that parents, particularly mothers, interact with their children that positively supports mathematics. Additionally, a mother-centered narrative allows for further exploration of the influences of larger structures within U.S. society in shaping those interactions and expectations of mothers.

Western society has established a clear divide between men with masculinity and women with femininity (Wittig, 1992), where mathematics is grouped with the masculine, and "'masculinity' does not exist except in contrast with 'femininity'" (Connell, 2010, p. 232). As Mendick (2006) argues, "this socio-cultural constitution of gender and mathematics in oppositional terms makes it more difficult for girls and women to identify as 'good at maths'" (p. 204). Research that discusses women in mathematics is always in the context of how the subject has historically been intended for others. The tensions present in what mathematics is and who it is for, coupled with the research on women's experience in mathematics confirms the disruption that must happen with how mathematics is understood. The intersection of masculine mathematics and the further raced experiences of women in mathematics can extend into the experiences of mothers interacting with their children in the subject. In the same way that men and masculinity have been separated from women and femininity, the roles of father and mother have been divided to only correspond to what is understood as 'appropriate' gender roles. This places fathers, who are seen as men and masculine, within the realm of mathematics and mothers, who are seen as women and feminine, outside of it. As such, the very structure of mathematics and U.S. society's expectations attempt to exclude or distrust mothers' involvement. By looking collectively at the context of motherhood and mathematics expectations, new research can establish a frame for discussing mothers' roles in mathematics and resist limiting narratives.

Expectations of Parental Engagement and Early Learning

Only a few factors in connection to parents' school involvement receive consistent attention. Epstein and Dauber (1991) lay out six major types of involvement that support children's education: basic obligations of families (e.g., providing for child's health and well-being), basic obligations of schools (e.g., parent communication), presence at the school (e.g., volunteering), learning activities at home, decision making (e.g., PTO), and collaboration with community organizations. Unfortunately, what is most often considered parent involvement relates to what they are doing physically at the school. In some ways, the language of "involvement" that is used is limiting. Barton and colleagues (2004) propose the use of the term "parental engagement" which is viewed "as a dynamic, interactive process in which parents draw on multiple experiences and resources to define their interactions with schools and among school actors" (p. 3). A focus on engagement is more inclusive of these additional forms of activity that parents may implement to support education. Recognition of the limitations in parent involvement allows for clarity in how the expectations of parental involvement are narrowly framed around white, middle class ideals (Posey-Maddox, 2017). The following section details the assumptions of who participates within parental involvement, tensions between parent and teacher expectations, positive forms of parental engagement, and early learning through school readiness.

When research and schools discuss parents involved in children's learning at school, the assumption is that mothers are the ones who are participating (e.g. Posey-Maddox, 2017). The expectations placed on mothers for parental involvement creates the intersection between motherhood and parent involvement. As such, when literature talks about parental involvement or engagement there is an underlying assumption that mothers are doing this work, such that

parent involvement is an element of expected mothering. While this section will detail further the tensions present in expectations for mothers' involvement in school vs. expectations of school stakeholders and examples of early childhood learning, a focus on parents shows an overall positive intent in supporting education. Suizzo, Pahlke, Yarnell, Chen, and Romero (2014) found from their study of mothers with pre-kindergarten age children that there was a "variety of ways that all mothers interact with their children with the goal of supporting their learning across developmental and cognitive domains" (p. 278). Their findings suggest the myriad of ways that parents, particularly mothers, are engaged with children and their education but that these forms of engagement are not always recognized and supported by schools as forms of educational involvement.

Parent Involvement vs. Engagement

For decades, parents and school stakeholders have seen the purpose of parental involvement in education differently (Allen & White-Smith, 2018; Epstein & Dauber, 1991). K.J. Anderson and Minke (2007) found that "parents and educators define involvement differently; parents take a more community-centric view that includes keeping their children safe and getting them to school, whereas teachers define involvement primarily as parental presence at school" (p. 311). The tension between parents and teachers on this expectation is visible in some research in how they focus on more limited forms of involvement. The school-centered model of parent involvement privileges norms of white, middle-class families in schooling and creates inappropriate expectations for how other families engage in education (Posey-Maddox & Haley-Lock, 2016). The white, middle-class expectations of parent involvement also parallel expectations of motherhood in U.S. society, that privileges white, middle-class ideals (Dillaway & Pare, 2008). When research and expectations are instead focused on what parents are actually

doing, engagement in child education is visible through intent, positioning, and community connections (Barton et al., 2004).

Research on parent engagement is more broadly centered on what parents do to connect with school stakeholders and school content (like homework) and on home-centered activity that promotes learning and the value of getting an education. Toren (2013) found that the distinction between school and home parental engagement is that supporting school learning is about monitoring and supporting home learning is often about relationship building. When attention is focused on school-centered forms of involvement, there is often concern that parents are not involved or helping enough, because school-involvement typically means volunteering or homework help. This is seen as a decline as students move into middle and high school. However, Bhargava and Witherspoon (2015) highlight a shift instead of a decline in parental activity:

> Parents may reduce involvement in strategies that may infringe upon adolescents' autonomy (e.g., homework assistance, volunteering at school) but increase involvement in strategies that allow them to scaffold independence in youth and promote youth's decision making ability (e.g., communicating the value of education)" (p. 1714)

What is understood as parental engagement in education depends on the measures used or the people asked. When parents are centered, more varied forms of engagement become apparent. With a focus on parental engagement, some additional forms of activity include making decisions, management of tasks, and showing the importance of learning are visible (K. J. Anderson & Minke, 2007; Castro et al., 2015; Ule, Živoder, & du Bois-Reymond, 2015).

Literature using a Black feminist lens identifies alternative forms of engagement parents employ that are frequently disregarded as forms of educational involvement. For example,

Bhargava and Witherspoon (2015) found that Black families are most likely to engage using academic socialization (i.e. telling children why school is important), but this form is not often recognized by school leaders as a meaningful form of parent involvement. The tensions between teachers and parents and between parents and researchers indicates the missing investigation into other productive ways that parents engage with their children in education. Different forms of engagement and benefits are present in the studies that address tensions, or explore the experiences of more diverse families. However, the broader theme in research is to focus on limited forms of parental involvement and how it impacts achievement. Parent-focused studies on engagement (such as C. W. Cooper, 2007) will address the gaps in research, by emphasizing how the parents act to encourage and support their child's learning and time in school. The trends in parent-centered literature further support the need for my research, to look at a mother-centered model of engagement, specifically in mathematics education.

Furthermore, literature that centers parents with a Black feminist perspective works to challenge the limited narratives in school about what it means for parents to be involved (Allen & White-Smith, 2018; C. W. Cooper, 2007/2009). C. W. Cooper (2007) finds in her study of Black mothers' narratives of supporting their children in school that "their racialized, gendered and class-based identities intersect and greatly influence how they socially construct their parental involvement roles" (p. 507). The context of social factors and privileges of certain identities shape how parents respond and engage with their child's learning. The focus of Black feminist literature in parental engagement provides a frame for how better connections can be made between schools and families by centering the experiences and actions of parents within the context of expectations for parenting and schooling.

Early Learning and School Readiness

Preparing children for school is most often connected to expectations of parents supporting early childhood learning. In research, there is a desire to understand what it means for children to be ready for school (D. Leyva, Tamis-LeMonda, Yoshikawa, Jimenez-Robbins, & Malachowski, 2017; Sheridan, Knoche, Edwards, Boviard, & Kupzyk, 2010). The activities that parents engage in at home, both the variety and frequency, can influence what children know when they first come to school. Cannon and Ginsburg (2008) make the case that:

> The materials and settings that children learn in and from are largely elected by parents. For example, parents choose which toys children play with; which schools, if any, children attend; and whether to teach children specific subject matter at home (p. 239).

While parents' engagement can have an impact on children's learning throughout their life, significant attention is placed on what happens before children first enter school. As Chazen-Cohen and colleagues (2009) argue, "what parents do really matters—what they do early on as well as what they do over time" (p. 973). This statement captures what possibility parents have in making a difference in their children's learning while also explaining why research is often focused on what children should know before entering formal schooling.

While the literature recognizes the important role of parents in supporting children's early learning, it is also clear from different studies that a diverse set of activities and systems provides the best tools for children's learning (e.g., C. E. Cooper, Crosnoe, Suizzo, & Pituch, 2010; El Nokali et al., 2010; Sheridan et al., 2010). As Galindo and Sheldon (2012) argue "the two most influential contexts in which young children's learning and development occur are home and school" (p. 90). However, much of the attention and focus on school readiness is on academic over socioemotional skills (Duncan et al., 2007). Fixation on academic skills over other

important skills that children learn early limits what can be recognized as meaningful learning that parents engage in with their children. Delpit's (2012) book directed to teachers of children of color clearly describes the dichotomy of skills that children may come to school already knowing and the small subset of those skills that are privileged:

> Children come to us [teachers] having learned different things in their four-to-five years at home. For those who come to us knowing how to count to one hundred and to read, we need to teach them problem solving and how to tie their shoes. And for those who already know how to clean up spilled paint, tie their shoes, prepare meals, and comfort a crying sibling, we need to make sure that we teach them the school knowledge that they haven't learned at home. Unfortunately, though, different types of skills are not equally valued in the school setting (pp.54-55)

School settings that continue to privilege academic skills over other important life skills for children can further exacerbate the negative interpretation of parents' engagement with learning. Research on children show the benefit of a variety of activity and learning through home and school, but current expectations about schooling and learning focus almost solely on academic skills.

Intersection of Mathematics and Parental Engagement

Similar tensions between school and family expectations in parent engagement are also visible within mathematics education. Research and concerns in this field often have a more heightened focus on the academic contribution parents can (or should) offer their children, which parallels the focus on academic skills in early childhood learning more broadly. Attention on parents' efforts in mathematics with their children is largely divided into two broader areas: the impact of parent anxiety on student academic success and interest in the types of activities

parents do at home that engage and support mathematics. The rest of this section will describe the literature around parent anxiety in mathematics and the conditions of mathematical activity at home. I continue by making connections to the specifics of this study, the actions of mothers with their young children in mathematics. As such, I detail how literature talks about early childhood mathematics and parents' interactions and what that interaction means specifically for mothers. The section concludes with how mothers' engagement in mathematics can be framed more positively, with a parent-centered analysis of activity.

Parent Mathematical Anxiety

Often, studies of parents in mathematical interaction consider how mathematics anxiety is transferred between parents and children in ways that may impact mathematical attitudes or achievement (e.g., Maloney et al., 2015; Soni & Kumari, 2017). How parents discuss, interact with, and value mathematics can impact a child's perspective and performance. Soni and Kumari (2017), for example, found that "parental math anxiety positively influenced children's math anxiety and negatively affected their math attitude…parents' math anxiety transfers math anxiety to their children, which in turn negatively influences their children's attitude toward mathematics" (p. 342). How parents should respond to issues of mathematics anxiety are mixed across research, where some suggest more involvement in and out of school mathematics can support achievement even with the presence of anxiety (Vukovic et al., 2013), others find increased involvement can instead be damaging (Maloney et al., 2015).

While responses to what parents should do about their mathematical anxiety remain mixed, there are themes that suggest this anxiety stems from parents' past experience in the subject. It is this past experience (often seen as anxiety) which influences children. D.B. Martin's (2000) analysis of African-American children and the factors that impact their success or failure,

brought attention to how parents' experience can influence a student's mathematical attitude. D.B. Martin argued that "although parents and community members can make pro-mathematics statements, indicating that it is an important school subject and that they want their children to do well, the legacy of their own mathematics experiences can sometimes unwittingly undermine these sentiments" (p. 116). While some of these parent sentiments may be driven by anxiety in mathematics, D.B. Martin's statement and the research on parent mathematical anxiety suggest a connection between how parents experienced mathematics and how they will shape their children's perception of the subject. Given the variation in how researchers understand what parents should do to support mathematical development, and the significance of parent action, it is important to consider parents' actions at home. By centering the present study on the experiences of mothers, mathematics education can learn what activities, beliefs, and behaviors mothers are actively implementing to support mathematical learning. This has the possibility to reframe recommendations of mathematics at home in more nuanced ways than simply increased (or decreased) mathematics involvement.

Mathematics at Home

A common theme from research on parents is not recognizing activities that happen at home as being mathematical. Goldman (2005) argued "that even though family members accomplish math in the context of their lives, they do not define it as such" (p. 59). While this perspective has a positive intent in helping families realize they are doing mathematics at home in areas they did not previously consider, there must also be support from schools that recognize this as mathematics. "This 'values gap' between everyday family math and school math may hold some of the clues to the alienation that many individuals feel from learning mathematics as a subject in school" (Pea & Martin, 2010, p. 11). Helping parents to recognize the mathematics

they already do is important but not enough to support positive connections to mathematics for children if only families and a few key researchers are recognizing the mathematics that occurs at home.

The body of research on mathematics at home is promising in its centering of families and their mathematical activity (e.g., Lefevre et al., 2009; Sheldon & Epstein, 2005; Skwarchuk, Sowinski, & LeFevre, 2014). The work of families' mathematical engagement is also not meant to be viewed as a supplement or secondary to involvement in school mathematics (and thus parent involvement in mathematics). Stevens and colleagues' (2006) study "found that mathematical problem solving in the family, while less explicit than school math, is complex and varied, and while occasionally based in routines, commonly requires adaptive flexibility due to specifics of the situation" (p. 1090). Their work indicates that how parents are engaging with mathematics is valuable beyond school-related activities. This research suggests a fount of opportunity at home in mathematics that must be connected back to the school mathematics environment. Further exploration is required to consider how these family activities and interactions are gendered. The existing studies do not specify who in the family is leading what activity, which could indicate gendered patterns of engagement between mothers and fathers. I expand on this branch of literature that starts with a focus on mathematics at home, where I look specifically at mathematics learning at home with mothers.

Early Childhood Mathematics

Similar to the literature that focuses on early learning and school readiness, research on early mathematical learning emphasizes well-rounded support, through school and the home in varied but also quality activities (Varol & Farran, 2006). Some research further emphasizes how mathematical activity at home and school support each other, where what does not happen at

home in relation to mathematics can be made up in early schooling (Anders et al., 2012). This is to say that while parents can and do meaningful mathematical work at home, placing full responsibility on parents to make sure children have all of their mathematical skills before starting school is unnecessary. Informal activities that engage mathematics through numeracy, such as cooking and number games are opportunities for parents to engage children in mathematical development that children may not be able to do independently (Skwarchuk et al., 2014). The possible activities that parents can do with children at home to support mathematics are varied and address concepts beyond that of numeracy. Possible activities include reading books, singing songs, everyday play, and board games (D. Leyva et al., 2017). Mathematical skills that can be addressed across these informal activities include number, shape, space, and measurement (e.g. A. Anderson & Anderson, 2018). These skills and activities provide varied opportunities for parents to engage with their young children in mathematics.

The majority of studies on parental mathematical activity with young children focuses on helping parents work on appropriate math content (e.g., Elofsson, Gustafson, Samuelsson, & Träff, 2016; D. Leyva et al., 2017; Starkey & Klein, 2000). This body of literature often considers particular resources or games that can promote certain mathematical skills. For example, Starkey and Klein (2000) developed a parent intervention with sessions that modeled use of particular math activities, that parents could take home and then try on their own with children. A smaller sample of studies look at what parents are already doing at home that supports mathematical learning (A. Anderson & Anderson, 2018; Blevins-Knabe, Whiteside-Mansell, & Selig, 2007). A. Anderson and Anderson (2018) categorized the at-home mathematical activities for 6 diverse families to classify the type of activity and the mathematical skills addressed within, showing an expansive variety of activity and skills across families.

Whether the individual research is focused on helping parents learn mathematical activities or documenting what is already happening at home, there is recognition that parents generally want to be involved in supporting their child's mathematical learning. Paralleled with parents' intent to support learning more broadly, Wilder (2017) argues that parents often feel a shared responsibility with teachers to support early math learning. These points show a general positive parent intent to be involved in children's early mathematical learning. This body of literature suggests possibilities to view parents, and specifically mothers, with a positive intent, possessing diverse forms of engagement in mathematics.

Mothers and Mathematical Engagement

Whether addressing concerns of parent anxiety or not, attention to mothers in mathematics is aimed at their influence on their children's mathematical attitude or performance. For example, Boehme and colleagues (2017) consider a more pointed look at child anxiety in mathematics based on the values mothers place on schools and testing, such that higher values of the family and mother but lower self-concept by the child results in increased testing anxiety. Correlations of anxiety are attached to specific emotions in Else-Quest, Hyde, and Hejmadi's (2008) study, where the emotions of the mother in mathematics are shown to correlate to the emotions experienced by their children. Finally, Muller (1995) shows a link between the employment of mothers and the engagement they have with their children in supporting mathematics learning. In each of these cases is an assumption of mothers being the family members meant to support education, while also focusing on the negative impact mothers are likely to have on their children's mathematical learning in doing so. What is missing is the context of such emotions and the assumptions about what parental engagement and mathematical activity must look like.

The fixation of literature on mothers in mathematics doing poorly coupled with the expectation that mothers are the first teachers of their children (Maloney et al., 2015) creates tensions in understanding what is being asked of mothers. Perhaps Western society rectifies seeing mothers in charge of raising children and early education by the limits placed on what counts as mathematics. If early education done by mothers is focused on counting and arithmetic, this is not viewed as mathematics (e.g., Hacker, 2016; Watson, 2008). The struggle, then, that mothers face in supporting children in what is considered mathematics begins later, in middle and high school. Trying to separate arithmetic and counting as mathematical foundations only does a further disservice to the efforts of mothers in mathematical interactions, and does not eliminate the concerns of mathematical anxiety in later grades. Issues of the mathematical environment lie within understanding what counts as mathematics and who it is for, which has historically been limited to a select and elite few (Joseph, 1987). "Given the wide variety of mathematical practices and contexts in which individuals participate or are denied participation (classrooms, curriculum units, jobs, etc.), mathematics socialization can be conceptualized as both a mechanism for reproducing inequities and for working toward equity in mathematics" (D.B. Martin, 2003, p. 16). The tensions of mathematics that reproduce inequities for women, and thus mothers, can also create a space for thinking about alternatives. My research investigates the tensions in the intersecting contexts of motherhood and mathematics to find the positive ways that mothers can engage with mathematics.

Literature that can function to strengthen connections between school and home mathematics while alleviating the assumptions about mothers negatively impacting their children is often focused on the positive influence of Black mothers on their children in the subject. Jackson and Remillard (2005), McGee and Beale Spencer (2015) and Robinson and Werblow

(2012) identify different ways mothers engage with their children to promote academic success. As McGee and Beale Spencer (2015) claim,

> African American parental involvement may not be recognized as such by classroom teachers, particularly teachers from socioeconomic and racial backgrounds different from their students. What might be perceived as a lack of involvement may, in fact, represent behaviors and norms generally different from those primarily evident in White or middle class homes (p. 475).

How these authors frame the tensions between school and home for African American families can be extended to how researchers explore mathematics engagement at home, considering wider frames of parent interactions. Some ways that mothers are described as successfully supporting mathematics achievement in their children is through being a resource, motivator, and supporter of the whole child through regular conversation and leveraging positive role models in the community (Robinson & Werblow, 2012). These forms of interaction described can still represent parental engagement in mathematics, but in more nuanced ways that have not often been as widely explored across parental involvement literature. I intend to frame mothers in this context of attempting positive mathematical interactions with their children, in ways not limited to just helping with math homework, in order to create a parent-centered model of engagement. This new frame of mothers in mathematics has the potential to shape new understandings of engagement across motherhood, mathematics, and schooling, to better support children's learning.

Conclusion

Across the literature of expectations for motherhood, mathematics, and parent engagement in learning is a common thread that privileges the norms and values of white,

middle-class families. Arendell (2000) and Dillaway and Pare (2008) show in their research how the expectations around motherhood, reinforced by the media, are rooted in white, middle-class ideals. These expectations are often coupled with the assumption that views Black mothers as failures in their role as mothers, because they do not match the white, middle-class expectations (Littlefield, 2007). Similarly, in school settings, expectations of parental engagement center the skills and norms of white, middle-class families (Delpit, 2012). This often translates to an expectation of parents being involved in learning through their presence at the school (Allen & White-Smith, 2018). In mathematics, what counts as content and who can do mathematics also privileges the norms of the white, middle-class (Rousseau Anderson & Tate, 2016) while also limiting that privilege to men, creating a masculine mathematics environment (Hottinger, 2016). A masculine mathematics that privileges men creates further tension for mothers. Mothers are often viewed as synonymous with the identity of woman (Dillaway & Pare, 2008; Maher & Sugeres, 2007), where women are not privileged within the mathematics field. However, mothers (as women) are expected to support children's learning, which can include mathematics. Mothers experience push and pull in what is expected or assumed of them in their role as mothers, the experience with mathematics, and what they do to support their children's learning.

Even through the tensions of expectations for motherhood, mathematics, and parent engagement, there are signs of possibility that can expand what parental engagement in mathematics looks like. Studies of early childhood mathematics show a wide range of informal activity that can happen at home to support children's mathematical learning (e.g., A. Anderson & Anderson, 2018; Skwarchuk, Sowinski, & LeFevre, 2014). Often, these activities may already be part of routines that happen at home, addressing important skills that parents do not recognize as mathematics (Goldman, 2005). Helping parents see their activity as mathematical can increase

their confidence to engage their children in such learning. Centering how mothers characterize their actions and define themselves within mothering via an identity theory framework provides a more nuanced experience of parent engagement to explore in research. Another area of possibility are the changing perspectives on what counts as positive parent engagement in students' education. Studies of Black parents, and Black mothers in particular, in mathematics education demonstrate different forms of connecting children to their learning, including motivation, support, and community connections (Robinson & Werblow, 2012). Recognition and value of the work these parents do to support children's education can expand current Western expectations of what parental engagement means. The review of literature indicates few studies that look at the role of the mother in their young children's mathematical activity and fewer consider that activity from the perspective and past experience of mothers. The present study addresses this gap to understand why mothers do what they do in their interactions with children, while also considering the influence of larger societal expectations.

Chapter 3: Theoretical Framework

How I structure the study, engage with the participants, and respond to the research questions is centered within particular feminist perspectives of identity theory. Identity theory considers the elements that make up who people are, informed by their positioning in society (Pratt, 2010) and how people see themselves (Cervantes-Soon, 2017). I consider three major elements that inform my use of identity theory: (1) identity is shaped by external factors, such as social, political, and cultural context (2) identity is also simultaneously shaped by the self where a person can self-author and modify their identity, and (3) an identity of a certain type exists in a wide array of possibilities given the influences of the external and personal. Together, this framework centers the voices and value of people based on their self-definitions and personal experiences. A person's identity may be situated within larger societal expectations of how they must look, act, and behave, but it is how they take up meaning of the self that becomes the focus. Given my focus on disrupting norms about motherhood expectations and women in mathematics, the use of identity theory is most appropriate, because it considers the impact of societal expectations on how people see themselves and then act out their identities. The theory supports a look at how mothers describe their own experience, and how societal norms of gender and race can shape those experiences. Taking this theoretical perspective in research places value on what mothers have to say about their lives and who they are to inform larger narratives about the experiences of mothers in mathematics.

The first part of this chapter shows identity theory within its foundations of social psychology and how the elements I center in analysis stem from feminist perspectives. I detail how identity theory has been taken up in the literature of motherhood studies as well as mathematics education. I discuss how elements of identity theory in motherhood studies and

mathematics education align or diverge from the framework I use and what it means to consider maternal identities and mathematics identities together. The chapter concludes with connections to how matrices of domination (P. H. Collins, 2000) play a role in understanding mothers' actions within the context of the larger society and details of pervasive gender binaries in motherhood and mathematics. These points are an extension of what has been discussed in the previous chapter pertaining to women's experience in mathematics. Ultimately, my theoretical framework allows me to better understand who the mothers of the study are, why they do what they do in mathematics, and how their intent and actions fit within broader societal expectations.

Identity Theory

The beginnings of identity theory stem from the field of social psychology. To understand the underpinnings of the theory and its context within mathematics and motherhood, I describe identity theory's background in the social psychology field. In this section, I briefly discuss the major themes of identity theory through social psychology and what is missing for understanding the experiences of mothers in mathematics. I also make explicit connections to my use of identity theory within a feminist perspective.

Social psychology research splits into two major perspectives on identity. Identity is viewed as a development of social structure (Stets & Serpe, 2013) or through a process of self-verification (Stryker & Burke, 2000). At their cores, these branches consider the external and internal factors that influence identity, role-choice, and behavior. For Stryker and Burke (2000), identities are recognizable in how they present themselves in actions, such that "identity salience is...the probability that an identity will be invoked across a variety of situations" (p. 286). This perspective is tied more to how an individual performs self-verification for their particular

identities. Stets and Serpe (2013), on the other hand, consider an identity to be a shared set of meanings that define individuals in particular

> *roles* in society (for example, parent, worker, spouse, or teacher role identity), as members of specific *groups* in society (for example, a church, book club, or softball group identity), and as *persons* having specific characteristics that make them unique from others (for example, an athletic or artistic person identity). (p. 31)

Stets and Serpe's (2013) perspective implies similarities of identity across a given social structure. For example, the identity of a parent will have similar characteristics across others who identify as parents. Within, and also between, these two major branches on identity theory are several areas of contention, such as the role of emotion in forming or recognizing identities, whether and how identities in individuals may change, and whether individuals may possess multiple identities (Stets & Serpe, 2013).

Social psychology attempts to represent identity theory from a very broad or universal perspective. Stets and Serpe's (2013) focus on roles for describing identity does not allow space for identities that change over time or appear different within the lives of people in different circumstances. Unlike social psychology, where identities for specific groups have the same characteristics, some feminist theorists (Pierre, 2000), race scholars (Appiah, 2006), and even education identity theorists (Gee, 2001) recognize identities as multiple, negotiated, and varied. My use of identity theory within this study aligns with the perspective of identities as negotiated, multiple, and varied. I expand on this perspective of identity from feminist scholars in the remainder of the section. In this sense, understanding mothers' experience in mathematics provides space for multiple identity formations across a person, not limited to the role of mother or mathematician.

Looking deeper into feminist perspectives of identity, there are three major branches across different scholars about what identity means. Some scholars see identity as inherent, with a group of people who share an identity acting in similar ways, naturally (Gilligan, 1993; Scott, 1986). Some of these features align with the social psychological perspective of Stets and Serpe (2013) with people of certain roles acting in similar roles. Other feminist scholars see identity as a construction, through the influences of society and shaped by experience (Alcoff, 2006; Brickhouse, 2001; Perpich, 2010). Another branch from feminist scholars sees identity as distinctly unique, not generalized by a group of people or type of person (Butler, 1990; Fraser, 2000). Within this last identity perspective are scholars who view unique identities more pragmatically, such that self-authoring is key to identity formation within people, that meaningful identity is established by how someone sees themself (Cervantes-Soon, 2017; Young, 1994). While feminist perspectives often focus on gender identity, I argue that some of these perspectives can be extended to a discussion of how people identify within motherhood and mathematics (which may or may not align with gender identity expectations).

I further solidify an understanding of identity within parts of the feminist perspectives described above, through a synthesis of literature that defines identities as a construction and the literature that defines identities as unique. I rely more specifically on the work of Alcoff (2006), Cervantes-Soon (2017), and Young (1994) to form this perspective. Alcoff (2006) argues that "social identities are relational, contextual, and fundamental to the self" (p. 90). Alcoff's statement stresses the importance of recognizing the impact of social, cultural, and political factors, and not one perspective will fully capture the complexity of an individual, in considering what makes up identities. Cervantes-Soon (2017) indicates that identity is a form of self authoring, "that is, beliefs and concepts of self often serve as a guide to the actions and directions

that we give to our lives" (p. 211). Her claims indicate that people have the agency to name and describe themselves and act out their identities in the ways they desire. Young (1994) suggests thinking of gender identity as seriality, which ultimately "allows us to see women as a collective without ...implying that all women have a common identity" (p. 714). Young's (1994) claim relates to belonging to different groups, with sets of values and beliefs, to define women in one way. I extend Young's position beyond gender identity, such that people are not made up of a singular identity that defines all of their behaviors and actions. The elements across these feminist scholars shape identity as a concept where a person has the ability and authority to define who they are, as influenced by a great many factors, and how they define themselves is not a static and universal representation of the whole person. Each of these points relate to the framework I take up for this study, that identity is shaped by the external and personal, and exists in an array of possibilities for individuals enacting similar identities. Again, these feminist perspectives speak to how understandings of value for women, and mothers, can be complicated to consider multiple roles and identities. The next two sections explore how motherhood studies and mathematics education has taken up notions of identity and what these perspectives say for the framework I use.

Identity Theory and Motherhood

Identity theory when applied to motherhood centers around understanding what maternal identity is and how it develops. Like the point made earlier in how identities form and present differently in relation to race and gender, maternal identity can look and feel different for diverse mothers. A development of a maternal identity in motherhood can happen "through an instantaneous identification as 'mother' or the long-term practice of mothering" (Laney et al., 2015, p. 138). Several scholars recognize that maternal identities are not formed solely from

pregnancy and birth but also through action, where being a mother is a process of becoming (Ali et al., 2013; Mercer, 2004). This perspective aligns with the element of my framework where identities can change over time as formation of the self is negotiated (Alcoff, 2006). For many, mothering may personally shape one's identity, where mother becomes part of one's identity but does not subsume all of who they are (Maher & Saugeres, 2007). Similar to what I emphasize as the external shaping identity is the influence of social factors (such as expectations of race and gender) and personal reflection that shape maternal identity (Sousa, 2011). Maternal identity can thus be shaped by individual perceptions and societal expectations of what it means to be a mother or to be a good mother. The tensions around societal expectations of motherhood is further explored in the literature about mothers' experiences as shown in the previous chapter.

Recognizing the influence of societal factors as well as honoring how mothers define themselves within maternal identity literature shows further alignment with self-definition (Cervantes-Soon, 2017). As Mercer (2004) argues, "only the mother can provide data about her perceptions of self as mother and of her infant for conclusions to be made about her cognitive assimilation of maternal identity" (p. 229). Respecting how people define themselves as mothers, whether through having children, their actions in parenting, or personal perceptions allows for difference in definitions of what it means to be a mother, defined by those who see themselves as mothers. The parallels between maternal identity and feminist perspectives show how the importance of self-authoring (Cervantes-Soon, 2017) can allow for the empowerment and recognition of individuals whose perspective is otherwise ignored such as diverse mothers, who are not white or middle-class. Use of language and self-definition can also benefit the maternal identity of adoptive mothers. In Weller's (2019) analysis of the use of the term mother in adoption communities, she states that "motherhood is socially constructed by the language we

choose to describe mothers in everyday vernacular, thus, there are multiple visions of motherhood" (p. 268). Focusing on the language and the lived experiences of those who identify as mothers opens up avenues to new conceptions of motherhood.

Identity Theory in Mathematics Education

Early foundational works on identity in mathematics education stem from perspectives in learning theory from scholars such as Lave, Wenger, and Holland. Key elements of these perspectives focus on membership or forms of legitimate participation (Lave & Wenger, 1991) in activity associated with a particular community. Holland and colleagues' (2001) work on figured worlds considers identity within context, how artifacts and actions take on certain meanings within a group. My framing of identity most closely aligns with Wenger's (1998) conception of identity in practice. Wenger highlights identity as a negotiation between the individual and the social, similar to my perspective where the external and the self shape identity. Additionally, Wenger describes identity as "something we constantly renegotiate during the course of our lives" (p. 154) similar to my framework that recognizes how identities change over time.

Other mathematics education scholars have used identity theory based on the perspectives of learning theorists described above, adding detail and complexity to how they are applying and thinking about *mathematical* identity. I highlight several mathematics education scholars' approaches to identity and how they align with the framework I use. Solomon (2007) pushes for the recognition of self-definition and unique identity constructions. Solomon questions how participation and engagement, particular patterns of mathematical practice, do not always mean an identity aligned with the subject. Her perspective aligns with the idea of identity formation through the self. Gholson and Martin (2014) pay careful attention to the complex and changing ways that identities are formed through the multiple influences of environment and

experience and the agency of the individual to resist or reshape those particular narratives. Gholson and Martin's perspective aligns with the impact of external and personal factors that shape how people identify. In these cases, there is attention to what counts as mathematical activity and a mathematical identity from the influences of teachers, peers, and classroom routines and how a person sees themself in the context of these mathematical communities.

In mathematics education research, significant focus is placed on practice and participation as informed by individual and social contexts, with occasional nods to negotiation for identity formation. Mathematics education researchers' attention to participation relates to how people are seen in the context of external expectations, such that how someone is seen as mathematical or not is based on how they are positioned as knowledgeable in recognized mathematical content and activity. While many of these researchers discuss identity negotiation or change, few (e.g. Martin, 2000; Nasir, 2002) discuss variations in mathematical identity and the challenges with granting particular activities legitimacy as mathematical. Martin (2000) discussed the constraints of mathematical identity formation due to context, race, and gender. Nasir (2002) considered the challenges of legitimacy in informal mathematics environments. I am concerned with the recognition of mathematics activity within the context of mothering, where constraints of expectations of motherhood context, race, gender, and the informality of mathematical learning play a part in mothers' interactions with their children and the subject.

A Maternal Mathematical Identity

What is largely missing from the research of both maternal identity and mathematics education is its application for mothers in mathematics. While there may be focus on raced and gendered perspectives within mathematics identities, these cases are centered around students or teachers. Additionally, while the literature on maternal identity may consider the influence of

societal factors and the importance of self-definition, little work considers mothers' experiences in mathematics. Occasionally literature may consider mothers in mathematics, but from the perspective of mothers as students (Chase, 2018). Perspectives of identity from motherhood studies and mathematics education have the potential to consider what it means to be a mathematical mother. Motherhood studies discuss maternal identity as a process of (personal) becoming (Mercer, 2004), while many mathematics education researchers discuss Wenger's (1998) concept of the nexus of membership, where people negotiate belonging in multiple groups. The intent of the present study is to explore the intersection of motherhood and mathematics, within identity theory. My work extends this identity analysis to understand the formed and changing identities of mothers who do mathematics, recognizing the negotiation of mothering and doing mathematics into an identity that is influenced by external factors, shaped by self-definition, and looks different in context for different families. What these identities look like in practice, will look different across people with different experiences and societal expectations, that they may negotiate into an identity that works for them in the moment.

A Deeper Look at Constructed Identities

Considering the impact of external factors in shaping one's identity requires a critical analysis of the external factors and expectations it places on people. As addressed in the previous chapter, the expectations for motherhood and mathematics are centered around white middle-class ideals as the norm (Arendell, 2000; Rousseau Anderson & Tate, 2016). Assumptions of race and gender in these fields shape perspectives of who can and is viewed as mothers, as mathematicians. Thus, given my feminist perspective of identity that considers the role of social, cultural, and political factors in shaping identity, it is important to consider how gender binaries and pervasive whiteness shape expectations of motherhood and mathematics. P. H. Collins'

(2000) concept of matrices of domination is used as an analytical tool to be critical of the influence of expectations surrounding race and gender. Collins defines a matrix of domination as "how these intersecting oppressions are actually organized. Regardless of the particular intersections involved, structural, disciplinary, hegemonic, and interpersonal domains of power reappear across quite different forms of oppression" (p. 21). Following a discussion of Collins' matrices of domination, I address the literature on gender binaries and its ultimate promotion of masculinity vs. femininity. The division of gendered expectations contributes to the constraining expectations of mothers and what they should be doing, while not considering the positive work that mothers already do or would like to do. This chapter concludes with what it means to listen to mothers and their perspectives, seeing their activity in the roles of motherhood and mathematical engagement as legitimate.

Matrices of Domination

P. H. Collins' (2000) concept of matrices of domination has ties to motherhood and their expectations intersecting with race and gender. P. H. Collins' concept brings awareness to the assumptions of a gender divide intersecting with norms of whiteness. I use this perspective to consider the implications of gender binaries and whiteness intersecting within motherhood and mathematics. Gender and race within the context of motherhood and mathematics have persistent power structures with sets of expectations for who mothers and mathematicians must be and how they must act. The matrices of domination create specific expectations of women, and also mothers, based on race, class, and sexuality (P. H. Collins, 2000). The process of mothering, within this context,

> is racialized, is organized in class-specific ways, and has varying impact on women of diverse sexualities. Women are differentially evaluated based on their perceived value to

> give birth to the right kind of children, pass on appropriate American family values, and become worthy symbols of the nation (P. H. Collins, 2000, p. 248).

What one mother does to support her children may be viewed as commendable by society, but when another mother (of a different race or class) does the same thing society views it as a failure in parenting. P. H. Collins points out that matrices of domination are about intersections of oppression, ones that cannot be separated from race. These intersections and expectations are upheld in U.S. society that consider women from different backgrounds as meeting or not meeting the expectations of motherhood. The combination of forces of oppression in the United States including race, gender, and class feed into one another in particular ways that shape the expectations of motherhood that demand gendered performances and assume a culture of whiteness. Studying mothers and their experiences thus requires careful attention to how their experiences sit within the dominant narratives of what society expects of them, from their race and gender, within motherhood.

Stereotypical images of Black mothers show how the intersections and constraints of expectations via gender and race operate within the matrices of domination. Four images of Black women, often associated with motherhood, have circulated over time and evolved to fit what a white, patriarchal society incorrectly perceives as the quintessential or negative characteristics of Black women: the mammy, the matriarch, jezebel, and the welfare queen (e.g., P. H. Collins, 2000; Harris-Perry, 2011; Rosenthal & Lobel, 2016). The infamous Moynihan Report of 1965 further emphasized the critique against Black motherhood, citing Black women as the cause for a breakdown of families and Black children's success. Moynihan's focus was a comparison of Black families to the expected normalcy of white, middle-class, patriarchal families. I describe the stereotypical images of Black women and what this means in relation to

expectations of motherhood. How Black women are viewed by society in their identity of mother shows what challenges are present in talking about motherhood more broadly.

The mammy image is what U.S. society has represented as ideal Black motherhood. “The mammy archetype is the image of an unattractive Black mother who is strong and content in her caregiving role for many children, in the service of White slave owners or White employers” (Rosenthal & Lobel, 2016). The mammy image is dedicated to others, portrayed as a mother figure for white children, but not her own (Nilliasca, 2011). “The Mammy myth portrays [Black women] as unwavering in their commitment to the white domestic sphere. In this role, Mammy serves to stabilize the racial and gender order, and therefore the order of the state” (Harris-Perry, 2011, p. 77). While the mammy image is meant to portray the ‘good’ Black mother, it is both undesirable and inappropriate, because of its deeper intent to maintain social hierarchies.

The matriarch, jezebel, and welfare queen are images meant to show Black women as poor mothers. The matriarch is the Black woman who is the head of the family, viewed as aggressive and emasculating (Harris, 2015). The jezebel is seen as “the embodiment of deviant black female sexuality” (Harris, 2015, p. 5), such that she is inappropriately sexual, producing children purposely or accidentally through her promiscuous behavior. The image of the welfare queen was created by Ronald Reagan, pictured as the Black woman who takes advantage of the government and public assistance by having as many babies as possible (Rosenthal & Lobel, 2016). Each of these images is a critique of how Black women are (incorrectly) portraying the identity of a mother. “Taken together, these prevailing images of Black womanhood represent elite White male interests in defining Black women’s sexuality and fertility” (P. H. Collins, 2000, p. 93). The mammy image of Black women is fixated on obedience and attached to slavery. Black women who have children too young or outside of marriage are seen as

promiscuous (jezebel). Black mothers who work to support their family are viewed as outside the moral order for not staying at home (matriarchs) but are viewed as burdens on society if they opt to stay at home and make use of government resources to support their children instead (welfare queens). However, these same actions in white middle-class women, such as staying at home or choosing to work to provide a better income are not often viewed as deviant motherhood (e.g. Dillaway & Pare, 2008; Gorman & Fritzsche, 2002). Using P. H. Collins' (2000) matrices of domination to analyze the stereotypical images of Black mothers shows how the fixation on a white perspective of motherhood establishes rigid and limited opportunities for other women to be viewed within the image of mother.

These moments from history and pervasive representations continue today to challenge who counts as being mothers at all and exist from the assumption of motherhood associated with gender (women as feminine, women as mothers) and whiteness. The matrices of domination draw attention to the impact of these assumptions around gender and race. Given my perspective of identity that considers the impact of external factors and self-definition in how one is seen and sees themselves, the matrices of domination place the identities in context. I use matrices of domination as an analytical tool to demonstrate why the participants of the study see themselves as they do because of society's assumptions of how they must act because of their roles as mothers. While this section has focused on an example that centers the impact of race and assumed whiteness in motherhood, the following section considers the implications of gender and gender binaries that contribute to identity formation.

Gender Binaries and Silencing

A divide between what men should and are expected to do and what women should and are expected to do has persisted within Western society (Wittig, 1992). As detailed in the

literature review, this is apparent in the roles of mothers and fathers that expect and assume women to do the work of mothering, to care for children, in what is understood as feminine (Odenweller & Rittenour, 2017). Gender is viewed in terms of opposites, what defines women and femininity is considered the negation of what defines masculinity (Paechter, 2006). Wittig (1992) argues that a societal social contract maintains certain rules people must follow, which set up particular expectations for women behaving within the activities of what is feminine and thus opposite of the masculine. Expectations of femininity shape expectations of motherhood, with motherhood closely linked to womanhood and femininity. Recognition of the difference between masculinity and femininity is "constructed in and by the practices in which people participate" (Esmonde, 2011, p. 29). What is expected of mothers in the realm of femininity shapes how people who are mothering are identified or identify themselves (as women, as mothers, as parents, or as something else).

The binary separation of gender roles (and masculinity and femininity) functions as an element of heteropatriarchy in Western society, that upholds heterosexual relationships as the norm and the men (fathers) in these relationships as the head-of-households (Smith, 2016). Valdes (1996) argues that this separation of men and women while conflating sex with gender "creates hetero-patriarchal categories and hierarchies that privilege masculine, heterosexual men and subordinate all other sex/gender types" (pp. 169 - 170). Heteropatriarchy is reliant on a distinction between men and women, supported by elements of white supremacy that further privilege white, heterosexual men (Smith, 2016). Norms of heteropatriarchy delineate the expectations of women as mothers, as separate from the labor of men. "Within the heteropatriarchal family, women remain the primary caregivers of children, the elderly, and the infirm" (Nilliasca, 2011, p. 409). The systems of heteropatriarchy have assumed for decades that

women will produce children and act as caregivers. Assumptions of identity and action for women, to be mothers, does not honor the various ways that people act, within and outside the activity of mothering.

Who is listened to and who is silenced in these societal expectations reflects a perpetuation of the constraining views of what mothers can and should do (in general and within mathematics). The continued association of motherhood with femininity functions to silence the perspective of those that participate in mothering outside of expectations aligned with the feminine. Who is heard in the work of mothering and granted legitimacy in the environments of motherhood and mathematics (particularly in relation to expectations of gender binaries) aligns with elements of Dotson's (2011) discussion on epistemic violence. Dotson argues that epistemic violence happens "at the juncture where an audience fails to accurately identify the speaker as a knower" (p. 243). In the case of motherhood, this represents a failure of an audience (i.e., Western society) to recognize how a mother describes her mothering as appropriate or an example of good mothering. From Dotson's (2011) argument, coupled with P. H. Collins' (2000) concept of matrices of domination, who is silenced for their experiences and activity in motherhood is often raced and classed. I would argue that this violence and silencing of some mothers' perspectives of their own actions can be internalized for the speaker, who then might believe certain things about themselves, such that they must not be a knower (must not be a good mother, a mathematical thinker). Dotson (2011) claims that "to communicate *we all need an audience willing and capable of hearing us*" (p. 238). This study aims to be the audience for a group of mothers, to hear their perspective of their actions and intentions as they work with their children in mathematics.

Conclusion

The use of identity theory with attention to assumptions of race and gender in society's expectations of motherhood and mathematics is a beneficial lens for studying mothers' experience, from the perspective of the stories they tell and the identities they have formed. I define identity as shaped by external and personal influences with the possibility of people changing in perspective and possessing multiple narratives at once. Identity can be captured through the stories people tell about themselves, which ultimately honors the lived experience of people. How people shape their identities through life stories is also informed by the assumptions of society. Using P. H. Collins' (2000) matrices of domination, I draw specific attention to the assumptions and implications of whiteness and gender binaries in motherhood and mathematics. Some work within mathematics education that focuses on identity considers some of these intersections of race that align with the feminist perspective of identity I emphasize in this study. For example, Larnell (2016) sees mathematics identity defined by stories told by the individual. Nasir and McKinney de Royston (2013) see identity formation developing over time with influence from the individual and the social world. Varelas, Martin, and Kane (2012) "view identities as lenses through which people make sense of, and position themselves through stories and actions, and as lenses for understanding how they are positioned by others" (p. 319). While these references touch on elements of identity theory from a feminist perspective that consider the role of the personal and external, they also emphasize the importance of stories, of self-authoring. The voices of those not often heard are listened to and believed in the experience they share through stories.

The form of identity theory I highlight illuminates the complexities of people and honors how they represent themselves. It allows for recognition of the variations of how someone can be

a mother. The core elements of identity theory that I use center and value the person and the definitions they use for themselves. These theories frame future participants as whole people, who change and grow over time, and are not defined solely by their roles as mothers. My intent is to implement this perspective of identity theory, using matrices of domination as an analytical tool (P. H. Collins, 2000), in both research design and analysis as a way to decentralize notions of what is expected of mothers in mathematics and the positive opportunities for interaction stemming from their own lived experience. A focus on honoring the mothers as speaking truth of themselves and their identities is present throughout the methodology of narrative inquiry, that focuses on stories. Attention to disrupting white, patriarchal norms of motherhood expectations and parental engagement is present in the analysis of the mothers' stories and the framing of past literature on women in mathematics, parental engagement in education, and expectations of motherhood.

Chapter 4: Methodology and Methods

How I recruited participants, collected and analyzed data is built from my theoretical perspective of a feminist identity theory. Understanding how mothers engage, the context of their engagement, and the structural implications of race and gender came from the stories and experiences of the participants themselves. I use narrative inquiry as a methodology and critical reflection in analysis to continually support my theoretical perspective. I gathered and analyzed data that honors participants' lived experience (P. H. Collins, 2000) and centered how participants define themselves (Cervantes-Soon, 2017; Dillard, 2012). In analysis and reflection, I was attentive to the impact of racialized and gendered perspectives within the participant narratives, through the use of P. H. Collins' (2000) matrices of domination. The beginning of this chapter addresses how I make use of narrative inquiry, its location within existing literature in mathematics and motherhood, and why it is important for this specific study. Next, the chapter addresses who my participants are and why I selected them, my own positionality, and the design of the study itself. The chapter concludes with an account of my data collection and analysis, with attention to how this process works to respond to the research questions.

Narrative Inquiry

I use a narrative inquiry methodology to explore the experiences of mothers and mathematics through the stories they tell. The major elements of narrative inquiry relate to the interpretation of life stories, the connection of these stories to identities, and narratives extending over time. The essential features of narrative inquiry are similar to work in ethnography (Kondo, 1990) and oral history (Thompson, 2000) that focus on stories as telling of experiences and identities. In this section, I discuss more of the background of narrative inquiry and its connection to identity. I highlight how researchers have used narrative inquiry in the past in

relation to identity and time. More specifically, I make connections to how stories have been studied about mothers in mathematics education as a basis for how I can implement narrative inquiry through participants' stories in the present study. The common threads of letting narratives help researchers understand the people that are not often heard and recognizing those same people as full of complex and changing identities parallels how I discuss my theoretical intentions in identity theory around studying mothers interacting with mathematics.

In the realm of narrative inquiry there is use of a number of terms with overlapping meanings. While I described the terms and their distinctions in the first chapter, I return to them here before their extensive use in the current chapter. Narrative inquiry begins with stories, where stories are what detail a particular experience (McAdams, 1993). People's lives are made up of many stories, and a collection of stories in a particular area creates a narrative (Clandinin & Connelly, 2000). Life stories are the stories that shape who a person is and is becoming (McAdams, 1993). Life history is an extension of life stories that captures the events and experiences of a person across their lifetime (Creswell, 2007) while also placing those experiences within the context of larger events (Karpati, 1981). Oral history is often discussed as part of narrative inquiry and life history, as a spoken format of a person (or family's) life stories (Thompson, 2000). While some researchers of narrative inquiry may use these terms interchangeably in discussing the experiences of participants, I define and use them in a layered context. Stories are the smallest unit, used to describe events and experiences. A collection of stories can create a narrative, while a collection of stories about oneself can create life narratives (also called life stories). These narratives can be multiple, to define different parts of oneself (such as a collection of stories showing one's motherhood, or a collection of stories showing one's experience as a mathematical thinker). Life history situates these larger narratives of an

individual's experiences into a broader context of the world around them. Finally, narrative inquiry is the study of these narratives, whether as discrete stories or within the context of a life history.

By looking intentionally at life stories, researchers learn more about who a person is and how they represent themselves. "Narrative inquiry in the field is a form of living, a way of life ... [it] is one of trying to make sense of life as lived" (Clandinin & Connelly, 2000, p. 78). In this sense, narrative inquiry looks at the life of people as storied fragments, that can illuminate the depth of their experience. "Narrative is not merely a literary form but a mode of phenomenological and cognitive self-experience" (Eakin, 1999, p. 100). While Eakin is pointing to narrative exploration from an autobiographical perspective, narrative inquiry extends to listening to the stories of others. Experience, as understood within narrative inquiry, is what gives truth to the stories told by others, which parallels the value placed on lived experience (Dillard, 2012). Narratives are not just a collection of stories that people listen to, but are instead forms of sense-making around the self and others. "Life stories, then, are a crucial ingredient in what makes us human and, in turn, what kind of human they make us" (Goodson, 2013, p. 63). Narrative inquiry relates to understanding life stories, whether that be one's own or others' stories. A researcher learns more about who a person is, their identities, by looking at their life stories.

Narrative inquiry explores stories and experiences over time. Narrative inquiry connects to the past of the individual and to notions of identity (Kohli, 1981). "Life stories express our sense of self: who we are and how we got that way" (Linde, 1993, p. 3). Linde's claim about life stories relies on time; understanding who people are is built off of who they have been and who they are becoming. Similar to my perspective in identity theory, attention is given to stories,

identities, changing over time (Cervantes-Soon, 2017). A person does not contain one fixed life story, but multiple stories that are ever evolving as they experience new things and develop different perspectives of past stories of their lives. The multiple nature of stories, describing a person's life is similar to Young's (1994) concept of identities, enacted in diverse ways. Narrative inquiry provides temporal connections, "a patterned integration of our remembered past, perceived present, and anticipated future" (McAdams, 1993, p.12). Narrative inquiry is a way to explore the diversity in individuals through their life stories while also making connections to their past, present, and future. A focus on life stories as a thread of identity, allows for more fluidity and complexity in seeing others than just a set term to describe who someone is. Instead of describing a person as a mother, it is a collection of stories a person tells that make up a larger narrative, showing an identity of mother. Steeves, Clandinin, and Caine (2013) "understand stories to live by as fluid, as evolving over time, as relational, as both personal and social, and as grounded in places" (p. 225). Stories, through inquiry, allow for connections not only across time and through the individual but to a larger social and historical picture. The perspective of stories connecting to historical and social influences also speaks to my use of matrices of domination and the critique of historical implications of gender binaries (Smith, 2016) and racialized expectations in motherhood (Rosenthal & Lobel, 2016). In responding to RQ3, how engagement and experiences reflect gendered and racialized perspectives of motherhood and mathematics, critical reflection of narratives allows me to ask, what do the stories of participants reveal about larger systems of privilege, of white and patriarchal norms?

Background Literature

Other researchers that use narrative inquiry come from a perspective of learning deeply about a person or group of people. While this can be similar to ethnography, narrative inquirers rely on stories as the mode to understand the complexity of the people they research. Stories offer a richer context into the lives of participants and are focused on understanding people's lives. In Marx's (2006) work with preservice teachers and racism, she argues that her use of "storytelling served a powerful means of conveying information rich in context and feeling" (p. 26). Through stories, researchers learn more about an event through a person's perspective when attached to emotions, context, and background decisions that may have influenced the event. James (2000) relays the narrative of Dona Maria and her role in the development of the Argentinian Labor Party, with experiences vastly different from his own. As James (2000) discovers in his narrative project with Dona Maria, responses to even more information-seeking questions could receive deep and meaningful answers when told through stories. Similar depth of experience and context is apparent in Warren's (2017) use of narrative inquiry to tell the stories of Black men from a charter school and their future moves into college. For Warren, storytelling is used as a way to zoom in and out of the broader context of the young men's experiences that reflect the condition of the school and their individual lives. How narrative inquirers explore phenomena from the lives of their participants gives attention to meaningful context and complexity in the stories they tell.

Along with the attention to learning more about the individuals they study, narrative inquirers also consider what someone's stories say about their identities. Stories, particularly life stories, become a way to understand people's lives and how they represent or identify themselves. "As narrative inquirers we are fundamentally concerned with people's lives and so

our wonders around transitions are inextricably linked to wonders around identity" (Clandinin, Steeves, & Caine, 2013, p. 51). Clandinin, Steeves, and Caine see a clear connection between stories, people's lives, and their shaped identities. If life stories are ultimately about identity, then the fluid and dynamic nature of stories can be applied to understandings of identity. In Kondo's (1990) ethnographic work and storytelling method, she claims that "identity is not a fixed 'thing,' it is negotiated, open, shifting, ambiguous, the result of culturally available meanings and the open-ended, power-laden enactments of those meanings in everyday situations" (p. 24). How storytelling, and thus narrative inquiry connects to understanding identity is similar to how I have defined my use of identity theory in Chapter 3. Identities are dynamic and are captured through the narratives people tell about themselves. The parallel notions of identity in my theoretical frame and in narrative inquiry support the use of this methodology in exploring the identities and experiences of mothers interacting with mathematics, in a person- or mother-centered frame.

Stories in mathematics and motherhood. While narrative inquiry is present in ethnographies (Kondo, 1990) and explorations of issues in schools (Warren, 2017), analysis of stories is also prevalent in mathematics education and motherhood literature. Researchers exploring a particular group of students by examining their stories often find the factors of societal expectations around mathematics influences the beliefs of individuals in how they start to see themselves (Bartholomew et al., 2011; Mendick, 2006). Observation alone does not often capture the complexities and intent in the experiences of participants being studied in mathematics. As such, it is the use of narrative inquiry that provides the necessary depth of understanding people's experiences in mathematics and motherhood. For example, DeGregorio (2005) discusses the context of her college student participant, Susanna, and what was happening

in her personal life that increased tensions in her mathematical performance. Weinstein (2004) explains how the narratives of remedial college algebra students showed how their "spending 8 to 12 hours on Basic Algebra meant those students were working quite hard in comparison to the norm" (p. 233). Given more context into the situations of the college students from both of these studies shows a tension in larger narratives that may represent remedial mathematics students as incompetent or lazy. The college students' stories shape their identities into more than one-dimensional caricatures. Sfard and Prusak (2005) support a more unified understanding of stories and identities, where "identities may be defined as collections of stories about persons" (p. 16). Sfard and Prusak's argument indicates a need to use stories to understand people. In order to learn about the identities of students in mathematics, research must explore the stories of their mathematical experience. When research cleaves student experience from the phenomenon being studied, much is lost in the richness of perspective.

Narrative inquiry's presence within motherhood often highlights the tensions individual mothers experience with the expectations placed on them by society to act in certain ways. For example, Austin and Carpenter (2008) and Garey (1995) highlight mothers' stories of the 'super mother' stereotype that expects mothers to be able to do it all. In the stories, mothers discuss the mental and physical challenges imposed on them in order to maintain a 'super mother' status. Christopher's (2012) analysis of employed mothers' stories shows how these mothers negotiate new definitions of motherhood for themselves that allow them to work and also support their children. Similar to how narrative inquiry in mathematics highlights the nuance in student experience, narrative inquiry in motherhood shows how mothers enact motherhood in ways particular to their circumstances, often in tension with society's expectations to devote all of

their time (Dillaway & Pare, 2008) and sense of self (Maher & Saugeres, 2007) to being mothers.

Why Narrative Inquiry

This section describes why the methodology is particularly useful for the present study and further connected to the theoretical framework of identity theory. Narrative inquiry allows me to better understand the lives of mothers within a broader context of historical and social influences as well as how those elements shape their evolving identities. Connection of stories to external factors parallels Alcoff's (2006) perspective of identity as influenced by the social, cultural, and political. Analysis of stories is an integral component of research in identity theory. The expression of stories as representing complex people with intersecting identities parallels elements of my identity framework where the presentation of an identity can look different across people, as well as Young's (1994) perspective of serial identity. Lived experience, as a representation of people's lives as they define them, is valued in a methodology that centers stories. Stories capture an important part of lived experience in ways and from individuals that can often be ignored. In the use of narrative inquiry through oral history:

> historians discovered that oral history could bring not only more nuggets of information, but wholly new perspectives - evidence, and also interpretations, from the previously ill-represented standpoints of ordinary men, women and children about what *they* believed had mattered most in *their* lives (Thompson, 1981, p. 290).

The attention to stories relating to the generational impact of interactions with mathematics can provide a new perspective as well. "Narrative inquiry allow[s] for an exploration of the social, cultural, linguistic, familial, and institutional narratives within which each individual's experiences were constituted, shaped, expressed, and enacted" (Clandinin, Steeves, & Caine,

2013, p. 45). Learning through stories provides a vital depth in understanding and attention to the complexity of mothers' experiences with mathematics, by honoring and listening to what they have experienced.

Narrative inquiry has clear connections to stories as identities (Clandinin, Steeves, & Caine, 2013; Sfard & Prusak, 2005) and how people can self-author those identities (Cervantes-Soon, 2017; Morgan, 2018). A feminist narrative inquiry often supports the telling of narratives through the words, tone, feeling, and history of the participant (Kwakye, 2011; Madison, 1993). Such narratives honor how the participants are telling their stories, which acts as a way to honor their lived experience. Attention to lived experience extends through recognition of self-definition (Morgan, 2018). For instance, Madison (1993) describes how Alma stories and performs her identities such that "as she nurtures and heals in bringing life forth in the narrative performance of the told, she nurtures and heals in bringing her self-defined identity forth in the narrative performance of the telling" (p. 228). Madison gives space for Alma to perform her identities in the stories that she tells, while honoring her "self-defined identity." In my work, I represent mothers' stories with attention to their words, tone, feeling, and history while also honoring what self-definitions they create for themselves.

Stories are more than just a form of gaining information about a particular phenomenon. They also provide the basis for how people interact with one another. Goodson (2013) explains that "our understanding of the world [is] constructed and mediated through the stories we share with each other" (p. 3). In order to understand the experiences of mothers in mathematics, it is important to listen to their stories as it is through stories that we learn about the world. "*Each person views the industry and their location in it and to it differently. . .* Furthermore, each person's perspective on the industry bears the stamp or more of their tier or social world"

(Denzin, 1981, p. 158). Stories, within larger narratives, also show different views of society. The context of mothers' lives that I study and how it relates to their experience becomes clear through their stories and the perspective of different mothers draws attention to how different stories inform a collage of possible and positive mathematical interactions with children.

Research Design

The study itself consisted of three approximately 1-hour interviews, two participant observations (Spradley, 1980) with debriefs, and collected artifacts to support stories shared from each participant. The elements of the study were meant to capture participants' past experiences, current stories of mathematical activity, examples of what that activity looked like, and confirmation of their stories and experiences. The first interview focused on past experience, the second interview focused on current mathematical interactions, the observations were examples of everyday activity with their children that involved mathematics, and the last interview was a review of transcript excerpts. Throughout the interviews and observation debriefs I used semi-structured interview protocols (see Appendix A). I see semi-structured interviews as more closely following a conversation, which made the sharing of stories between participants and the researcher feel more authentic, natural, while following a path of inquiry that honored the experience of the participant. Such interviews did not intend correct or incorrect answers or stories for particular questions because the interview questions themselves were merely an initial frame. It honored the stories, the lived experiences, as meaningful and truthful (Dillard, 2012) because the participants were able to direct the interview to stories they found important in discussing their life. "Without a trusting, mutually respectful relationship between investigator and participants, participants cannot be expected to share their honest feelings about controversial topics" (Marx, 2006, p. 25). With openness from the researcher, flexibility in the

interview protocol, and reassurance that shared stories were not judged in terms of parenting, trust could be developed and participants could share about their complex experiences.

The data collection process of the study occurred during the COVID-19 pandemic of 2020. In some ways this complicated and changed the participant recruitment, data collection process, and some of the analysis. I started recruitment and first interviews with participants in February and the beginning of March 2020, meeting with three participants in-person (Amanda, Brittany, and Elizabeth). On March 16th, the university through which the study was conducted shut down for almost all in-person activity, including research. In order to continue my work, I made changes to my data collection process and widened my sphere for recruiting participants. By the end of April, I was back into a regular schedule of interviews and observations with participants, but in a virtual format. Appendix B shows a more detailed timeline of the impact of COVID-19 on my data collection. The subsections below each address more specifically how COVID-19 created some changes to the study itself, while still being able to respond to my original research questions.

Participants

I used snowball and community sampling methods to obtain participants for this study. These recruitment methods are loosely based on the community sampling processes used by Ladson-Billings (2009) and Warren (2013) with similar features to the snowball sampling used by Christopher (2012). Community sampling involves a nomination of individuals who fit a call (such as good teachers) by people who would know them well (such as their students). In accordance with community sampling, I consulted people from three different areas of my background (university, church, and neighborhood) to suggest potential participants. My aim was to obtain participants with diverse experiences and backgrounds. In order to do this, I reached

out to specific contacts that would be able to share the details of my study with potential participants with more diverse backgrounds, covering differences in race, location, and class. An example of the letter I sent to contacts and the flyer shared with potential participants can be found in Appendix C. The intention of this recruitment has further ties to P. H. Collins' (2000) matrices of domination by seeking out a diverse sample of mothers, more representative of mothers across the country, and who may experience existing tensions of expectations via race and gender. My selection criteria also considered those whose approaches to mothering are not represented in dominant discourses of what makes someone a mother in the United States. Given the nature of data collection changes due to COVID-19, I was able to widen my search to allow for participants that did not live in the immediate community. Several of my participants were from other parts of the same state and nearby states as a result of the move to virtual data collection.

As discussed previously in the literature on narrative inquiry in mathematics education, attention is mostly focused on current students. My study more intentionally considered mathematical experience impacting interactions with children by listening to the stories of mothers in mathematics. Ten people consented, nine participated in some elements of the study, and seven completed the entire experience. Only the participants that completed all aspects of the study are discussed. These participants ranged in age from late 20s to late 30s and lived in urban to rural locations. Two of the participants were women of color (Native American and Black), and all but one participant lived with a working male partner. Two participants were expecting another child at the time of the study (Amanda and Brittany), and one participant's children were adopted as newborns (Elizabeth). Only one participant was not involved in paid work, while the remaining participants ranged in employment from giving music lessons, to part time work, to

teaching. All of the participants had some level of higher education, ranging from some college experience to working on a Ph.D. and all were currently part of the middle class.

Of the participants, I focused on the experiences of five: Amanda, Elizabeth, Tara, Brittany, and Courtney. All of their names and the names of their children are pseudonyms and can be found in Table 2. A more detailed representation of participant demographics (including those not used within the study's analysis) can be found in Appendix D. The participants I selected provided the most diversity in experience across the study, while also focusing on fewer people to devote the appropriate space and reflection on their experience. While full of interesting background and experience, the participants not analyzed in this study (Kelsey and Stephanie, also pseudonyms) had significant overlap in their experiences with the other participants. Kelsey (mother of one) was married, living in a rural community, as a part-time music teacher and struggled to connect to mathematics growing up. These features closely paralleled the experiences of Brittany, however Brittany spent significant time in interviews talking about the distinction of activity between her two children and added additional layers of diversity with her faith and desire to homeschool her children. Stephanie (mother of two) was married, living in a rural community, a stay-at-home mother who previously taught, with consistently strong experiences in mathematics. Stephanie's experiences were similar to Elizabeth and Courtney, however Elizabeth and Courtney had additional diverse experiences in adoption and parenting children of color.

My use of five participants was intentional to meaningfully understand their lived experience both as individuals and in the context of the society of which they live, aligning with self-definition in identity theory (Cervantes-Soon, 2017). Exploring the stories of five participants allows for depth and complexity in the details about their experiences (Clandinin,

Table 2

Names and basic demographics of selected participants

Participant	Children (+Age)	Race	Partner Status	Occupation
Amanda	Grant (2)	Native American	Married	Graduate student
Elizabeth	Talia (2), Luna (7)	White	Married	Stay-at-home mother
Tara	Sasha (18 mo), Peter (3.5)	White	Married	Part-time grocery worker
Brittany	Rosie (2), Bobby (4)	White	Married	Part-time music teacher
Courtney	Eva (3)	Black	Single	Teacher

Steeves, & Caine, 2013). As such, these participants and their experiences provide a diverse sample of mothers' experience in mathematical interactions with children but do not act to generalize the experience of all mothers in U.S. society. Michael and colleagues (2017) framed this issue by stating "none of us intends to represent our whole racial group, or even our whole families; those are diverse, individual experiences of the cultural manifestations of whiteness" (p. 21). I do not intend to have these participants act as a generalization across all mothers in the United States, or to have the experiences of Courtney and Amanda act as a generalization of experiences for mothers of color. However, this sample of mothers with different backgrounds and mathematical engagement show what is possible in interactions and intent with children's mathematical learning that expands the existing norms of mothering in mathematics that has privileged white, middle-class values (C. W. Cooper 2007, 2009).

Participant limitations and COVID-19. There were certain limitations to the sample of participants used for this study. Only two participants were mothers of color, most were around 30 years of age, all were heterosexual and identified as women, and all were currently part of the middle class. There were a number of features of U.S. demographics for those who do motherwork that was not represented in this sample, such as young, working class, Latinx, and/or queer individuals. The stories shared here provide a window into the experiences of middle-class, heterosexual mothers of the United States, which may capture the experience of many people but does not represent all mothers. I make no allusions that this study speaks to all the possible experiences of those doing motherwork in the United States. However, as stated earlier, the diversity that does exist within this sample, given their different backgrounds and experiences show the possible and positive interactions mothers can and do have with their children around mathematics.

Completing this study during the COVID-19 pandemic presented other limitations in participants. One of the major limiting factors for participants in this study relates to their current working arrangement. All of the participants who completed the study had no work or flexible work outside of the home. While I had ten participants that originally consented to this study, the three who did not complete the process were all people working less flexible part-time or full-time jobs. More responsibility and the burden of care-work was placed on women during this time (C. Collins et al., 2020) particularly with the shutdown of in-person schools and daycares. As Perelman (2020) stated, “working mothers all over the country feel that they’re being pushed out of the labor force or into part-time jobs as their responsibilities at home have increased tenfold” (para. 23). It was challenging, then, for many working mothers to do something on top of their increased workload like this study. Thus, the participants of the study were only those

who felt they had time to do so, often excluding participants who worked more traditional hours. I recognize that the current study does not speak to the experiences of people with full-time work and inflexible schedules as those who were able to participate were either stay-at-home parents or had flexibility with their current job to participate in the research activities. While limiting for some, a benefit to the current circumstances of the study during the COVID-19 pandemic is the increased flexibility for some parents to participate. In the case of Tara, the shut-down and need for everyone to be at home opened up her schedule to participate in the study at all, where she described how she would not have been able to beforehand given her and her children's schedules. Overall, the limitations and changes to participants did not change the core of the original research questions I posed, but shaped my responses with attention to the impact COVID-19 had on these mothers' engagement with children in mathematics.

Positionality

As I worked towards researching the stories and experiences of mothers and their use of mathematics, I became conscious of my own voice shaping the narrative. As Eakin (1999) claims "the ethics of writing of self - you necessarily write about others too" (p. 156). I would argue that writing of others will include (intentional or not) writing about yourself. Researchers are not disembodied entities, writing about and interpreting particular phenomena and people from a context-free and universally true position. "You are not an 'I' untouched by context, rather you are defined by the context" (Kondo, 1990, p. 29). The writer of an event, another person's experience, cannot scrub away how their own life will color what they emphasize or let go of in the writing. As such, I carefully considered how my own experiences and background may influence how I interpreted the stories of my participants.

The bleeding through of other narratives into the intended story does not mean narrative inquiry, storytelling, is an invalid form of research. Instead, "one of the starting points for narrative inquiry is the researcher's own narrative experience, the researcher's autobiography" (Clandinin & Connelly, 2000, p. 70). Such exploration of personal narrative and positionality can explain or support how you are interpreting particular stories (Kondo, 1990), what brought or motivated you to this research (Clandinin, Steeves, & Caine, 2013), or even how you may relate to your participants (Warren, 2017). "We are too easily led to generalize from our own experience and to take for granted that it was shared in other social groups or at other periods" (Thompson, 1981, p. 293). Doing this intentional work on oneself first allows the researcher to be more aware of how elements of another's story may be similar to one's own, but not entirely the same. What follows are details on my own perspectives and appearance that may shape how I was viewed by participants and how I interpreted their stories.

Building off of the narrative of my experiences with family and mathematics shared in the introduction of this study, there are a number of experiences that shape my beliefs about mathematics and motherhood. My experience throughout childhood of working through difficult mathematics and values of my parents that practice supports growth informs my perspective of how other people can learn mathematics. When I encounter others, who believe they are not good at mathematics, I believe that means they have not yet been supported in the ways they need to learn the subject. This belief is present in how I initially interpret the stories of mathematical struggle from my participants. With respect to motherhood, I have my own mother as a strong role model for supporting my development in mathematics. Even though she believed she was doing very little to help me mathematically, growing up I felt significant support in understanding the subject because of her presence. This experience shaped my perspective that

mothers can and do help children in mathematical development, even when they feel uncomfortable with the material.

My appearance also shaped how participants positioned and connected with me. I am a 31-year-old, white, middle-class woman, married to a man. These are qualities that align with U.S. society's more acknowledged elements of a 'mother' (e.g. Dillaway & Pare, 2008). They are also qualities that can be more apparent to participants, both in appearance and assumption. However, at the time of data collection I did not have children, and I was a researcher asking participants questions about their interactions with children. The features of who I am, fitting U.S. society's expectation of who a mother is and the fact that I was not currently a mother created particular relationships with participants. Many made assumptions that I wanted kids, perhaps because of my outward appearance fitting society's norms of 'mother' (Arendell, 2000) or because I was interested in doing this work about mothers.

The assumption by some and recognition by others that I did intend to have children eventually, established several positive elements of the researcher/participant relationship. Several participants responded to questions and provided additional advice from their own experience about mothering writ large, and not focused primarily on mathematics. These moments were always unprompted and outside of interview questions, with a tone of kindness but authority. Tara was the most explicit in giving mothering advice, where at the end of the final interview she commented that what I learned from our meetings together would help me not only in my study but personally. Another form of establishing connections came from myself in small moments of relation to stories or experiences that participants shared. This occurred with Courtney and talking about a mutual love of board games, with Tara and a hand at craftwork, with Brittany and an authentic understanding of the music activities she used, with Amanda and

experiences as graduate students, and with Elizabeth and the experience of adopting (or planning to adopt) children. These interactions provided potential to rebalance power dynamics in the researcher/participant relationship. I may be writing about their stories in an academic setting but they are the ones who have the stories to tell about mothering.

Study Components

In order to allow for the development of mutual trust and respect as well as time to unpack the depth of stories shared, multiple interviews with a different focus were key. Sharing stories about one's life "should be seen as a life process. It cannot be fully achieved in a single interview" (McAdams, 1993, p. 264). The purpose of the first two interviews was to probe participants' past and current experiences with mathematics and with their children, taking time to more flexibly reflect on the meaning of these experiences through a semi-structured protocol. In order to achieve depth in responses that connect to a story-telling model, I related initial questions to Clandinin and Connelly's (2000) three-dimensional space of inquiry, where "stories have temporal dimensions and address temporal matters; they focus on the personal and the social in a balance appropriate to the inquiry; and they occur in specific places or sequences of places" (p. 50). Common questions across interviews and observation debrief sessions focused on contextualizing the stories told, asking about when and where the story took place, the relationship with those involved, and the emotion associated with the experience. The initial protocols for these interviews and debriefs can be found in Appendix A. In many cases, stories or elements of stories were repeated in future interviews as participants made connections between activities and feelings, or between their own childhood and the interactions they were encouraging with their own children. Participants were also asked to share artifacts (such as writing or photographs) of the stories they shared to provide further context into the activity.

The different elements of the research design are structured to respond to the research questions while also being attentive to the theoretical framework of identity theory and the use of P. H. Collins' (2000) matrices of domination to understand the impact of race and gender. The first interview focused entirely on a participants' past and their mathematical experiences, which helped to address RQ2 (how previous experiences support or contradict engagement) while also centering their lived experience (P. H. Collins, 2000). The second interview focused on current interactions with mathematics, which helped to address RQ1 (positive forms of mathematical engagement) while also making space for connections to their past and reflections to the racialized and gendered nature of their experiences (RQ3). Addressing RQ3 was prevalent across the interviews with the repeated question: "how do you make sense of this experience now?" and probing for details about why a particular event happened. The observations functioned to enrich the response to RQ1, by recognizing the activity described by the participants in the interviews and further mathematical action they did not see before. The third interview and collected artifacts brought all of these elements together by making sure they captured the participant and who they were, honoring their identity and lived experience, while giving them space to reflect further on these stories.

I negotiated two observations, each followed by a debrief, in order to strengthen understanding of the interactions participants had with their children in relation to mathematics. After the first two interviews, I had a better idea of what types of activities they did that may use mathematics. In the first observation, I asked the participant for an activity that they believed used mathematics and in the second, I asked about another activity that came up in their stories that I saw as being mathematical, that they may not have recognized as such. The selection of the activities for the observations represented the negotiations, as the participants selected one with

discussion of how it would represent mathematical activity and I selected another with less recognizable, but still rich, mathematics. The intent in the observation activity decision was to address the common issue in literature where parents do significant mathematical activity at home but do not recognize it as such (e.g. Goldman, 2005). My aim was to draw attention to the positive forms of interaction that were discussed in their interviews and then carried out in meaningful ways in the observations. This supports the literature that argues that mathematics that occurs at home can be rich and meaningful (e.g. Pea & Martin, 2010; Stevens et al., 2006).

All observations were conducted through a video-conferencing platform due to the restrictions of face-to-face research in the COVID-19 pandemic. The participants were prepped on expectations of time for the observation and how to set up the space for observation in advance (either via email or a telephone conversation after the second interview). Participants joined the video-conference call and made sure the placement of the camera allowed for an adequate view of the activity space. I then muted my audio and video while observing to limit potential distractions for the children involved. In most cases, the participants did not acknowledge the camera in place and they interacted in an activity with their children almost as if I was not there. In cases where one of the children brought attention to the camera, the participants explained that someone was watching them play and why. When appropriate, I showed my video to wave hello so the children knew who it was and would feel comfortable returning to the activity. I wrote field notes during the observation, with special attention to what was said by the participant and their children, what they did, and the materials involved in the activity.

Debriefs of observations, which generally occurred immediately following an observation, were conducted to provide context into what happened from the perspective of the

participant instead of the researcher. The debrief sessions provided the participants space to contextualize the activity, making it clear how it was part of their lived experience (Dillard, 2012). This included clarifying particular actions, asking about the participant's thought process and feelings behind certain interactions, and probing about the mathematics that happened. The attention to the mathematics was to see how participants would classify their activity as involving any mathematics content or not and its similarities to what had been discussed in previous interviews. After participants exhausted what they believed was the mathematics that happened in the observation, I shared additional moments that were recognized in the observation as containing mathematical content based on the field notes. Every observation conducted across all participants contained at least one instance of mathematical content that was not initially recognized by the participant. This was expected, given previous literature that shows how parents frequently do not recognize their activity as mathematical (Goldman, 2005). These new moments of mathematics were then connected to other moments or other activities that also would use the same type of mathematics by the participants. If necessary, further clarifying questions were asked about participants' experiences and interactions with the new moments of math that I pointed out.

The third interview acted as a form of member-checking (Creswell, 2009) for the information across the study that had been collected of the participants. Returning to the participant with the transcripts of their stories to ask for clarification was not intended to confirm that the words were what they said. As Clandinin and Connelly (2000) claim,

> It is something much more global and human: Is this you? Do you see yourself here? Is

> this the character you want to be when this is read by others? These are more questions of identity than they are questions of whether or not one has correctly reported what a participant has said or done" (p. 148).

The focus was on who the participant was as a person. Identities construct who people are (Appiah, 2006). The focus on mothers' identity, or identities, alludes back to the study's theoretical framework that centers and values lived experience, self-authoring, and stories as part of someone's identity (Cervantes-Soon, 2017). I reviewed all collected data before the final interview, and began with clarifying questions that were not fully addressed in stories told previously. Given the intent of reviewing transcripts to understand who the participant was and not correct wording, as well as timing limitations, the third interview did not have the participant read through all transcripts. Instead, I picked out up to 10 excerpts across interviews and debriefs that I believed best represented the participant and would likely be passages I would pull direct quotes from in future writing. The participants were asked to read through these passages and see if they felt if individually, they represented their thoughts and collectively if they represented them as a person. They were given opportunities to add to, change, or delete parts of the excerpts. If their desired change was in relation to a particular story (e.g. my mother was a motivator for me throughout my life) then changes were made just in relation to that excerpt or relevant narrative across their stories. If their desired change was in relation to a feature present across interviews (e.g. I don't like how often I use filler words) then discussion followed about how those changes would look and I later combed through all participant documents to make those changes (e.g. removing "like" when it is not being used to make a comparison). While any and all changes suggested by participants were permissible, what was requested by the participants was only ever to clarify a particular point they were trying to make and changes

made across all documents were only in relation to a desire to remove discourse markers (e.g. you know, so) and filler words (e.g. like, um). These interviews concluded with overall reflections by the participants, often including notes by participants in what they were seeing across their stories about themselves.

Just as COVID-19 impacted my participant recruitment and their involvement in the study, the pandemic also influenced the study components. Due to the university's suspension of all in-person research, I needed to move all future interviews, observations, and debriefs to an online format. I contacted participants who had already shown interest in the study with these updates and allowed participants a selection in the virtual platform of their choice. Scheduling observations and debriefs became more aligned with the needs of the participants as opposed to limitations of travel for the researcher. This meant conducting a participant observation at 11:00 a.m. and returning to debrief at 1:00 p.m. after Brittany's children had been put down for naps, or the last-minute rescheduling of an interview from 8:30 p.m. to 9:30 p.m. because Tara's children were taking longer than expected to get to sleep. As a researcher, I could more carefully fit elements of the study into the everyday lives of participants, which also helped to more authentically capture their experiences.

Data Collection and Analysis

The data collected across the study included audio-recordings of all interviews and debriefs, field notes of observations, and artifacts shared by the participants via email or temporary shared folder. Artifacts that participants shared in relation to the study included photographs, videos, and old worksheets (Clandinin & Connelly, 2000). The audio-recordings were transcribed by the researcher and included all voice exchanges, such as long pauses, "ums", and laughs. Attention to this detail of exchange within the interviews allowed for future analysis

of thought process and challenges in recalling particular stories as well as initial emotions or reactions about certain stories. Secondary data was a series of memos for each participant, with reflections on their stories, emerging themes, and initial connections between their past and present experience. The secondary data formed the basis for initial analysis, with return to the primary data for confirmation and coding for themes.

Artifacts helped contextualize the stories and interactions participants had in the study. These artifacts were connected to stories shared in the interviews or the debriefs of observations. As Clandinin and Connelly (2000) explain, these artifacts mark

> a special memory in our time, a memory around which we construct stories. . . It is these artifacts, collected in our lives, that provide a rich source of memories. Viewing these documents in the context of a narrative inquiry constitutes something that might be called an archaeology of memory and meaning (p. 114).

I used photos, worksheets, and videos that participants shared with me to deepen understanding and descriptions from the stories they told. Almost all participants shared photos or videos of their children doing activities that involved mathematics. Several participants shared photos or worksheets of their own mathematical work from early childhood and in current household projects. The artifacts illuminated details and nuances of participants' stories. Overall, the purpose of the artifacts was to expand on the stories shared by participants to memories connected to items, pictures, or videos.

Analysis Process

All data requires careful reading and rereading. Where "a narrative inquirer spends many hours reading and rereading field texts in order to construct a chronicled or summarized account of what is contained within different sets of field texts" (Clandinin & Connelly, 2000, p. 131).

Careful engagement with the data was a key component of analysis throughout the study. In reviewing data, I looked for themes for each participant around identities they attached to themselves, the described interactions in mathematics with children, the relationships between action and experience, and the gendered and racialized experiences that informed their interactions. The attention to identities in stories supports the identity work of Sfard and Prusak (2005) that frame identities as stories. The focus on identities as participants name them, also centers the self-authoring perspective represented by Cervantes-Soon (2017). The other themes listed for analysis in reading and rereading the data address elements of the research questions.

Formative analysis happened for all participants throughout their time in the study, as I reviewed their previous transcripts before our next meetings to frame particular questions or clarifications around their experiences. After a participant completed the study, I reviewed all of their collected data making memos with emerging thoughts more broadly about their experience, mathematics, and their interactions with their children. I reviewed all memos across a given participant to find particular themes in the stories they told. For example, Tara's stories indicated themes of seeing mathematics in everyday life and that hands-on activities were key in learning. After memo-writing and further familiarizing myself with the data, I wrote brief biographies for each participant that included elements of their life growing up, feelings about mathematics (past and present), and general trends in their interactions with children. These narratives form the basis of Chapter 5 of this text.

An analysis of the narratives of the participants requires a return to considering my own positionality. Considering my own position and connection to participants was important not only in data collection and building relationships, but also in my analysis and writing of their stories. While earlier I made nods of connection between myself and each participant, it is

natural for that connection to be stronger with some participants but weaker with others. For example, I was more drawn to connect with Courtney's stories, with similar experiences in mathematics, teaching, and even hobbies but a weaker connection to Elizabeth who expressed the most hesitancy in connecting her experience and activity to mathematics and education. As Clandinin and Connelly (2000) state "we are forever struggling with personal tensions as we pursue narrative inquiry" (p. 46). My different levels of connection with participants should not impact the quality of the analysis and portrayal of their experiences. To meet this demand, I was intentional in how I presented the participants, with similar levels of clarity and depth of analysis. I considered, am I making assumptions about Courtney's experience because of what I have been through? Am I providing enough richness to Elizabeth's stories? I repeatedly returned to the transcripts of participants to make sure my analysis and writing truly reflected their stories. Additionally, I read across their narratives and selected excerpts to see if the detail and clarity across participants would be comparable. In this way, I continually checked my positionality and made sure to center the lived experiences of the participants.

Analysis across participant interview and debrief data focused on responding to the research questions and the nuanced context of participants' stories. The nuance in participants' words, feelings, histories, and self-definitions received careful attention in determining codes. The attention to details beyond the words spoken parallels the ideas of feminist narrative inquirer Madison (1993). In transcription I included deeper detail such as laughs, pauses, sighs, and filler words. In analysis I used these cues as additional indicators of participant tone and feeling. Data were analyzed using NVivo. Initial coding schemes can be found in Table 3. Looking across all of the excerpts in a particular code, I focused on zooming in and zooming out to understand the context of the stories via individual participants and trends across participants. I wrote additional

Table 3

Initial Coding Schemes and their Connection to the Study

Code	Study Significance
Emotions in mathematics [past and present]	Honors theory
Positive mathematics engagement	Addresses RQ1
Past influencing present [support or contradict]	Addresses RQ2
Gendered mathematics/mothering experiences	Addresses RQ3
Racialized mathematics/mothering experiences	Addresses RQ3

memos upon reviewing the excerpts in a code about what stood out for a given participant, such as Amanda's touch points of using her mother's and her own experience in mathematics as motivation for different engagement in mathematics for her son. Themes across participants showed how these people positioned their experiences and current resources to create an environment that would be as supportive as possible for their children's learning more broadly.

The initial code pertaining to emotions of both past and present focuses attention on the context of the stories told by participants. The transcripts were intentional in capturing these tones and feelings of participants by recording sighs, pauses, and laughs, in addition to the pointed questions about how a particular story shared makes them feel. This argument on analysis is supported in qualitative inquiry as Corbin and Strauss (2012) state that "emotions and feelings cue the analysts as to the meaning of events to persons" (p. 83). While not only benefiting the methodological components, a focus on emotion also aligns with the theoretical framework of feminist identity theory. From a feminist perspective, emotions, tone, and feelings

show individuals to be whole people and support their lived experience as true and meaningful (Kwakye, 2011; Madison, 1993). Emotion is also part of identity (Stryker & Burke, 2000) and provides nuance to who people are beyond seeing good and bad emotions (Stets & Serpe, 2013). Coding for emotions allowed me to more deeply consider who my participants were and how their experiences shaped them, into whole people.

The remaining codes in Table 3 were directly tied to the research questions. Coding for positive engagement addressed RQ1 and how mothers positively engage with their children in mathematics. Coding for the past influencing the present addressed RQ2 by looking for instances of how their stories of their past shaped what they did in current mathematical interactions either aligning or contradicting their own experience. Coding for gendered and racialized experiences in the transcripts addressed RQ3. As I analyzed the experiences for participants within the codes that addressed my research questions, I found another emerging theme in connection to my theoretical framework: mathematics identity and expectations. I thus returned to the data to code for moments where participants pointed to what counts as mathematics or not and how they saw themselves fitting into the discipline. This new theme showed connections across existing code and created further context for participants' experiences and current mathematical interactions.

The participant observations were analyzed similarly to that of the interviews by being careful to read and reread field texts, and making connections to the codes discussed above. Participant observation texts require a look for patterns along cultural and social trends, with attention to the context of place, actors, activities, objects, and goals (Spradley, 1980). Doing this wider analysis in context of cultural and social dynamics allows for connection to understanding larger structures shaping participant decisions, which may further illuminate the role of matrices of domination as discussed by P. H. Collins (2000). Observations (as well as debriefs) were

analyzed for their connection to stories described in interviews, the expressed identities, and mathematical interactions with children as a way to make further connections from the analysis of the interviews in relation to the research questions.

In relation to RQ1, additional analysis was done across participant observations on the emerging codes connected to positive engagement. The interactions participants had with their children in mathematics was mapped to broad activity types (such as reading books, meal time, and puzzles) as well as mathematical skill. A list of possible mathematical skills was constructed before this analysis using the existing literature's recognition of early childhood mathematics (A. Anderson & Anderson, 2018; Skwarchuk et al., 2014). All skills identified by participants as mathematical (such as those discussed in the second interview or the observations) as well as others that were present in their activity and validated by existing literature formed the list of skills (Table 4). These skills were mapped onto particular activities that participants did with their children. Analysis was done to show activity and skill engagement via individual participants as well as common activities and skills used across participants. More detail on what this looked like and its implications can be found in Chapter 6.

To a lesser extent than participant recruitment and data collection, COVID-19 also impacted my analysis. The influence of the pandemic on the lives of the participants came up in interviews and debriefs for almost everyone, discussing new limitations in childcare and typical at-home activity. Seeing how the pandemic changed their activity informed my understanding of responses to the research questions, particularly RQ3 on gendered and racialized experiences. I was able to see how the expectations of mothers taking care of children, coupled with the shutdown of school and daycare facilities created significant changes in additional

Table 4

Mathematical skills and activities used in interactions

Skills	Activities
● Number recognition ● Counting ● Shape recognition ● Sorting/shape attributes ● Shape properties ● Quantity comparison ● Fractions ● Measurement ● Estimation ● Color ● Time ● Operations (+/-) ● One more/one less ● Spatial terms ● Spatial awareness ● Patterns/sequences ● Volume ● Size comparison ● Money	● General play [playdough, cars, etc.] ● Outdoor play [walks, sandbox] ● Music time ● Crafts ● Books ● Puzzles ● Blocks/Legos ● Meals/cooking ● Routines ● Family tasks [church activities, if/then statements]

responsibilities for Amanda and Tara. At the same time, the pandemic had little impact on the day-to-day life of Brittany, which was indicative of her activity and actions prior to COVID-19.

Throughout the different components of the analysis, maintaining reliability of the stories and interactions of participants was key and required the same level of care as that expressed in regards to collecting their stories. Part of the analysis of interviews began between interviews, with constructed narratives and themes coming forward before the final interview. Developing reliable narratives of the participants was more likely when I brought them back for revision and

feedback in the third interview. There must be “this sense of continually moving back and forth between being in the field, field texts, and research texts” (Clandinin & Connelly, 2000) in order to accurately represent participants and inquire into their lives. Once the last interview was completed, I was intentional in linking themes and codes back to multiple points in the data, looking at the stories shared in interviews, their actions in observations, the shared artifacts, and their reflections in the third interview. To further make sure that the interpretations I made from their stories support who participants were, I returned repeatedly to their stories and my own, as a way to confirm what was truly their perspective and what was mine. In this way, I most authentically captured how the participants saw and portrayed themselves within their experience and interactions with mathematics. Attention to their experiences, as told, allowed for a richer perspective into who they were and how they lived their lives.

Chapter 5: Participants

To understand how the participants interact with mathematics from their past and present requires particular attention to who they are. The people represented in the narratives of this study are not nameless or faceless people with generic stories supporting a point about issues of mathematics education. Their experiences and life stories are rich in describing who they are, who they have come to be, and what they hope to do for themselves and their children. What they show as people is important to consider first to understand their context within the study itself. Sharing details about the lives of Amanda, Elizabeth, Tara, Brittany, and Courtney provides the reader a chance to see the rich and meaningful context of the participants' lives, and not just what their stories mean collectively.

The attention to narrative and providing space to show participants as whole and complex people honors elements of narrative inquiry and identity theory. From narrative inquiry, the focus "serve[s] a powerful means of conveying information rich in context and feeling" (Marx, 2006, p. 26). Doing so shows participants as more than just mothers or mathematics educators. Within identity theory, attention to the background and stories of individual participants shows that such work is about more than trying to define what kind of person someone is (which is a challenge in many other definitions of identity). Instead, a focus on stories honors who participants say they are and how they define themselves (Cervantes-Soon, 2017; Sfard & Prusak, 2005).

The stories presented of each participant offer rich descriptions of their life in the present, life growing up, relationship with mathematics, hopes for the future, and hopes for their children. Interspersed in these key elements are details about their families and interests and how they define themselves. The order that the participants are introduced is not to make thematic

connections between one participant and another. Instead, the order reflects the chronological introduction I had with these participants. Amanda was the very first person I interviewed and Courtney's final interview was the last of study. While I will draw more explicit connections between participants and their stories in Chapter 6 and Chapter 7, the order of participants presented here may show the influence from one participant's experience to the next. As such, what I learned from Amanda had the potential to influence how I understood Tara's experiences and what I learned from Elizabeth had the potential to influence how I interpreted Brittany and Courtney's stories. The end of this chapter briefly describes larger themes across participants' stories in working with their children in mathematics.

Amanda

'I think my earlier struggles definitely defined, a lot of who I was growing up. And I think they made me who I am today' (Interview 3)

Like many other people in the world in 2020 during the COVID-19 pandemic, Amanda was dealing with a lot of uncertainty and change in her life. She and her partner went from working outside of the home to in it, taking care of their 2-year-old son Grant full time because his daycare was closed. As a graduate student, the pandemic put Amanda's research plans in limbo and, as an expectant mother, she was unsure what would happen in a few months' time when she was going to give birth to her daughter. Yet through these issues, Amanda remained calm and positive. Much of this attitude was put into perspective because of the challenges faced in her past. While she recognized that her life growing up was very different from her life now, she talked about how the challenges she experienced as a child motivated her actions and decisions in raising her children.

Amanda was living in a small city in Wisconsin. She appeared as someone with light brown hair and paler skin, often mistaken as white, but identified as Native American. Amanda saw herself as more of a typical person, who worked hard and was passionate about making learning fun for children:

> I'm a pretty average like normal person...my cultural identification is really important to me...that connection is a huge, kind of, meaningful link to me and...I also like identify as a mom now. I think, I think that is, I identify as a student, um I identify as, fairly hard working, um and motivated (Interview 3).

Amanda's identification with her culture, her role as a mother, and her role as a student were important parts of who she was and what she did. She interweaved these elements across her actions, incorporating what she felt was important for teaching and learning as a graduate student, as well as her family's culture, into the mothering of her son, Grant.

The importance of culture and Amanda's past motivating her present actions mostly stemmed from her Native American heritage. Unlike her younger brother and her mother, Amanda saw herself as mostly passing for white. Amanda's husband was white and in talking about how others perceive her and her son as white too, she said,

> {my son} is about as white passing as they get. Um…he's got blonde hair and blue eyes [laughs] so genetics are weird...I recognize that like a lot of things are easier for me in life because of the way I look, compared to like how the other half of my family looks. Um...but I still think it's important to recognize that this is my family and this is my history (Interview 3).

Amanda's perspective was full of careful nuance about recognizing the privileges she experienced because of her white-passing skin color. The privileges, as well as assumptions

made by others, about her skin color was also something she recognized in her current middle-class status. These markers of privilege have not always been available to her or her family members. Her Native American background, her white-passing, and her current class status shaped how she thought about her actions as a parent today as well as the perspectives she had about her own childhood.

Most of Amanda's time growing up was spent in a smaller midwestern city, in a family experiencing extreme poverty and occasionally homelessness. While her parents battled with addiction issues and occasional incarceration, Amanda saw school, and especially reading, as a form of escape. Mathematics did not hold the same joy as reading. Amanda recounted "growing up I never thought I was good at math" (Interview 1). Struggling with material, feeling like she was constantly 3 weeks behind in understanding the content, Amanda believed that math was not something that everyone would be able to figure out. Amanda explained that she "just sort of internalized it as these were innate things in people that like some, like reading came easy to me but math came easy to other people and I wasn't one of those people" (Interview 1). Connecting with education, and specifically mathematics was not a priority for Amanda given the challenges at home.

Amanda's disconnect from mathematics stemmed from her early experiences with her mother and at school. She believed girls were just not good at mathematics. In a moment of reflection, Amanda shared:

> I feel like it was very gendered when I was a kid. Like I always assumed there were the smart boys in class. And they were just better at math and that maybe it had something to do with me being a girl that I wasn't good at math. My mom would openly talk about how she wasn't good at math either (Interview 1).

Amanda's experiences showed her that boys were good at math and that it made sense or was okay for girls to be bad at math. Learning was also stressed as doing well on tests or finding answers quickly, which was not something Amanda was able to do. In many cases, she felt like her teachers did not fully understand what she was experiencing.

Partway through high school, Amanda switched to an alternative school, that allowed her to complete classes on a different schedule so she could also work to support her family. In this school, she had teachers that were more understanding of her experiences. Amanda "just felt the teachers were really supportive and they kind of understood all the different life experiences that kids had" (Interview 1). Supportive teachers at the alternative school showed Amanda what was possible through education, but Amanda also had experiences with teachers in the traditional school that made assumptions and judgments about her life that made feeling comfortable in their classrooms difficult. Amanda reflected that,

> [Teachers, I] didn't feel like, um, the more like white normative school stereotypical experience really kind of understood [me]. Um...or expected, like cause they'd look at me and see one thing and make assumptions. Um, not to like fault them or say they were bad teachers or anything like that it's just that's the population they worked with 98% of the time and that's the assumptions they could make about things and didn't really dig deeper (Interview 1).

Amanda went on to describe how school in that community was full of mostly middle-class white kids, and her tardiness to class or late assignments was often perceived by the traditional classroom teachers as a lack of caring or laziness in education. The alternative school gave Amanda a better opportunity for learning at her own pace, teaching her the importance of continued education.

Throughout the interviews, Amanda repeatedly reflected on how her mother was a major motivator for her, in continuing school and eventually going off to college. She returned to make this observation explicitly in our final interview, stating "I think a lot of, you know a lot of my motivation is behind my mom. And a lot of my motivation is behind my background of growing up really low income." Her mother's explicit calls to action and education and her childhood experience with a low income motivated Amanda to do more to secure her future and the future of her children. While Amanda's mother was often referred to as an example of what she did not want to become, she appreciated how her mother motivated her education and bright future:

> My mom always regretted dropping out as young as she did. And so, she really kind of pushed me the whole time to like not make the same mistakes that she did. And she always felt like she could have done so much more with her life, um if she had just like graduated high school and gone to college and not dropped out at such a young age. So I think that really drilled it into me that this is important and if you want better than this then you need to like use education as a way to not stay like this (Interview 1).

The explicit motivation Amanda received from her mother not only pushed her to complete a college degree but also inspired her to return to school for further higher education.

Amanda used this motivation from her mother to interact with her son, Grant. She saw education as the way toward opportunity and used learning in play with Grant to show him that learning can be fun. She wanted him to see learning as part of play time at this age so that as he grows up, he will continue to seek out opportunities to further his education. Amanda focused on making positive associations with learning for her son so that he will not develop a stance that he is naturally bad at certain things. To support this style of learning and attitude towards education, Amanda incorporated learning into everyday play and typical family routines, drawing from the

types of tasks that her son loved to do (like play in the sink and race toy cars) as well as what she had seen him do in daycare.

Elizabeth

'I think I care an awful lot...I care about the kids and how they learn...the earth, racial diversity...I just care, I care about a lot of things. And so I take the time to try to learn, educate when I can' (Interview 3)

The empathy Elizabeth put into speaking about and with others showed a truly kind person. Elizabeth was living in the suburbs of a city in Wisconsin. While she appeared often quiet or hesitant to speak up, Elizabeth thought meaningfully about how her actions could support others. She was a stay-at-home mother while her husband worked full time. During the pandemic, her husband worked from home and she helped her oldest (Luna, 7 years old) with online schooling and made time to play with her youngest (Talia, almost 2 years old). Both of Elizabeth's daughters were adopted as newborns. Elizabeth and Luna were white-presenting, whereas Talia was part Hispanic. Elizabeth talked explicitly of how she was intentional in the experiences she provided to make sure that Talia was surrounded by people, books, and toys that looked like her. Elizabeth enjoyed music, doing work that supported and cared for others, and teaching others, especially her daughters, social-emotional skills.

Growing up in a more rural part of the Midwest, Elizabeth lived with her mother (an infant ICU nurse), her father (manager of a local hotel) and her sister. Elizabeth was still very close with her sister, who was an elementary school music teacher. She described her parents as very different in how they acted, where she said "my dad was always really easy going, my mom was more the...the one to make the rules and enforce the rules and um, yeah be more critical"

(Interview 1). Her mom was also the one to stress the importance of mathematics and support her in her school work. In reflection on her mom and mathematics, Elizabeth shared:

> I think back and am like woah my mom was really smart to start that that young and bring it to real life. Um, bringing all the book learning and classroom learning to real life and have the like real life ramifications of things. Um, and even just the repetitive nature of her saying these things to me over and over was probably good (Interview 1).

In talking through her experiences, Elizabeth realized the important work that her mother did outside of school to bring that learning into real life such as calculating grocery costs and shopping discounts.

Elizabeth loved making friendship bracelets and playing with baby dolls growing up. She had an early childhood friend that enjoyed baby dolls as much as she did and Elizabeth had fond memories of them playing "house", making pretend daycare, and taking care of multiple baby dolls. While Elizabeth had a series of close friends growing up, a sharp memory that stuck out was of an early friendship where her friend decided abruptly that she no longer wanted to be friends with Elizabeth. In recounting this story, Elizabeth reflected,

> I think that does shape my friendships today still cause I think even though I was young it was still kind of was a, first friendship experience and to have it end so abruptly with no reason was kind of, harsh. And um, and I do look at that with my kids now too, as they develop friendships (Interview 1).

Elizabeth's own experience with early friendships shaped her attention to what happens with her kids today. She focused on the early relationships they form with others and encouraged strong social-emotional skills in them.

Mathematics in school presented challenges for Elizabeth, who felt like a missed section on long division in the 4th grade has always impacted her. She recalled when a 5th grade teacher tried to catch her up with learning long division, that

> to this day I'm still terrible at long division because I never really learned it fully or was tested on it multiple times. I just learned it that one quick day in class. Yeah, if you asked me today to do it, I don't think I could [laughs] (Interview 1).

While she went on to complete higher level math courses, Elizabeth was uncomfortable asking for help in a way that would show her as different from other students. This was particularly clear in her college experiences, where Elizabeth felt she was "better off doing well and flying under the radar and being like 'oh she's just doing well and she just gets it' versus trying to like go ask questions differentiates me maybe makes me look dumber than I am" (Interview 1). Because of this, Elizabeth felt that she could do some mathematics but parts of it would always elude her.

Her experiences in school in general were different from her struggles with mathematics, as Elizabeth was a good student, who aimed to do as well as possible. Elizabeth's goal of doing well in school and getting to the top of the class became a motivator for particular mathematical decisions she made in high school. At her school, the top student in the class received a big scholarship for college. Elizabeth remembers that she

> did drop out of my calculus cause I was afraid I wouldn't get a good enough grade that it would, it would be detrimental to my GPA...so then I took I retook calculus the following year, senior year when my grade didn't matter as much because we did early admission to college...and, it turned out well like I ended up getting the scholarship that I was hoping for so I made the right decision that way (Interview 1).

Elizabeth admitted that choosing to drop calculus was part of a numbers game, that she cared about her education to get into college and be able to afford it and doing so meant finishing high school as the top student. Her desire to get to college, coupled with her lack of confidence in mathematics informed her decisions about dropping calculus.

Some of Elizabeth's hesitation with mathematics translated to a comparison of her skills and actions to those of her husband. In discussing her struggles with division, she said "my husband is great at math and yeah, I um...I could say I'm pretty good at math but that division part is [laughs] nope" (Interview 1). These feelings were related to who was more likely to work on mathematical skills with their children, where Elizabeth stated that her husband "does most of the math teaching…{my husband} is better at incorporating learning into playing than I am, generally. Um, if I'm playing, I'm less likely to, teach about math" (Interview 2). Her struggles with mathematics growing up and lack of confidence in the subject made Elizabeth believe she did not do much work with mathematics.

Many of the activities that Elizabeth engaged in with her children had mathematical components, that prior to this study she did not recognize as doing mathematics. She aimed for activities with more structure and organization that were easy for her to implement and showed the learning for her children. In her explanation of why she liked to use puzzles as a tool to learn about mathematics, Elizabeth thought "it's a very direct, organized activity that doesn't take much imagination so I think, in that regard for me, um, with my play skills [laughs] I think it's an easy activity that lets me keep everyone engaged" (Interview 2). While Elizabeth did not believe she was well-versed in education and learning, she was open to learning from other resources that she could incorporate into activities with her children. Elizabeth liked direct, teachable moments in play time but she believed trying to incorporate those can be difficult

while still keeping her children engaged. She found it easier to incorporate the learning in activities like reading books, building with blocks, and puzzles.

Just as Elizabeth liked structure and direct teaching for new skills with her daughters, she tried to be intentional about many other forms of their learning. Elizabeth claimed that they cannot control what comes from their children's biological parents and as such they take every opportunity to "boost their learning," being more intentional to push learning and support their education. While Elizabeth talked at length and was a strong supporter of development of social-emotional skills, she also stressed the importance of racial diversity and representation for her youngest daughter. In finding older children's books in storage that she wanted to read with her youngest, Talia, she expressed how she

> was really disappointed at how many books were like white kids in the books. Um whether it was illustrated or whether it was real pictures in them. . . I think more and more how important it is for when {Talia} to open a book to see people like her reflected in that book" (Interview 3).

She wanted both of her daughters to recognize diversity in individuals as a normal part of life and her youngest to feel empowered seeing people in books and other media that looked like her and were doing meaningful work in the world. Elizabeth strove to make learning meaningful and empowering for her children, with the activities she tried to engage them in and their exposure to diverse opportunities for who they could be in the future.

Tara

'I would like to think I'm creative as well. And you know I have some brains. Not nearly as much as I felt like I had prior to kids, cause I'm so tired all the time, but...that's just motherhood' (Interview 3)

Tara's stories were almost always reflective of her experiences in the past and present, seeing the bigger picture of where she fit in. The important things she learned about being a parent frequently came forward in stories as pieces of advice about motherhood as well. Tara was living in a city in Minnesota at the time of the study. While a creative person and reflective thinker, Tara frequently grounded herself in the identities of mother and wife, stating:

> I'm a mother and I'm a wife and I'm more than that but at the same point, that defines me a lot, day to day, um but I would like to, I would like to think I'm creative as well. And you know I have some brains (Interview 3).

Tara mostly described herself as a stay-at-home parent, but also did part-time work in the pricing department of the local grocery store. Her partner was a mechanical engineer. Tara had two children with her partner, 18-month-old Sasha and Peter (who was almost four). Tara's children were half-Korean, which factored more heavily into her thoughts and actions about raising them. Current events of 2020 surrounding racial profiling of Asian Americans with the COVID-19 pandemic as well as the catalyst of the 2020 BlackLivesMatter protests (i.e., George Floyd's murder by police) happening in her home state during our interviews made Tara reflective about what this would mean for her children and how others would perceive them as they grew up. As a result, Tara frequently made remarks connecting her own experience and feelings around mathematics to what she ultimately hoped for her children's education. These connections to the present and hoped-for future were clear throughout the narratives about who Tara was.

Creativity and crafting were where Tara enjoyed spending most of her time. Sometimes this could be cutting down a recipe for hummingbird nectar to add to their outdoor feeder or building a wooden gate for their outdoor deck. Whether it be baking, drawing, or woodworking,

Tara enjoyed working with her hands and constantly saw the different mathematics she needed in her projects. Tara was intentional in getting her children involved in these activities:

> I want to have my creative outlet still and a lot of times I try to do that with the kids. More so than I did independently before they were born. Um and I still want to be able to make things you know, I just like making things (Interview 3).

Tara's hands-on creative time was something that she wanted to share with her children. She saw her kids as a part of herself and felt that what she enjoyed should include them.

Growing up, Tara also enjoyed crafting and hands-on work, whether it was baking and cooking with her mother or working in the garden with her grandmother. Staying in the same area that she does now, Tara's grandmother lived with her family for a long part of her childhood. Tara's father was an electrical engineer and her mother ran an at-home daycare. Much of the crafting that Tara did and enjoyed in middle and high school came from her time in Girl Scouts, an important piece of her childhood. When she was not busy creating bead creatures or painting her room, she was involved in an extensive array of sports: hockey, track, and swimming. In reflection on time spent with her parents, Tara recognized the different elements each of them supported:

> My mother and I, we did a lot of baking and like a lot of cooking. And we did things like shopping, things like that together. My father was more of the academic side of what I needed and my mom did more of the um basic things that you need to know, like take care of yourself (Interview 1).

Crafty efforts and work at home she saw as part of her relationship with her mother and also her grandmother. In many ways, these activities were things that she wanted to continue sharing with

her kids. Her father's efforts on her academics was a support that Tara experienced across her time in school.

Tara's experiences in school mathematics were often filled with frustration and confusion. She did not enjoy doing word problems and felt that the way the subject was taught did not help her understand the content. Her father, however, was always there to help her work through it, supporting her to work hard and do what he could to help her understand. Tara described her experiences with her father in math as follows:

> I was not strong in math and…it was one of those things my dad like 'you need to understand this foundation, it's okay if you don't get it right away but I'm here to help' um but it was quite helpful you know in middle school and high school because there was times where I didn't understand what the teacher was explaining to me. And he was available (Interview 1).

His support encouraged a deep value in Tara that she should continue to work hard and persevere in what was challenging. Tara referred back to this often when she talked about how she was able to get through some of the most challenging mathematics courses in college to complete her meteorology degree.

The motivation by her father to work hard and do well in mathematics helped push past gendered stereotypes of who could do mathematics. Tara pointed out:

> And my father, because he was an electrical engineer he wanted to make sure that I understood math. He wanted me to become an electrical engineer, but I didn't! But I still had as much math background for my major that I went to at university (Interview 1).

Tara still experienced some struggle with mathematics but this did not become as much about gender because of how her dad framed it. She discussed the gendered divide in STEM and how

that was a motivator for her dad to have her do well in mathematics, supporting her university work as a meteorology major. Because of these experiences and the confidence Tara had, she engaged with mathematics for her children consistently across many activities.

Much of Tara's interests and beliefs about learning that she developed growing up factored into the hopes she had for her children and their learning.

> I'm more hands on I feel like I'm able to do, than you know, than maybe what it's gonna be in high school and in college but…I don't know, I don't know what my kids are gonna be interested in but I'm gonna try to help them as much as I can. Because it, it's …and if I don't know the answer then, I will try to find it from an online source and or, or someone else who may know. Or, um, because I, don't know the new math ways that they're teaching. But I'm sure that when I'm introduced to it I'll try to figure it out myself so I can help my kids understand it (Interview 2).

Tara's hands-on experiences with her mother and grandmother translated into how she wanted to be hands-on with her children's learning. This was clear in the creative activities she used to engage her children in learning and mathematics, such as using watercolors to paint numbers or popsicle sticks to build shapes. Additionally, the value of working hard to figure something out, instilled in her by her father, was present in how she would continue to work hard to support her children's learning. Tara relied on resources, such as people and online materials to help her with projects and plans to continue relying on them to support her children's future learning.

Tara's thoughts of her past, her interests, and her interactions with her children were almost always tied to hopes for the future of her children. While some of her reflections for the future were positive, instilling ideas of hard work and opportunities to learn, other thoughts were tied to worries about how her children were perceived and treated based on who they were. In

asking about what she anticipated for her kids as they grew up, Tara reflected on the potential racial prejudice they may experience:

> Yeah I'm worried about my kids. Um, because right now they're in the super cute adorable Korean, half Korean/half white stage and they're just angelic and everyone loves them but then when they become teenagers they'll be little shits and then you know they won't have that you know, that draw anymore, and I just hope that they can just be respectful and understand um, that everyone has their own opinion and you don't have to necessarily you know agree with them. So, cause now it's just it's so [much] more scary (Interview 3).

Tara's care for her children's learning and hopes for their future was also a desire to protect them, both mentally and physically in regard to how people might speak or act towards them. Many of these concerns were not something Tara had considered much with her children until the presence of racial profiling against Asian people due to the pandemic and the current protests against police brutality towards Black people. These issues became more pronounced for Tara with their physical proximity and personal connection to her family. As our interviews sat in the midst of these events, they impacted Tara's reflections about her children and her interactions with mathematics.

Brittany

'In the past musical theater really defined a lot of my life and now it's mostly, my kids and my family' (Interview 3)

Brittany's commitment to her faith and love of music and creativity were core elements to how she saw herself. Brittany was living in a small village in rural Wisconsin with her husband and two children, Rosie (2) and Bobby (4), and another on the way at the time of the

study. While Brittany described herself as a stay-at-home mother, she also occasionally taught voice lessons. Brittany and her family were members of The Church of Jesus Christ of Latter Day Saints, otherwise known as the Mormon church. Her faith and music were very important aspects of Brittany's life, with many stories past and present related to these areas. She defined much of who she was around caring for her family and working to raise her children to have good values.

Growing up in a suburban area of Utah, Brittany was the oldest of 5 siblings. Her father ran a vinyl decal business where her mom ran the financial side of the business, and Brittany helped in various ways during high school and after college. One of her favorite hobbies as a child was reading, where she revealed she "just read every written word in our house" (Interview 1). Music was also a key part of her early life, not just for her but her entire family. She explained that her and her siblings participated in

> this children's choir that my grandma started growing up. And so I did a lot of music . . . and it was a big part of our life. They practice Saturday mornings from 7 - 9 so we didn't really do Saturday Morning cartoons [laughs] we got an early start to our Saturdays (Interview 1).

Being involved in this choir and music in general was a normal aspect of her family's life. Beyond this choir, Brittany also participated in music through piano, middle school band, and musical theater. Music continued to be an integral part of Brittany's life in interactions with her children.

Her love of reading and music (both in and out of school) did not translate to mathematics. The subject frequently brought frustration, in working hard to understand what often did not make sense. While her mom was the one who helped Brittany and her siblings with

math, she felt they often thought very differently about problem solving, creating more struggle for Brittany. In a moment of reflection on her capabilities in math, Brittany said the following:

> I would say I'm not good at math and then if I'm being more honest I would say I'm not bad at math but I'm not quick at it, it takes me a while to get it but it's really satisfying to finally understand it and then when I get the concept that I'm pretty good at following through or figuring it out (Interview 1).

Brittany felt that because mathematics did not come easily, the subject was not meant for her but realized she could do it with time and patience. Her unease with mathematics, however, was often reflected in gendered statements. For example, she laughed in recalling mathematics struggles with her mom and told her "I better just marry someone who's good at math so they can help our kids cause I don't know [if] that's gonna be me" (Interview 1). In some ways, Brittany had resigned herself to being bad at the subject but handled it by having a partner who was better at mathematics and could help their children. When Brittany paused to more critically consider her ability, she recognized that she had more to offer, given time and perseverance. This attention to perseverance and learning in different ways became pervasive in how she thought about learning for her children and further reflections about her past.

The distinction Brittany started to make in the first interview about herself in mathematics (being easy vs. being possible) was reflected in her values of learning for her children. Brittany also recognized different ways to learn because of her dad's struggle with traditional schooling as someone with dyslexia:

> He's so creative and I think that he kind of instilled that there are other ways to learn besides book learning and it's really important to play, have creativity be part of your life and your education. I think probably so, he's just maybe more aware of that because, I

> feel like both of my parents are very intelligent but they're so different in the way that they, that that manifested" (Debrief 2).

Brittany connected her parents' difference in learning to what she thought may happen with her children, who were already showing different ways of connecting with learning. Her interactions in play and plans for their future education further reflected this perspective of difference.

Learning, for Brittany, needed to be supported based on the individual needs she saw in her children. She stressed that to support their learning in the best way possible at their early ages required attention to play, exploration, and creativity, forms of learning she did not feel were used in more formal schooling. Because of this and other factors, Brittany was

> planning on homeschooling, and so that's something that, I want to kind of be incorporating is I feel like play is super important and so just finding ways to in their play, give them, new ideas that they're ready for" (Debrief 2).

The purpose of that education was not about learning mathematics or reading skills at a certain time or pace, but encouraging learning in the everyday and at a pace appropriate for each child. In some ways this was reflective of Brittany's experience in mathematics, recognizing that the extra time she needed to figure out math content did not make her bad at the subject, and was just something she needed in order to learn.

Brittany engaged with mathematics in many different ways in her life at the time of the study, both individually and with her children, reflective of her musicality and creativity. Activities that involved mathematics for herself included home improvement, budgeting and sewing projects, while those that included her children involved music, dancing, baking, book reading, and clean up time. However, these ways of doing mathematics were not identified as such at the start of the study by Brittany. She often did not recognize the mathematics in

activities with children because it was already an integral part of what she did all the time (such as call and response vocal patterns). Across the activities specifically with her children, Brittany was still focused on encouraging play and creativity, to focus on them learning without it feeling like a formal lesson. As Brittany reflected in the final interview,

> Even though, we didn't sit down and go 'ok we are gonna learn about math and learn about sequences and patterns' they're just part of the activity and they are picking up on it. So that realization has been kind of fun.

Learning, and in this case mathematical learning was part of what Brittany was already doing. When it came to engaging her kids, she did this in activities that she enjoyed and felt comfortable working with, like baking and music.

Courtney

'I feel like I've always been a teacher, at heart' (Interview 1)

It was immediately clear from the way Courtney talked and acted that she was a teacher. Conversations with her were laid back and enjoyable as she had an easy ability to make herself and others laugh. Courtney was a vivacious and witty single parent to her three-year-old daughter, Eva. Courtney was a Black woman who lived with her younger sister in a city in Missouri. Comfortable with herself, she said "I'm not perfect but...I'm me and I'm ok with that" (Interview 3). At the time of the study, Courtney was completing her Master's in education technology and preparing to start a new job as a robotics teacher at a local high school. While this was a transition into a more mathematics focused field, work in education was not new for Courtney, who had also been an English teacher, preschool teacher, and nanny. Most important to Courtney was seeing herself and her daughter as life-long learners, able to be curious about

the world. Throughout her childhood, her everyday activities, and her interactions with her daughter was attention to learning something new.

Growing up, both her parents worked full-time jobs, with her father running a business building and repairing computers and her mother working in finance. As the oldest of 5 kids in the family, Courtney felt that she was "kind of like the babysitter" (Interview 1), spending a lot of play time with them but also being there to help them with homework. Acting in many ways as a teacher for her siblings, Courtney was encouraged by her aunt and grandmother to teach. Courtney recalls "[my aunt] and my grandma always telling me 'you'd make a great teacher, you have all these skills that would make a great teacher, you should do that'" (Interview 1). Courtney's recollections of childhood were also full of memories of playing games and doing puzzles:

> I remember going to [grandma's] house when I was in elementary school and doing puzzles. Um and like spending the night at her house and she had a, always had a puzzle on the card table that she was working on and we could always jump in and do it (Interview 2).

Overall, Courtney's childhood was strongly connected to family and spending time together. Her time playing games and being encouraged to teach played out in similar ways for her time in school. Courtney's strong support in being viewed as a teacher, and good at math, came from predominantly women, with a vocal mother and grandmother, and numerous examples of her aunts.

Courtney described herself as a good student, who worked hard to make good grades. She loved to learn, always wanted to do even better, and loved math. This was clear in one of her favorite memories about school where they played a game on multiplication facts, where you

went head-to-head with classmates. Courtney stated “I remember loving that game like any time the teacher said we were gonna play it I was all for it, like I knew my math terms I had done my drills I knew all of that” (Interview 1). The encouragement she received out of school about teaching even carried into the classroom with opportunities to teach her peers. She shared that in 3rd grade,

> We got to teach one lesson, during the school year. Everybody got to teach a lesson and you got to pick what you wanted to teach. And I remember I picked math and I picked multiplication. And I…I thought I killed it. Like I thought everybody understood what I was talking about, I was hot stuff (Interview 1).

Her school experiences and out of school experiences showed strong support in her ability with mathematics and teaching. Her love of learning in general and doing mathematics whenever possible has extended through her past and present.

Many of the things that Courtney recalled fondly from her childhood were still part of activities she enjoyed at the time of the study. She still played games with her family, board games with her daughter, and worked on puzzles. Courtney liked working on puzzles both by herself and with her daughter because “puzzles are a great way to I guess get your brain going, get you thinking, while having fun” (Debrief 2). Incorporating mathematics into any activity she could was also fun for Courtney. With the time she worked in retail, Courtney recalled trying to figure out sales for customers in her head, and felt good when her coworkers would ask her to help them with the mathematics. As Courtney summarized, “I love doing math so any [laughs] time I can incorporate it into anything I’m like I’m good, I’m a happy camper” (Interview 2). Her love for mathematics and use of it every day was present in almost every activity she did with her daughter.

Some of the most common activities that Courtney engaged in with Eva and mathematics were boardgames and puzzles, something that was available at any moment to engage in. “She always has a puzzle with her in her bookbag in my bookbag in the car, like there’s always something that she can do” (Interview 2). More than concrete activities, Courtney constantly asked Eva questions about her actions or noticings that got her to think more deeply about math. Some of these may be questions about time (why do shadows move), quantity (too many pillows for the starfish), and counting (what should we count to, for ‘hide and seek’). Embedded in these questions and activities was a desire to develop Eva into a life-long learner and see these moments as part of play time. “She doesn’t realize we’re working on things she’s gonna need for school, necessarily because she’s manipulating stuff with her hands. And it gets her imagination going too” (Debrief 1). Learning mathematics was not something separated from other learning or activity but part of the everyday.

Courtney had also intentionally created a robust support system of family and friends to help raise Eva to be a well-rounded child. These individuals were not part of her life just to watch Eva while Courtney was at work, but played an important role in Eva’s learning. For example, her sister that lived with her and worked in kinestheology taught Eva about her body and health, her parents, who often provided childcare, worked with Eva in reading and math games, her friends in the area had children Eva’s age who she could play with and built up her social skills. Many of these examples of support come from the women in Courtney’s family. Courtney reflected:

> I feel like gender wise though she kinda has a leg up because she is in the same situation that I was kind of in while I was growing up where she has lots of aunts, not very many uncles [laughs] um and uh her grandpa is very involved with her um, but she’s

> surrounded by strong women who voice their opinions and are not scared to say what they think and I think that's already kinda rubbed off on her [laughs] cause she's not scared to share what she thinks or her opinion. Um so I think that will work in her advantage (Interview 3).

Similar to her own strong examples of women succeeding, Courtney saw this same situation available to her daughter. This meant that much of the learning and encouraged confidence that Courtney engaged with her daughter was also meaningfully supported in interactions with others, particularly women.

Courtney's experiences growing up and today with mathematics had been overwhelmingly positive. She was encouraged to do mathematics and was boosted in confidence in her day-to-day when asked to do math problems for others. Given the strong women in her family that did mathematics (herself, mother, and one sister) she was sure her daughter had good role models to see she can succeed in math, or whatever she puts her mind to. Courtney was also reflective of possible challenges with how others would perceive Eva based on her race, where she may be "one of the minority in her classes and stuff, um and I don't ever want that to hinder her" (Interview 3). In order to support her daughter's identity as a Black woman, Courtney was intentional in the friends she played with so that she had models of what she can be. She wanted her daughter to "be able to see that she fits in no matter where she's at" (Interview 3). The positive and encouraging experiences that Courtney had growing up in school, was something Courtney was intentional to make sure would happen for her daughter.

Concluding Connections

The stories of Amanda, Elizabeth, Tara, Brittany, and Courtney showed a diverse set of experiences, desires, emotions, and actions in regards to their lives and mathematics with their

children. All but Courtney had some level of struggle or difficulty with mathematics growing up, with feelings of frustration, confusion and struggle. However, perceptions of themselves and encouragement over time have helped Amanda and Tara feel much better about their mathematics ability now and its engagement with their children while Elizabeth and Brittany still have some hesitancy. Their change in mathematics perception was not due to the same experiences, where Amanda was influenced by her education program and a desire to do better from the example of her mother, and Tara was encouraged throughout her childhood by her father to work hard and get support. Courtney's similar support and encouragement in learning throughout her childhood created a confidence in mathematics that she always felt and informed what she wanted her daughter to get out of learning: a sense of self-confidence and desire to always learn new things.

Across these participants, their experiences of mathematics (good, bad, or in between) were used to create or hope for just as good or better situations for their own children in mathematics and in their broader development. But mathematics was not often the goal for learning and development. Instead, mathematics learning was a part of helping their children develop as humans. For Amanda, this meant incorporating mathematics into play to show her son Grant that learning could be fun. For Brittany's children, this meant being okay with the time it took to figure something out and that everyone learned at their own pace. The participants' attention to struggle with regard to race and gender created more nuance and attention to these issues in working with their children based on their experience of the past or what they were learning from current events. For Elizabeth, this meant making sure her daughter Talia saw herself represented in others, books, and toys, so that she would be empowered to be and do whatever she wanted in the future. Tara recognized that there would always be people that

passed judgment about her children based on what they looked like but that it was important to show them they can still be who they want to be. And for Courtney, this meant helping her daughter Eva be confident in who she was and not afraid of what others thought.

The narratives of these people all showed examples of positively engaging with their children in mathematics (RQ1) whether they recognized that activity as mathematical or not. Their actions in mathematics sometimes aligned with or diverged from their childhood experiences (RQ2). For example, Tara followed similar exposure of mathematics and reassurance in ability she received from her father when she worked with her children in creative activities. Gender and race played particular roles in the experiences of the participants, that informed their reflections of their past and the hopes they had for their children (RQ3). In some, these elements were more salient, like Amanda, who recognized her childhood assumptions that mathematics was for men and her heightened intentionality in learning with her son. In different ways, their experiences shaped their current perspectives about mathematics and learning, to encourage what they thought was best for their children. Even with the nuances of the experiences and actions of the participants, there was one common theme among them; Amanda, Elizabeth, Tara, Brittany, and Courtney wanted good things to happen for their children and they were willing to spin the good and the bad of their past to make that possible.

Chapter 6: Understanding Experience as Individuals

The previous chapter shared the details of who each participant was, providing rich details about their lives, their children, and their connections to mathematics. Providing context into the lives of the participants honors their lived experience (P. H. Collins, 2000) and how they see themselves in their stories (McAdams, 1993). This chapter further analyzes the stories of the participants in response to the research questions of this study and in conversation with the literature. Beyond who the participants are is why they engage in mathematics and with their children in the ways that they do. The 'why' has been expressed by other scholars (e.g. Wilder, 2017) as an important element for understanding the relationship between parental involvement and student achievement. Elements of participant intent are tied to their experiences and beliefs, which align with my perspectives of identity theory, where external and personal experience and context shape identity (Alcoff, 2006). This chapter looks specifically at the findings of participants at a local level, how their perspectives and stories shaped how they saw themselves and chose to engage with mathematics.

Each major section of this chapter responds to one of the research questions. The first section on forms of positive mathematical engagement responds to the question, how are mothers positively engaging with their children and mathematics? The results of the study demonstrate that the participants' engagement was varied across types of activity, based on what the children liked to do and what participants felt comfortable doing. The range of activity and context in early childhood mathematics seen here is also reflected in other studies of parents engaging with mathematics (A. Anderson & Anderson, 2014; D. Leyva et al., 2017). The second section on actions informed by past experience responds to the question, in what ways do mothers' previous experiences support or contradict their engagement? Themes across the participants' stories

show that they opted to do similar tasks and activities they did with their parents or teachers if that activity was helpful and enjoyable and chose to do the opposite of activities that proved negative for them growing up. The adaptation of activity based on experience is reflected in Ule and their colleague's (2015) study on parent involvement in European countries, where parents' decisions for their children in education was based on their own experiences and beliefs. The final section on gendered and racialized experiences responds to the question, how does current engagement and past experience of the mothers reflect gendered and racialized perspectives of motherhood and mathematics? Many of the experiences for participants were influenced by race and gender. Common connections to gender and race were made with mathematics, connecting men and masculinity to the subject. Other scholars have frequently identified the heavily masculinized nature of mathematics (Hottinger, 2016; Mendick, 2006). How participants respond to moments of gender and racial bias depended on how they internalized such experiences as normal for them or not. For example, Amanda rejected the gendered norms of mathematics from her childhood as they perpetuated negative experiences for herself. Brittany, on the other hand, continued to implicitly see mathematics as masculine with jokes about different mathematical capabilities between herself and her male spouse. The layers of experience and activity of the participants, influenced by their past and own interests showed a wide array of ways to engage with mathematics and why they chose the activities they did.

Forms of Positive Mathematical Engagement

The mathematical activity that the participants engaged in was extensive and rich, with connections to common family activities and child play. The mathematical skills that were addressed in the participants' engagement with children were aligned with the literature's representation of appropriate early childhood mathematics content (A. Anderson & Anderson,

2018; D. Leyva et al., 2017). Table 5 is an extension of the math activity and skills table shared in Chapter 4 to include what skills participants engaged in and what activity (or context) that skill was related to. The organization of the table is modeled off of a similar set of activities via participants in the work of A. Anderson and Anderson (2018). Another version of this table that includes the skills and contexts of the participants not specifically analyzed for this study (i.e., Kelsey and Stephanie) can be found in Appendix E. Several categories of context are left broad like crafts, play time, and routines because of the layers of complexity within them for a given child and across participants. Crafts refers to activities that involve hands-on action and making/building something that is not related to another defined category (like braiding or blocks/Legos). Play time refers to an activity that involves participants and their children's imaginative play, creating scenarios and stories to shape their time together. Routines relate to activities that need to be done, by the child or by the whole family that have a regular pattern or structure but not related to another defined category (like clean up or getting dressed). This section details the types of activities and some of the participant reasons for engaging in such activity including connections to the interests of their children and their own comfort levels.

Table 5

Math activity and skills

Math skill	Participants	Context
Number recognition	Amanda, Elizabeth, Tara, Brittany, Courtney	Toy cars, walks, crafts, sidewalk chalk, blocks/Legos, play time, board games, pool time, puzzles
Counting	Amanda, Elizabeth, Tara, Brittany, Courtney	Toy cars, walks, books, sandbox, cooking, meal time, crafts, play time,

		sidewalk chalk, braiding, blocks/Legos, music, church activities, clean up, board games, puzzles
Shape recognition	Amanda, Elizabeth, Tara, Brittany, Courtney	Walks, books, meal time, crafts, play time, books, board games, playdough
Sorting/shape attributes	Tara, Brittany	Crafts, play time
Shape properties	Tara, Brittany	Crafts, play time
Quantity comparison	Tara, Courtney	Crafts, books, play time, rock collection
Fractions	Elizabeth, Tara, Brittany	Cooking, baking
Measurement	Amanda, Elizabeth, Tara, Brittany	Cooking, baking, crafts, play time
Estimation	Brittany	Play time
Color	Amanda, Elizabeth, Tara, Brittany, Courtney	Crafts, play time, books, church activities, board games, getting dressed, puzzles
Time	Elizabeth, Brittany, Courtney	Music, play time
Operations (+/-)	Elizabeth, Tara, Brittany, Courtney	Crafts, play time, meal time, board games
One more/one less	Elizabeth	Play time
Spatial terms	Amanda, Elizabeth, Courtney	Play time, walks, books, blocks/Legos, music, cooking, baking, puzzles
Spatial awareness	Amanda, Elizabeth, Brittany, Courtney	Play time, blocks/Legos, sandbox, routines, puzzles, pool time
Patterns/sequences	Amanda, Elizabeth, Tara, Brittany, Courtney	If/then statements, walks, meal time, blocks/Legos, music, books, routines, church activities, play time, getting dressed
Volume	Amanda	Play time, sandbox
Size comparison	Amanda, Tara, Courtney	Walks, crafts, books, playdough
Money	Brittany	Church activities

Participants' Varied Forms of Engagement

The types of activity participants most frequently engaged in with their children was reflective of their interests and experiences as seen in their larger narratives, showcased in Chapter 5. Amanda's mathematical activity with her son Grant focused on the use of language to describe what he was doing, with spatial terms, counting, and colors. She frequently made comparisons to object size and number recognition during their walks. Elizabeth also did much describing of her daughter Talia's actions during play time. Blocks and Legos were a more common activity that Elizabeth's daughters participated in that Elizabeth encouraged with creating patterns and helping count pieces. Tara created both clearly structured and unstructured time that engaged her children with mathematics. The most common structured activities for Tara involved crafting, where the nature of the activity involved math or Tara asking questions about shapes, patterns, or operations. Brittany engaged in mathematics mostly without realizing it in general activities with her children. She often used measurement and estimation when baking with her kids, Bobby and Rosie, and pattern modeling when singing with them. Courtney regularly asked her daughter, Eva, questions about what she was doing and about the world around her that incorporated mathematical thinking. These questions were often about spatial awareness with fit and pattern recognition, in playing with puzzles and Eva's imaginative play. While there was some overlap in the types of activity and mathematical questions of the participants, their contexts were more reflective of their and their children's interests. All of their actions and activity in engagement with their children are valid motherhood tasks, using rich mathematics, even if in different contexts. The variety of activity and their connection to motherhood and mathematics speaks to my perspective of identity and Young's (1994) concept

of identity seriality. What counts within the identities of motherhood, of doing mathematics, is not confined to one set of activities.

One of the most common examples of activity that parents recognized as mathematical often involved counting or measurement, in the context of money or cooking and baking. This models Jay and colleagues' (2018) study that found "most parents referred only to activities involving money and cooking, and so work would be needed to support parents in exploring the mathematics involved in other everyday activity" (p. 11). Most participants brought up stories that involved time in the kitchen with their children as a first instance of how they engaged with mathematics. Tara and Elizabeth shared how they used counting out scoops or ingredients as mathematical. One of Brittany's first shared stories of engaging with mathematics involved money. She shared in their family's attempt to do Sunday school at home,

> this last Sunday my husband did the activity and he made money, but, using the, money that happened in the scriptures [SP: hm] and, gave them each little, he just cut coins out of paper and then we wrote like, there's the spot in the scripture where it talks about, this is 2 of these and this is 4 of these and this and it kind of breaks down their money system and so he wrote that all out for the kids and then he did a little 'ok if you wanted to get candy and it was 1 of your monies, which one would you use' and started to do, essentially it was math activity with them (Brittany, Interview 1).

While Brittany's example is more connected to a family activity led by her husband, it showcases the attention that participants place on what counts as mathematical activity with young children, often relying on contexts that involve money and cooking. With encouragement during the interviews and explicit identification of mathematics activity from the observations, participants recognized more of their actions with children as involving rich mathematical skills.

Reading books and using mathematical language was another common activity across participants. Amanda, Tara, and Elizabeth explicitly talked about reading books that involved counting and shapes using foundational mathematical language with their children while reading. For example, Elizabeth shared how bringing in mathematics was easy with Talia's polka dot book, saying "it's real easy to like count with it because there's the dots to press um for each page" (Debrief 2). Their use of mathematical terms in describing what happens in books and also what their children are doing in an activity (such as finding the biggest stick, pointing out they've made lots of playdough pillows) is supportive of early mathematical associations for children. "By being exposed to words such as bigger, small, six, lots, and shape in the rich context of storybook reading, children were acquiring the vocabulary of mathematics and the associated meanings" (A. Anderson, Anderson, & Shapiro, 2005, p. 21). The use of participants' language to describe situations was not immediately seen as mathematical. However, as A. Anderson and colleagues (2005) indicate, frequent use of such vocabulary is important for building mathematics connections. All participants used some form of mathematical language to describe situations in books or children's imaginative play, whether they recognized it as mathematics or not.

An element of the observation debrief sessions was to point out mathematics that was present in the activity. As the researcher, I often pointed out actions or elements of the activity that were mathematical which participants did not previously recognize as mathematics. For example, when I pointed out the patterns in the vocal call-and-response Brittany did with her children she said: "it's so awesome to hear all these things that I don't, don't think of [laugh] as math" (Debrief 1). With more recognition during debriefs of what may involve mathematics, more activities and contexts came to light for participants. These additional activities were

already part of the participants' family routines but were not initially recognized as mathematical. How the activities shifted in perspective for the participants and shifted views of themselves reflects the identity perspective that how one sees themself can change over time (Cervantes-Soon, 2017). Once further recognition of their activity as mathematical occurred, the examples described by the participants modeled the research of D. Leyva and colleagues (2017) who found that

> common activities through which parents support their children's development of mathematics are playing board games, reading number and shape books, singing number songs, discussing everyday number-related artifacts such as money, calendars and clocks, and engaging with their children in everyday number-related activities such as cooking and shopping (p. 64).

For example, Courtney shared many instances of engaging her daughter Eva in mathematical skills through playing board games, and explained how her mom "is very big...at incorporating the math skills in those games...my grandma, my mom her grandma, is trying to cover everything before she hits preschool" (Interview 2). Part of Courtney's second observation was her playing a board game, Smooshy Mushy Food Factory, that involved counting, number recognition, shape recognition, and color. Across the participants were different examples of mathematical activity aligned with the activities mentioned by D. Leyva and colleagues (2017) including Amanda's reading of shape books and Tara's singing of number songs.

The different ways that the participants engaged in mathematical activity with their children aligns with what past studies have identified as rich mathematical skills for early childhood learning. Sometimes these activities were more formal and structured (such as Tara's

time with her son Peter and work on number facts) and at others it was informally incorporated in their children's play.

> Both formal and informal home experiences are important in children's mathematical development. Activities involving applied aspects of mathematics (e.g., cooking, measuring, sorting) may become relevant to the development of number-related vocabulary knowledge, quantitative awareness abilities, and cognitive development in general (Skwarchuk et al., 2014, p. 80).

What the participants decided to engage in, and how, offered many opportunities for their children to develop mathematical skills, within the contexts of child-directed and family-directed activities. The different backgrounds that shaped what participants chose to engage in reflected what they saw as appropriate for themselves (as mothers) and as mathematical. The variation across that activity reflects their identities in context (Alcoff, 2006), shaped by the different personal and external factors of their lives.

Activities Focused on Children's Interests

The variation of activity across participants involving mathematics often relied on the individual interests of their children. As Courtney indicated in the debrief of the first observation about her daughter Eva:

> I definitely think she, will usually take the lead cause like I think like you saw if she's not interested then there's no, she's not gonna participate [laughs] so I definitely, she takes the lead and then I try to, I guess base my questions around what she's interested in.

Courtney's statement about what she did being based on what Eva wanted to do was common across participants. The types of activities and thus engagement with mathematics was based on what their children were most interested in doing. This theme is also present in A. Anderson and

Anderson's (2014) study of early childhood mathematics activities such that the activities chosen by parents for the study "were mainly those we intuitively associate with children's play (i.e., using stickers to create pictures) and child's at-home participation in family routines (i.e., baking cookies) with minimal examples of school-like activities" (p. 35). A. Anderson and Anderson's observation suggests that parents' engagement with mathematics in context is based on typical at-home activity and play that children are more interested and familiar with (especially for children who have not yet entered school). A. Anderson and Anderson's (2014) point is similar to the argument Alcoff (2006) makes about how external factors shape a person's identity, where in this case children's interest shaped the participants' perspective of what mathematics can look like. The rest of this section shares several of the participants' stories of how they engaged with an activity based on their child's interests.

Amanda's family frequently went on walks with their son Grant, who loved to explore whatever he found in the outdoors. Amanda would often describe to Grant what he was doing or pointing at and his latest interest had turned into a game that involved number recognition:

> [Grant's] favorite thing is to like run up to the mailboxes and like they have the numbers for the house [SP: right] like on the sides of the mailbox and he'll like point to the numbers and we'll say the numbers that he's pointing to. And he just thinks that's hilarious. [both laugh] And he'll find a number that he likes, I think last time it was 4. So he'll keep pointing to the 4s and find more 4s [SP: hm]. Um, so maybe he's kind of getting a feel for what they look like. I mean we live in a pretty uniform subdivision-y type thing and so all the letters on the mailboxes are the same. So it's like all of the 4s are open 4s, um which probably helps him with the recognizing things [SP: yeah] cause it's

> not like, you know different fonts for everything single thing. Uh, he thinks that's a blast (Interview 2).

Amanda continued to point out the numbers on mailboxes and asked Grant to find the same number on other mailboxes on their walks because it was an activity that he enjoyed. Her laughter while sharing this experience indicated her enjoyment of the activity as well. The inclusion of mathematics was not forced as it was the element that Grant wanted to use as part of play that Amanda supported with her questions and playing along with him. Amanda's attention to Grant's interest and incorporation of mathematics is also reflective of different ways parents engage with their children to support whole child development in the literature of Black mothers' parental involvement (Robinson & Werblow, 2012). While Amanda was not sitting down with Grant to complete worksheets or practice math facts, she was encouraging and motivating his learning as part of and integrated into his whole development.

Brittany's son, Bobby, loved to be hands-on and help the family during their church time. Church and singing were important parts of Brittany's life and she encouraged Bobby to be involved. As Brittany described:

> [Bobby] really likes whenever we have church, we have our hymn books and he really likes to find the hymn number himself [SP: hm] um and so talking about like 'ok it's 3 9 7 and so you're in the 1s and you have to get all the way to where the first number is a 3' um 'and then you can look for the 9' um and kind of like having him connect 2 hundred is lower than 3 hundred, even though he can't count all the things (Interview 2).

Finding the right song number in their hymnal became an opportunity for Bobby to work on number recognition and counting. Brittany's encouragement of this activity in her son was also reflective of how she defined herself in her faith and musicality. Brittany's identity was invoked

through her action in attending church, engaging with hymns, as reflective of the elements of my identity framework where cultural context (as an external factor) shapes activity and thus action. From a feminist identity perspective, one's lived experiences shape conceptions of oneself such that what someone does informs who they are (Cervantes-Soon, 2017). This activity was not formally teaching Bobby mathematics, but provided an opportunity for practicing mathematical skills in an important part of Brittany's family life.

Elizabeth and Tara engaged in activities with their children that they were not as interested in but made it something where everyone could participate. Elizabeth shared "I don't really like Legos that well [laughs] … our 7-year-old just really loves them" (Interview 2). To make it more enjoyable for Elizabeth, she incorporated questions and dialogue. Sometimes her questions involved basic mathematical language around the number of blocks and tower height comparison while spending time making rainbow patterns to show her daughters and ask what could come next. Tara's son, Peter, adored doing addition and subtraction facts, which was not Tara's favorite thing to do. Because of her son's love for numbers, Tara incorporated math facts into more craft-directed activities that she enjoyed too. Together they did crafts like painting in watercolors or building in popsicle sticks where Peter enjoyed drawing out expressions and making number patterns.

Activities Focused on Participants' Comfort Level

The types of activities that participants were likely to encourage or engage in more often with their children also related to their own interests and comfort level. Parent selection of activities (when children's interest allows it) is reflected in other studies of parents supporting young children in mathematics. As Cannon and Ginsburg (2008) found:

> the materials and settings that children learn in and from are largely selected by parents. For example, parents choose which toys children play with; which schools, if any, children attend; and whether to teach children specific subject matter at home (p. 239).

This study shows the other thought that goes into parent decisions beyond simply toy selection. The participants made many decisions for their children and their learning. As the last section detailed sometimes the decisions were in relation to their children's interests, this section addresses how sometimes the decisions were in relation to the interests and comfort level of the mothers.

Participants' actions and selections in relation to their own interests also reflected how they interpret their own identities within mathematics to the mathematical interactions with children. How people see themselves and their capabilities shapes what actions and directions they take in their lives (Cervantes-Soon, 2017). As the participants solidified their identities, they acted out what fit within that perspective for them, similar to the process of how "naming creates identity" (Dillard, 2012, p. 36). They made adaptations of what it meant to be a mother and do mathematics based on their context. This is clear across participants in the activities they chose for engagement. For example, Brittany's named identity of a devout follower of her faith and musician led to common activities with her children that centered church and singing. The remainder of this section shares several participant stories that demonstrate the connection between their activity and named identities.

Tara saw herself as a creative person, someone who made things and enjoyed working with her hands. In defining herself, Tara described that she was a 'jack-of-all-trades' (Interview 3). These features of herself were prevalent in her selection of activities with her children that involved many craft projects. In talking about helping her son, Peter, build a birdhouse, Tara said

> I want him to be able to use the tape measure and to measure out how long it needs to be or find the right. My plan is for him to find the right tools so that we can make it together, because my father had instilled that kind of stuff with me. Um, rather than giving him the answers all the time (Interview 2).

Tara's parents and grandmother, but especially her father, taught her the importance of creating things. It was something that Tara defined in herself (a maker, a crafter) and used to interact with her children to support mathematical skills. There was a connection between the identity of a maker and creative person engrained from activity with her parents and grandmother, to how she saw herself, and ultimately chose to engage with her children.

Courtney identified herself as a teacher, both in her profession and in her life. This identity was affirmed by family members and some teachers as well as in Courtney's interactions with her siblings growing up. In this way, Courtney's activity was sometimes more formal or explicit to support mathematical learning in her daughter, Eva. In talking about what mathematical content she covered with Eva, Courtney was explicit in different concepts and what they do to make the most of learning opportunities:

> So I feel like right now it's a lot of, counting. That's just kind of where we're at. She can say her numbers 1 through 20 but she can't associate those with, quantities. So, I'm trying to do some of that too and we use a lot of M&Ms too, don't we sis? {talking to daughter}[laughs] So and I do that for colors and numbers, it's a two-fer (Interview 2).

Courtney's identity as a teacher supported her actions in more explicit teaching to Eva. While Courtney's more intentional teaching and learning was unique across the participants, it modeled how elements of participants' identities impacted their activity with children.

The different experiences and foci of activity across the participants demonstrate the wide array of mathematical skills and contexts that parents engage in to support early learning. The formal and informal, verbal and actionable tasks create a space for children to engage with mathematics in positive ways. The diversity of activity can also be beneficial for future student achievement, as was found in Galindo and Sheldon's (2012) study. As these authors argue, "all of these conceptualizations share the understanding that family involvement is multidimensional, and that researchers cannot use omnibus measures or any single type of involvement to fully understand how families shape children's education and development" (p. 91). Past expectations of parental support in mathematics have often focused on more formal teaching and direct connection with schools, such as homework help and volunteering (Civil & Bernier, 2006; Jay et al., 2018). However, the findings from this study demonstrate the much broader range of action and activity that parents may engage with their children that involve extensive opportunities for different mathematical skills.

Activities and Actions Informed by Past Experience

As an extension of how participants encouraged activity based on their comfort level and self-identification, this section explores how their selection of activities and actions were also informed by their past experiences. Across all participants was a positive intent to best support their children's learning, regardless of their own experiences in mathematics. Tara, for example, wanted to support her children's learning along their interests, stating "I don't know what my kids are gonna be interested in but I'm gonna try to help them as much as I can" (Interview 2). Intentionality in supporting learning is reflected in the literature of parent engagement (Barton et al., 2004). In studies that focus more on the parent perspective, authors argue that parents work hard to support learning but what that looks like is different across families (Posey-Maddox &

Haley-Lock, 2016; Allen & White-Smith, 2018). As such, the different past experiences of the participants inform particular beliefs and actions in working with their children in mathematics. Attention to difference in action and connection with mathematical identities is reflective of the theoretical framework on identity, which is shaped by the personal and external and presents itself in different ways based on the context for different people. The influence of the past on current beliefs reflects Alcoff's (2006) perspective of identity and how the participants move forward to define themselves and carry out particular actions reflects Cervantes-Soon's (2017) perspective of self-authoring identities. The action may align with or diverge from their past experience to create what, in their minds, would be the best case for learning for their children. Table 6 shows the major beliefs and statements made across participants from their shared stories framed from their past experiences. These beliefs and statements were identified through analysis across data sources for each participant with recurring themes in their statements relating their past experience to their present action. Statements have been categorized as major beliefs either contradicting or supporting what they experienced in their past. Recognizing how participant actions were influenced by past events responds to the second research question of this study. The remainder of this section details several stories across participants along the themes in Table 6 that demonstrate how their actions were informed by their past experiences through explicit contradiction or support.

Present Actions/Values Contradicting Past Experience

Each participant had actions with their children that contradicted their own past experience in mathematics. The influence of past activity shaped how the participants saw themselves in the present and what they hoped for their children. When their own experiences were negative, they aimed to change what they could for the better for their children's learning. This connection is

Table 6

Actions contradicting or supporting past experience

Participant	Present actions/values contradicting past	Present actions/values supporting past
Amanda	● Math is not scary, learning can be fun ● Feel empowered to keep learning	● Reading as learning/escape ● It is okay if math is hard
Elizabeth	● Building supportive friendships	● Math happens in school ● Reading as learning/fun ● Building social-emotional skills is important
Tara	● Work to learn, not just get right answer	● Need a math foundation/the basics ● Learning is hands-on (crafts) ● Learning is fun, should be interesting
Brittany	● Be observant of the world around you	● Music and dance as important ● Creativity is key to life
Courtney	● Be your authentic self ● Solve problems in your own way	● Being a teacher, loving learning ● Play, games, and puzzles are fun ● Math and learning happen in the everyday

linked in existing literature, that recognizes the input of parents' actions and decisions. "Parental decisions about their child's education are based on their beliefs, life contexts, and invitations from the school as well as their own desires for their children" (Ule, et al., 2015, p. 333). Moments of contradiction in current action and past experience were identified from comparing decisions, beliefs, and desires with their children to what they described about their own experience growing up. Sometimes the change in action was related to what they had seen or

been told by family members or by other teachers. In other moments, the changes related to what they learned later in life about different perspectives or opportunities for learning.

Amanda had the highest quantity of examples of her current action contradicting her past experience. In many ways she was explicit in how she wanted different things for her son, Grant, and her soon-to-be born daughter. Amanda's past experience centered around seeing mathematics as not for her, as something she struggled with and did not enjoy. When possible, she avoided it. Given her reflections on how that negatively impacted her early learning, she hoped for a different experience for her own children, not seeing mathematics as scary:

> I hope like at the very least that he thinks of like numbers and counting and stuff as like fun, from it. As like these are enjoyable things to do. Not like math is scary, numbers are scary, but like these are things that I do when I play. Um, and if that's all he gets out if, I'm fine with that too…cause I was scared of math when I was a kid. Um, and I would think that stuff was intimidating and I never correlated, like nothing math related as being fun. Um, so if he, if he thinks it's fun because these are things we do while we play and it's like a no pressure situation and like I don't care if he does it correctly or not [SP: mhm] hopefully that's something that will, like imprint early on him. That like these can be enjoyable playtime things and not like, scary school things (Debrief 2).

Amanda had engrained in herself through the example of her mother and her mathematics teachers that mathematics was not enjoyable, something intimidating that she would avoid. She shared that "growing up I never thought I was good at math...I felt like I was always playing catch up in math...like I couldn't do it at the pace that it was taught" (Interview 1). However, she wanted something different for her son. Her play time incorporated mathematics to show Grant that it could be fun. She wanted him to see by the time he started school that learning,

mathematics, and school did not need to be scary things. Amanda worked to self-author (Cervantes-Soon, 2017) a new perspective of herself and her capability in mathematics to best support her children and work against the expectations and experiences of the past that made her frame mathematics as not for her. Amanda's actions and change from her own experiences and attitude towards mathematics reflects previous studies that have shown what matters in children's early learning is not parent mathematical ability but their attitude and action (Blevins-Knabe et al., 2007).

Brittany and Courtney also shared explicit moments of using different activities from their own experiences in mathematics. Brittany expressed similar sentiments to Amanda, in wanting her children to do better than she did in mathematics. In talking about her son, Bobby, Brittany said "I want him to be better at that than me, I'm not very observant and I'm not super…good spatially" (Interview 2). To handle this difference, Brittany talked about how she encouraged Bobby to engage with activities and play that consider space and his location, asking questions about where items are and how to find them. Courtney's common contradiction with her past experience related more to how her past teachers treated mathematics. Courtney reflected the importance of

> just having the mindset that you can solve a math problem many different ways and it, frustrates me when other teachers who don't see that or they feel like it has to be solved a particular way whereas my thinking is with my students, if you can show me how you got there, then I'm good (Interview 2).

Courtney thus encouraged her daughter, Eva, as well as other students she worked with, to figure out mathematical tasks in whatever way made sense to them. This narrative reflected Courtney's belief about learning and solving problems in one's own way. In these instances shared by

Brittany and Courtney was a specific change in how they engaged in activity with their children to offer something better than what they had growing up, whether it was based in their own feelings about mathematical ability or of how others stated the subject should be. The change in their activity based on their past experience is also reflective of Cervantes-Soon's (2017) concept of self-authoring identity as the participants defined themselves in new ways, in this case to support the best outcome for their children, for their students.

Present Actions/Values Supporting Past Experience

Just as each participant had experiences from their past that they contradicted in their current actions, each participant also had positive past experiences that they used to support their current activity. The pieces of good and bad experiences that shaped diverse and changing actions reflects the perspective of identity for this study, such that how the participants see themselves and their actions with their children is multiple and changing over time (Cervantes-Soon, 2017; Eakin, 1999; Young, 1994). As Kondo (1990) states, how people see themselves and thus act out their lives is "negotiated, open, shifting, ambiguous, the result of culturally available meanings and the open-ended, power-laden enactments of those meanings in everyday situations" (p. 24). Participants thus took their experiences, the good and the bad, to spin into what they hoped would be the best for their children in terms of their mathematics learning. Similar to identifying the moments of contradiction, the actions of support were found from comparing how the actions the participants engaged with their children today with how they talked about their past experience in mathematics.

Courtney provided the highest quantity of actions and activity that supported her own positive experiences in mathematics. Her support particularly from family members that encouraged her as a teacher and a capable mathematician provided confidence in her continuing

role as a teacher today and enjoyment in everyday mathematics tasks. In sharing why she did so many puzzles with her daughter, Eva, Courtney stated:

> I think that goes all the way back to my grandma loves puzzles. I remember going to her house when I was in elementary school and doing puzzles. Um and like spending the night at her house and she had a always had a puzzle on the card table that she was working on and we could always jump in and do it. And that was my mom's mom. And I think that has been kind of engrained in her since she was a kid. And so I love puzzles um, my mom buys her puzzles or if we get puzzles as part of a like Happy Meal or whatever like she always has a puzzle with her in her book back in my bookbag in the car, like there's always something that she can do (Interview 2).

Courtney was supported in a love of puzzles by her mom and grandma, where the tradition continued with her daughter. It was also clear the relevance of the activity into the present with the smooth storytelling Courtney offered, without extensive pauses (indicated by commas and ellipses) or repeated filler words (e.g. um, uh, and like) which in other stories indicate a less clear or remembered story. Courtney's second observation started with working on puzzles, selected by Eva, and asking mathematics-oriented questions about color, patterns, and spatial awareness. While previous literature has often focused on the negative and intergenerational impact of parental experiences through anxiety on children (Maloney et al., 2015), Courtney's experience showed the positive counterpoint, influenced by her mother and grandmother to enjoy mathematics and encourage the same in her daughter. Courtney developed a strong mathematical and teacher-focused identity from the social experiences she had with her family members and teachers that positioned her as mathematically capable. The positive experience of working on

puzzles for Courtney became something that she actively chose to do with her daughter, while providing opportunities for mathematics learning.

Elizabeth and Tara also shared details of their past that shaped their current interaction, but that fit more into their broader interests and backgrounds. Tara described how she was more likely to select math-oriented activities because both her and her husband had schooling backgrounds in more mathematics-heavy subjects (meteorology and engineering, respectively). This seems to have shaped Tara's perspective of building a strong mathematics foundation in her children. Tara connected her actions to her own experience and her son, Peter's interests, saying "I feel like my kids will definitely learn more math because of our background and my son is like seriously interested and into it, like more than anyone any other kid I've ever met at his age" (Interview 1). Elizabeth shared how much she loved reading growing up and connecting with relationships and emotional well-being. One of Elizabeth's most common and preferred activities with her children involved reading books, where she said "I really like books that teach social-emotional skills. So I would tend to choose books that talk about feelings" (Debrief 2). This reflected Elizabeth's major belief statements of reading as fun and a desire to learn through social-emotional skills. While such content was not as explicitly mathematical as if Elizabeth chose counting, shape, or color books to read, they provided a space for Elizabeth to engage in material from her childhood that was comfortable and built her confidence. As Elizabeth showed in her second observation, reading such books to her youngest, Talia, there were still opportunities to engage with mathematics, most often through use of spatial terms in describing features or characters in the books she read.

How participants acted on their experiences in mathematics was based on how they perceived those experiences, not on their own mathematical knowledge or ability. As Blevins-

Knabe and colleagues (2007) claim from their study of the impact of mothers on their children's mathematical performance, it is more about parent behavior and attitude towards mathematics than their own knowledge. This was true for the participants of this study, where the mothers took up their own positive experiences while reshaping the negatives to create new activities and mathematical engagement for their children. The mothers established desires and expectations for their children based on what they experienced growing up. Their desires for their children were tied to their own identities as mothers and mathematical knowers, shaped by their past experience, as the context (Alcoff, 2006) and how they wished to change that perspective for the better, and as a form of self-authoring (Cervantes-Soon, 2017). The experience of a parents' past influencing their decisions for their children is also reflected in Moffatt and colleagues' (2009) work on parents' perspectives of their preschooler's mathematical ability. They argue that "there is every possibility that these parents' expectations for their children are deeply embedded in their ideas of themselves and their children as 'classed' and 'raced' people and their ideas of mathematics as an elite or culturally specific activity" (Moffatt, Anderson, Anderson, & Shapiro, 2009, p. 21). This section spoke more broadly of how the participants' past and thus beliefs shaped their activity. The following section extends on elements of the claim by Moffatt and colleagues by looking at the influence of racialized and gendered experiences on the participants' mathematical activity.

Gendered and Racialized Experiences

Many of the experiences within mathematics that participants shared were characterized by gendered and racialized expectations (as women, as mothers, and within mathematics). These types of experiences were expected given the literature in mathematics education and motherhood expectations that show how masculinity (as present in men) and whiteness are

privileged in these areas, respectively (Hottinger, 2016; Dillaway & Pare, 2008). The environment of mathematics has established over time a form of elitism that promotes a subset of people as more inclined to mathematical ability, which often aligns with men and whiteness (Douglas & Attewell, 2017). Within motherhood are the expectations that women must be mothers and the ones that take care of children as opposed to men and fathers (Odenweller & Rittenour, 2017). In addition to the constraints of gender in motherhood is an underlying assumption of race that privileges white mothers as doing good mothering (Morgan, 2018). In Gholson and Martin's (2014) study of identity formation at the intersection of race and gender for two Black girls, they suggest "that race and gender are ever-present and operate within the classroom's social world organizing relationships and, consequently, access to learning" (p. 31). Gholson and Martin's perspective here is relevant as well to the experiences of the participants growing up, interacting with gendered and racialized expectations of their behavior in mathematics in the classroom and extends beyond into the socialized expectations of motherhood. While I focus more on the individual experiences and their significance for participants, Chapter 7 expands these experiences and others to consider their location within broader structural systems of expectations, or matrices of domination (P. H. Collins, 2000). This section details the racialized and gendered experiences of participants that relate to their experiences and expectations within motherhood and mathematics.

Gendered Experiences

Gendered experiences for participants were present in how they talked about mathematics in school, their interpretations of their own mathematics ability, and assumptions about motherhood roles. Most of the participants assumed primary responsibility for raising their children as part of an expectation of motherhood. This aligns with existing literature, where a

common expectation is for women and mothers to do the work of child care and mothering (Arendell, 2000). These expectations form the external societal factors of what counts as a mother identity and what mothering must look like, aligning with the concept from the theoretical framework that identity is shaped by context (Alcoff, 2006), both external and internal influences. How the participants diverge from these expectations is a reshaping of that identity, showing an array or seriality (Young, 1994) to what motherhood can look like. With regards to mathematics was a general recognition that mathematics is heavily gendered to privilege men. What differed in this area was how participants were supported (or not) to see themselves as personally capable mathematicians. For instance, Courtney shared about working in retail when coworkers had math related questions that "people will come to me and ask me the answer… it gives me a sense of pride and I, it's something that I can do, well and I understand it" (Interview 1). Mendick (2006) stresses how the divide of men and women, masculinity and femininity, has maintained the assumption around mathematics as for men and not for women, arguing "that the sociocultural constitution of gender as oppositional, and the connection of this to the series of binary relations through which maths is constructed, makes it more difficult for girls and women to identify as 'good at maths'" (p. 46). Amanda saw this in her own schooling, sharing that she "did have that unconscious bias that like, it was okay for girls to be bad at math" (Interview 3). This subsection details several stories where gender played a role in the participants' experiences, within motherhood and mathematics.

With the exception of Tara, all participants talked about their mothers helping them with schoolwork and learning, whether this was doing well in mathematics or not. The commonality of their mothers doing this work is further reflected in the literature of expectations of mothers in raising and teaching children (Odenweller & Rittenour, 2017; Wittig, 1992). Brittany accounted

why her mother was the one in charge of homework help in general, but also more specifically mathematics. She shared,

> Mom was the one who helped us with math...So my dad does graphic design, that's his company and we're all fairly artistic. My mom graduated in business finance and she runs that side of the company. she would always help us with math (Interview 1).

While Brittany's comments helped justify for her why her mom helped with mathematics, other stories indicated how her mother helped all the kids with their school-work, further indicating an assumption of mothers doing the work of raising children. Across participants was a theme of their own mothers supporting early learning, which likely influenced their perspectives today and common beliefs that they should be in charge of supporting early child care and learning.

Given the nature of the study and the shared stories of the participants, there were more instances of gendered experiences as connected to mathematics. Elizabeth, Tara, and Brittany all spoke about how their male partners were better at mathematics and likely better at engaging their children with the content. These statements linking male partners over themselves (who identified as women) as more mathematically capable reflect common and persistent representations of mathematics as masculine and mathematicians as men (Hottinger, 2016). Elizabeth talked about her partner incorporating mathematics more easily into interactions with their children based on their own strengths and interests. She shared that her husband

> is better at incorporating learning into playing than I am, generally. Um, if I'm playing, I'm less likely to, teach about math and more about like social emotional like the 2 dolls are fighting and how will they work it out (Interview 2).

Elizabeth did not see herself as mathematically-capable as her husband at this stage of the study. As such she positioned herself as less likely to engage with mathematics. The assigning of

participants' male partners a higher understanding in mathematics was not a marker of actual mathematics ability. Similar remarks to Elizabeth were also made by Tara, even though Tara had an extensive background in mathematics through her meteorology work and had previously discussed her strengths in college working through the subject. In talking about mathematical activity with her son, Peter, Tara remarked that "he prefers to do everything with me. But I think that he learns the most with my husband" (Interview 2). These instances show a continued influence of the expectations of mathematics that privileges men (and masculinity). The expectation of mathematics as masculine and how the participants separated themselves from being as mathematical as their partners highlights how gender binaries perpetuate the masculine norms of mathematics. Masculinity is associated with men and femininity associated with women, defined as opposites (Wittig, 1992).

While the experiences of Elizabeth, Tara, and Brittany represent the present impact of gender expectations in mathematics, Amanda and Courtney shared stories relating to past influence and future hopes for their children. Stories of experience with gender produced particular challenges for Amanda in her past as a student. In returning to reflect on her past struggle with mathematics after discussing the rich mathematics she engaged in with her son, Grant, Amanda shared:

> I also feel like, he's a boy so a lot of that subconscious sort of like, girls are bad at math is something that he's just never gonna experience, sort of thing. Um…the daughter I'll be having in, the beginning of June, is a girl [SP: right, {name of future daughter} right?] So I feel like she might be more at risk of that. But I feel like, you know, even in all the boy books, the like "boy" uh books and like boy TV shows like, they…like have more like numbers and they have a bunch of counting and they have a bunch of like, you

> know? It's, it's just part of it? And maybe I just don't watch enough girl shows [both laugh] like stereotypical girl shows. But like, I don't know if that's the same. And maybe like, it's ok now? And things are better? Um…or maybe they're just like counting different things, like maybe the stereotypical girl show is counting teacups and the boy show is counting car jumps. Um, but like I don't know. Um, I feel like he gets exposed a lot to that sort of stuff and it's not…necessarily viewed as a negative thing. And again, I could be interpreting it from my own upbringing where like, math wasn't a traditionally girl, stereotypical thing [SP: hm] um and it was okay for girls to just say they were bad at math. Um, and that was the impression I was given and I, like don't want that impression to be given to my kids, in general (Debrief 2).

Notice in Amanda's narrative the frequent use of questions and pauses, which function to show the discomfort she had in her experiences that showed mathematics as not for girls and her hesitancy in knowing that things are better now to support her daughter as a future mathematics learner. As an adult, Amanda recognized how her experiences were influenced by expectations of what girls should do and that did not include mathematics. Amanda's perspective of who could be mathematical and how she viewed herself had shifted over time, as in school she was influenced by external factors shaping how she saw herself (Alcoff, 2006) that saw girls as not mathematical to the present, where she later defined herself (Cervantes-Soon, 2017) in divergent ways from societal expectations that she could do mathematics. In many ways the media upholds a distinction between what boys and girls can or should do, placing mathematics into what is appropriate for boys (Mendick, 2005). Amanda saw that perhaps the influence of girls not doing mathematics may still be present but she aimed for something different for her kids.

Examples from Courtney's experience involving gender and mathematics demonstrate what is possible with direct attention and with women as role models in mathematics. Courtney recognized this from her own experience and support growing up as well as how this would be similar for her daughter, Eva. In talking about gendered experiences, Courtney said:

> I feel like gender wise though she kinda has a leg up because she is in the same situation that I was kind of in while I was growing up where she has lots of aunts, not very many uncles [laughs] um and uh her grandpa is very involved with her um, but she's surrounded by strong women who voice their opinions and are not scared to say what they think and I think that's already kinda rubbed off on her [laughs] (Interview 3).

Courtney was surrounded by her mother, grandmother, and aunts who encouraged her teaching and recognized her mathematics ability that ultimately supported Courtney in seeing herself as a math person. These benefits were also present for Courtney's daughter, who had a mother, grandmother, and aunts who enjoyed mathematics and hoped to encourage Eva in her mathematical activity. Courtney's story is reflective of changes to persistent narratives around mathematics as predominantly masculine as she was encouraged and saw representation of positive mathematics from other women in her family. What occurred here for Courtney is proposed by Mendick (2006) as the necessary change within mathematics education, by "making a wider range of discursive positionings/stories open to a wider range of individuals" (p. 103). That is to say, to support more people in seeing themselves as mathematically capable, as experienced by Courtney, would require a recognition of other individuals and legitimizing of other experiences as mathematical.

Racialized Experiences

The racialized experiences of participants demonstrate the influence and assumptions around motherhood and mathematics that most frequently supports whiteness. Dillaway and Pare (2008) and Roberts (1993) have shown that in our more current times and historically the norms of motherhood in the United States is based in white, middle-class ideals. Similarly, mathematics privileges the norms of middle-class white men and their ability in the subject over others (Rousseau Anderson & Tate, 2016). The assumptions of race in motherhood and mathematics has implications not only for the participants of color, or had children of color, but also characterizes the privileges that are more often afforded to the participants who are white or who have white children. For example, neither Elizabeth nor Brittany made any direct mention or discussion about their race, both of whom presented as white. Elizabeth only talked about race in relation to the racial diversity and empowerment of her daughter Talia, who was Hispanic. Using P. H. Collins' (2000) concept of matrices of domination, Elizabeth and Brittany's silence on race except in relation to children of color highlights the expectation that motherhood norms align with whiteness. The experiences of mothers like Elizabeth and Brittany are thus normalized, where the experiences of mothers of color can often be silenced (Dotson, 2011). This subsection will detail several stories from participants of their racialized experiences, within the context of society's expectations for them that either privileged or challenged their position in motherhood and mathematics.

As a white-presenting woman, Elizabeth's role as a mother in U.S. society was privileged because of that whiteness (Oka, 2016; Morgan, 2018). It was not until she adopted her youngest, Talia, that she intentionally considered the impact of race in her mothering. This was perhaps

because her oldest was also white-presenting, where her youngest was Hispanic. As Elizabeth reflected back on our past interviews and observations, she said

> we talked a little bit about the, um, racial diversity, and that certainly is because of adoption. Um, I think, I would've probably talked about it with kids otherwise, but because {my youngest} is part-Hispanic um, I'm a lot more intentional and um…uh, proactive, about that piece (Interview 3).

Elizabeth's attention to race was for the sake of her daughter, while recognizing to some degree that many things in this world did not represent or empower Hispanic children. Elizabeth's own experience privileged her whiteness, where discussions of race and specific concern for her own empowerment due to skin color did not need to occur. Elizabeth's presence and experience aligned her identity with societal expectations (Alcoff, 2006), particular contexts of whiteness, of motherhood; she was a white woman who stayed at home with her children. However, her care for her daughter and acknowledgement of the impact of race and skin color had Elizabeth paying close attention to the overwhelming whiteness of children's material, such as her recognition of primarily white characters in children's books and the mostly white-washing of characters in Disney movies until recently.

Tara had similar experiences to Elizabeth with children of color, but brought up her concerns around wanting her children to connect to their Korean heritage. Tara brought up her German heritage and how she hoped her son, Peter who had cultural roots in Germany and Korea, connected to his background. She shared that

> it's one thing that I want to continue to have um, have a better understanding of, but the funny thing is I want him to understand his Korean culture more so than like my German culture I could care less. But like I want him to learn Korean, I want him to understand

> where he comes from because he's half Korean and I'm half German but for some reason that doesn't matter to me as much [laughs] (Interview 3).

Tara was most concerned with her son connecting to his Korean roots and culture, going on to describe the incorporation of Korean foods, holidays, and books into their everyday life, while also spending time with their hal-abeoji and halmeoni (grandpa and grandma) who lived nearby. Tara's claims about being less worried that her children connected to their German side may be in part because of how European heritage is more closely associated with whiteness, where such cultural elements were more privileged in the United States than the Korean features of her children.

A lack of racial representation and recognition in mathematics frame the examples of experiences of participants that connected race to their mathematical schooling experience. The mathematics classrooms and schooling experiences privileged whiteness and maleness (Hottinger, 2016) that did not leave space for Amanda (a Native American woman) and Courtney (a Black woman) to be as clearly recognized or represented in formal schooling spaces as the other participants. For Courtney, she represented one of only three Black people in her grade, encountering at least one teacher who made assumptions about her ability in relation to her Blackness. For Amanda, she found teachers made assumptions about her appearance that erased her identity as a Native American, saying

> I didn't feel like um, the more like white normative school stereotypical experience really kind of understood. Um. . . or expected, like cause they'd look at me and see one thing and make assumptions. Um, not to like fault them or say they were bad teachers or anything like that it's just that's the population they worked with 98% of the time and that's the assumptions they could make about things (Interview 1).

Whiteness was again privileged in Amanda's experience because of the assumptions teachers made that Amanda was white. The limited options of representation shown by Amanda and Courtney are made clear in D. B. Martin's (2006) study of parents with African American children and their experiences with mathematics. Mathematics schooling showed highly racialized assumptions about who could be included in mathematics. D. B. Martin found that for the boys of his participants, "because of stereotypes and presumptions about who can and cannot do mathematics, many of these young men are often overlooked by society as potential scientists, engineers, and mathematicians, and their potential status as role models in mathematics is diminished" (p. 214). D. B. Martin's point translates to the assumptions and limitations placed on Amanda and Courtney, that assume whiteness or were lacking in representation. They experienced a form of otherness or lack of representation by race, more broadly in schooling and also within school mathematics. P. H. Collins' (2000) matrices of domination highlight the assumptions of whiteness present in mathematics and motherhood and what this means as well in conversation of other features of Amanda's and Courtney's identities, such as the silencing of their perspectives as women of color, but privileging of their cis-gender identifications within motherhood.

The mathematical actions of the participants with their children, as influenced by the desires of their children, their past, and gendered and racialized experiences demonstrate the diversity with which participants think about themselves and choose to engage with mathematics. What creates limitations are the expectations of what counts as mathematics and appropriate mothering activity within U.S. society. These limited expectations are clear across the literature that continues to support a gender binary that separates the roles and actions of women with childcare and men with wage-earning (e.g., Rothausen-Vange, 2004). In

mathematics, the limited expectations highlight a privileging of the perspective of whiteness and masculinity (Esmonde, 2011; Hottinger, 2016). Back in 2000, Arendell captured this issue of a diverse parent population in the United States and its lack of recognition in their varied activity:

> Not only is American society increasingly diverse, but the experiences and perceptions of minority women—as legitimate and valuable in their own right and not as measures by which White, heterosexual, middle-class mothering is reified—have been given too little attention (p. 1201).

The stories of the participants here contribute to the needed attention to diverse mothers' actions in raising children and also in engaging meaningfully with mathematics. As has been shown in this part of the findings, the mothers' activity is richer and more varied than such expectations would have someone believe.

The findings from this chapter show the different influences that impact how the participants see themselves in the roles of motherhood and the world of mathematics, which in turn informs their activity with children. Layers of context shape the participants' stories of experiences in school and with adults, coupled with societal expectations about what counts as mathematics and motherhood and where they fit in with regards to race and gender. The attention to the different stories the participants shared helps create an understanding of their world. As reflected by Goodson (2013), "our understanding of the world [is] constructed and mediated through the stories we share with each other" (p. 3). Hearing the stories of the different participants and the themes that they return to over and over again tell more about the common threads of expectations in our society, as shaped through the perspectives of the participants. However, little work has been done focusing on the intent and reasoning behind parents' actions for mathematical engagement. As Sheldon and Epstein (2005) argue, most research does not

focus on the connections between schools and families in reform but instead on what happens in schools. Focusing on the stories of the participants and the connections between their experiences and actions provides detail on why parents do what they do with mathematics, that is not explored in the existing literature.

Chapter 7: Understanding Experience within Societal Structures

The participants' stories show a common thread that recognizes institutional whiteness and gendered binaries, present in mathematics and motherhood. The privileging of whiteness and rigid gender binaries is reflected in the use of P. H. Collins' (2000) matrices of domination and the continued expectation that separates masculinity from femininity (Paechter, 2006; Wittig, 1992). The stories of the participants demonstrate a trend in U.S. society's expectations for mothers and for mathematics education that shapes how people see themselves within or outside of these limited norms. This chapter extends the experiences of the participants to consider the influence of societal structures. As Jay and colleagues (2018) argue, "further research is needed to explore parents' and families' understandings of 'what counts' as mathematics thinking and learning and how this affects out-of-school learning in other cultural settings" (p. 4). Considering 'what counts' not only in mathematics but also in motherhood helps frame why participants made the decisions they did based on the expectations placed on them and their children.

What shapes participants' interactions with their children in mathematics was not confined to their past experiences with their families and mathematics. Their interpretations of themselves as mothers and their work within mathematics was shaped by larger societal structures of what it meant to be mothers and what it meant to do mathematics. Such expectations create layers of what should be done, what counts as mothering, and what counts as mathematics within gender and racial norms and aligns with P. H. Collins' (2000) matrices of domination. P. H. Collins (2000) defines matrices of domination as how different layers of oppression are organized, such that "regardless of the particular intersections involved, structural, disciplinary, hegemonic, and interpersonal domains of power reappear across quite different forms of oppression" (p. 21). The stories of the participants show how expectations of

motherhood shaped how they were expected to act within a particular gender and race in their parenting. At the same time expectations of mathematics shaped how participants may not fit into what counts as a mathematician given the norms of the subject that privilege whiteness and masculinity (Hottinger, 2016). For example, in talking about the mathematical patterns in Brittany's singing she said, "I feel like maybe somebody else [laughs] could find some math in singing songs with the piano but I don't really, I can't think of what math is involved" (Interview 2). Together, the expectations of their behavior as mothers and interacting with mathematics at a societal level informed their perceptions of themselves and their activity.

Given the layers of societal expectations that are influenced by gender and race of motherhood and mathematics, I analyze several stories across the participants within the frame of these expectations. I use P. H. Collins' (2000) matrices of domination as an analytical tool to draw specific attention to intersecting expectations within gender and race for participants. I also consider the impact of silenced perspectives, as related to Dotson's (2011) concept of epistemic violence, or assumptions of motherhood and mathematics within societal expectations of who mothers and mathematicians should be. I parallel the sections of Chapter 6 to address the research questions to consider structural influences. The first section on what counts as mathematics responds to the structural implications of the research question, how are mothers positively engaging with their children and mathematics? The second section on what counts as acceptable motherhood responds collectively to the questions of how mothers are engaged with their children and mathematics and how do mothers' previous experiences influence their engagement? The final section on the current privileging of whiteness and gender binaries in mathematics and motherhood responds to the research question of how participants' engagement and past experience is gendered and racialized. Overall, these elements demonstrate the types of

mathematical activity participants engaged in with their children and why, based on their own experiences, and perceptions of self, within societal structures.

Forms of Positive Mathematical Engagement (What Counts as Math)

Identifying mathematical activity from the perspective of the participants in their past and their current activity with children relied on what participants themselves saw as mathematical. Often, what was accepted as mathematics was informed by societal expectations of what counts as mathematical. In Moffatt and colleagues' (2009) study of parents interacting with their children differently based on gender, they found that "what you know about mathematics and what counts as mathematical knowledge depends greatly on when, where, and with whom you live and learn" (p. 5). In their study of different parent constructions of their children's ability in mathematics, the authors found how these constructions are shaped by the context of their worlds, their own experiences, and the expectations placed on mathematics. The influence of context and what counts as mathematics, as defined by parents, school systems, and media also informed how the participants of the current study interpreted their own actions as mathematical or not.

Across participants in the initial interviews was often a very limited acceptance of what they did with their young children as mathematical, trying to clarify that such activities would not really count as mathematics because it was too simple or not directly related to school mathematics. Elizabeth talked about playing with toy horses with her youngest and counting them, but said the focus was on "just the getting the vocabulary out there. I don't think I've ever thought of it as teaching or math" (Interview 2). On the other hand, Tara made statements about what counts as mathematics, particularly in school, stating "it's either true or false and with math

that's just the case" (Interview 2). These instances reflect what the participants recognized as mathematical or not, often discrediting their own activity.

The interpretations of participants at the beginning of the study here does not mean mathematics did not occur (as Chapter 6 has shown the rich and varied mathematical skills they engaged in). The issue lies instead with a limited understanding of what can be mathematical. From the design of the study itself was an opportunity to identify mathematical activity in the observation, from the perspective of the participant and the researcher, during the debrief session. After participants exhausted what they saw as mathematical in their actions, I highlighted additional skills and contexts that contained mathematical learning, often surprising participants that such everyday activity counted as mathematics. As Esmonde and colleagues (2013) argue in their study of families engaging with mathematics, "if we broaden our examination of people's experiences to include experiences with mathematics outside of school, then we might find a broader set of possible stories" (p. 12). The rest of this section shows the heavy influence of schooling and societal expectations of mathematics that initially limited participants' interpretations of what activity counts as mathematical. As I draw attention to the impact schooling has on shaping particular expectations around what mathematics should be, it becomes clear how limited these expectations are within the rich landscape of possible activity that participants have shown in Chapter 6.

When talking about mathematics from their past, participants shared a number of expectations that became part of their understanding of mathematics because of the norms of the subject within school. Themes of mathematical expectations across were that you must do (mental) mathematics quickly, that it is done independently, and that each problem had one correct way of being done. Amanda, Elizabeth, and Courtney shared stories (with different

feelings) about mathematics moving fast, either in the expectations of learning or solving problems. Amanda shared that she was

> so nervous about doing [the problems] fast enough that that's all I could think about and I never felt like I did well on them. And so I thought that because of that, that was part of the reason I wasn't good at math (Interview 1).

She associated the expectation of speed and her lack of ability to move that quickly through solving to mean she was not good in mathematics. Amanda's example demonstrates the influence of a schooling context to shape how she understood her mathematical identity (Alcoff, 2006). Elizabeth talked about the stress of needing to work independently on mathematics, as a sign of your smartness compared to other students, sharing "when you're not working together to solve a problem or working like at home like how do you do this homework you're just by yourself because you're trying to do the best you can to get the best grade to beat other kids you know" (Interview 1). Elizabeth recognized the change in mathematical expectation in later grades that wanted students to work more independently, and this became a stressful and challenging point for her in working through mathematics. By college it had developed into an understanding that she should work independently and not seek out help to make sense of the content. The stories shared by Amanda and Elizabeth demonstrate the personal challenges they had with school mathematics that expected them to work quickly and independently. However, the distinction in how others perceived them and their mathematical abilities at a young age is reflective of assumptions of who counts as mathematical along racial lines, which matrices of domination highlight. While Elizabeth and Amanda both struggled with the stress, speed, and independence of mathematical work, they were viewed differently by others. Amanda heard

from her mother and assumptions of teachers that she was not doing well mathematically, whereas with Elizabeth's struggles she heard from teachers that she would eventually 'get it.'

The expectation of solving a mathematics problem just one way came up in the stories shared by Amanda, Tara, and Courtney. In school they recognized moments where teachers wanted them to solve something in a way that did not make sense to them, refusing to allow alternative methods. In Courtney's role as a teacher and tutor for middle school students, she pushed the hardest against this expectation that continued to perpetuate in school systems. Courtney shared that she had

> gotten into arguments with some of my kids' teachers about it because they're very much like 'they need to do it this way this is the only way to do it' and I tell them like 'when you're grown like nobody's gonna grade your papers based on your work,' but if you understand how you get there, then [laughs] sometimes you just gotta make it through this class and next year might be completely different for you (Interview 1).

Courtney's stance begins to challenge one of the prevailing expectations of what mathematics should be and how it should be done. Challenging these expectations of what counts as mathematics is also reflected in Takeuchi's (2018) study of the first and necessary step to broadening opportunities for mathematical learning. As Takeuchi studies immigrant parents and their negotiation of legitimate mathematical learning, they argue "the significance of interrogating the assumption that mathematics is a pure mental activity, in order to enhance opportunities to learn for students who embody specific cultural tools" (p. 51). The expectations the participants have seen placed on mathematics from their own schooling experience shaped how they saw mathematics in the present, but challenging those expectations and showing the

extent of varied mathematics that already happens in their lives created opportunity to broaden their understanding of what can count as mathematics.

As an extension of associating what counts as mathematics to the expectations of the subject in school was a common practice. Elizabeth and Brittany often diminished their activity as not mathematical because it did not fit expectations of numerical calculations or number work that aligned with school mathematics. In talking about what she did with her youngest, Talia, while describing shapes, numbers, and patterns in books, Elizabeth shared that "when I say those things and point out...things it's more about, just the getting the vocabulary out there. I don't think I've ever thought of it as teaching or math" (Interview 2). While A. Anderson and colleagues (2005) have described in their work the significance of vocabulary and introduction of terms for young children's mathematical learning, this did not align with Elizabeth's perspectives of what counts as mathematical. Elizabeth separated herself and the activity from mathematics, setting up a continued binary separation that aligned masculinity and mathematics together (Hottinger, 2016) and femininity and herself as separate (Paechter, 2006). Brittany's initial hesitancy with recognizing some of her activity as mathematical related to her modeling mathematics without explicitly teaching or talking about the mathematics. In talking about being in the kitchen together, Brittany shared:

> when I have both of the kids helping me I will start breaking things down into 3...if there's a...tablespoon or something I'll do 3 teaspoons so we can each put one in because they like to take turns putting things in, so it's not necessarily telling them the math...but they do help with cooking (Interview 2).

The pauses in Brittany's narrative (marked by ellipses) occurred after direct mention of elements that could be mathematical, indicating some hesitancy in what Brittany understands would count

as mathematics. While Brittany's actions were not explicit mathematics teaching or even use of mathematical vocabulary, she was modeling mathematical tasks and engaging her children with sharing and fairness. Modeling mathematical activity is shown to have a meaningful benefit for early childhood development (Skwarchuk et al., 2014). Elizabeth and Brittany's downplaying of their own activity as mathematical was similar to the results of Jay and colleagues' (2018) study of families, such that "it is not clear that parents always recognize the potential of these forms of home activity for children's mathematical learning" (p. 4). The disconnect in Elizabeth and Brittany's mathematical actions and their recognition of their actions as mathematical is common in studies of other families that see very limited forms of what counts as mathematics. The disconnect also highlights the silencing of more diverse perspectives of mathematical engagement that people will engage in. Their work as parents teaching children mathematics is not recognized as legitimate, such as when a society fails to recognize a person, a mother, as a (mathematical) knower (Dotson, 2011). As the participants have shown in their actions and understanding of what counts as mathematical, the expectations of what mathematics should be, as established in schools, can have repercussions into adulthood.

Activities and Actions Informed by Past Experience (Motherhood Expectations)

What counts as mathematics was informed by participants' past and shaped their present action. Another element that showed the influence of societal expectations from past experiences is motherhood expectations in the United States that shaped how the participants felt about their own activity and what they were expected to do as mothers. P. H. Collins (2000) highlights the societal expectation that womanhood is associated with motherhood, indicating through the lens of matrices of domination the undercurrents of gendered expectations within the role of motherhood. Almost all participants shared how their mothers did most or all of the work in

raising them or supporting their learning, shaping an expectation of what they believed they must do for their children. Given the current COVID-19 pandemic, the expectations of mothers to do the work of child-raising spending all of their time in caring for children has become even more salient. “Mothers appear to be taking on a larger burden of childcare and homeschooling at the expense of paid work time, as evidenced by their larger reduction in work hours compared with fathers” (C. Collins et al., 2020, p. 9). Across the mothers was a general expectation to be the caregivers of their children which became more of their personal responsibility as day care facilities and other options for childcare were limited due to the pandemic. Amanda and Tara spoke broadly about the limited availability of other care options (daycare and family members) due to the pandemic, with implications of more work expected from them in childcare and socialization. The rest of this section details some of the experiences of the participants framing how they saw themselves in particular ways that were shaped by motherhood expectations of society as well as how they saw themselves as falling behind these (limited) expectations.

One common societal expectation of motherhood connects a mother's identity first and foremost with their children and family. Such expectation highlights the gendered role divide that places specific responsibilities on mothers, which are separate from the roles of fathers (Odenweller & Rittenour, 2017; Wittig, 1992). Several studies have shown that in the U.S. motherhood is expected to be a sacrifice of the self (Garey, 1995; Maher & Saugeres, 2007). Comments across several participants, particularly in the ways that they defined themselves, aligned with this perspective. For example, when Britney talked about how she saw herself she said “the things that I feel like really define, in the past musical theater really defined a lot of my life and now it’s mostly, my kids and my family. So sometimes that has been kind of a hard transition” (Interview 3). Tara made similar comments but connected herself very clearly to her

children feeling that they were “an extension of me you know and I feel like they're just the same” (Interview 3). Courtney and Amanda shared perspectives of raising their children and it being part of their motherhood identity. Courtney spoke about satisfaction when she saw her daughter being happy and learning, Amanda talked about the joy of seeing her son ask for her help and being able to provide it. In these examples is an association with how the participants saw themselves as primarily mothers, as the most important or perhaps only role in their lives. The influence of societal expectation of what a mother must be shaped how the participants saw themselves fulfilling the role of motherhood, shows the impact of external factors shaping one’s identity (Alcoff, 2006). Each of the participants had complex and varied experiences that made them into more than just mothers, however expectations of who they must be first and foremost shaped how they talked about themselves as mothers-first.

Another societal expectation of motherhood demands that a mother provides the primary care for children. As Rothausen-Vange (2004) stated how Western society sees motherhood by defining “being a good wife and mother as being continually available for emotional nurturing of the husband, children and other dependents, assuming primary responsibility for the physical and developmental care of dependents, and being warm and welcoming” (p. 55). Many of the stories shared by Elizabeth captured this particular societal expectation. Elizabeth was a stay-at-home mother and, since the pandemic, Elizabeth had taken on the bulk of responsibility of helping with schoolwork. In talking about moments that were challenging and trying to balance caring for both children at the same time with the different demands of their learning Elizabeth shared,

> I tend to feel guilty about things that I don’t do well or don’t go well. And so if there’s a bad interaction I tend to, um, think about that long after it happened. And I think that’s the same with my kids. If I had a bad interaction with them, like if it was a rough day

> with one of them, you know after they go to bed I think about them like what could I have done better and then like kind of like 'oh I should have done this' or 'I could have done this' or like even if days later I think of it and then I feel guilty (Interview 3).

The continuous flow of this story from Elizabeth demonstrates its clarity in her feelings, and further reflects how Elizabeth had defined herself (i.e. caring deeply about others). Elizabeth's guilt in how she wished she had done things differently to better support her children further reflect the pervasive expectation that mothers dedicate all of their time to childcare (Christopher, 2012) as well as that it falls on mothers that their children grow up to be 'good' (Austin & Carpenter, 2008).

The fixation of participants on their activity and identity as primary caregivers and being first and foremost mothers aligns with the pervasive and continuing expectations of motherhood within U.S. society. Even with the shifts of mothers working outside the home, there remains an expectation that mothers are the ones caring for children. As Duxbury and Higgins (1991) have highlighted, "home maintenance and child care are stereotypically women's roles. It is highly likely that work schedules and demands make it more difficult for a woman to perform her family tasks" (p. 69). Their statement resonates with experiences of different participants as they associated their identity and home role as primarily caring for children and continued guilt when participants believed they were not doing as much as they could. The influence of society's expectation of mothers' actions in the home shapes the identities that the participants take up (Alcoff, 2006). These common feelings of activity and self-identity from participants were reflective not just of their own experiences and beliefs about mothering from their childhood but also what U.S. society has and continues to expect out of mothers in relation to their children.

Gendered and Racialized Experiences (Gender Binaries and Privileging Whiteness)

The previous sections discussed the societal impact of expectations around what counts as mathematics and what is appropriate mothering activity. These areas are also heavily influenced by norms of gender and race that shape the participants' experiences. The gendered binaries that persist in our society maintain a divide in what is appropriate for men to do and what is appropriate for women to do (Wittig, 1992). Such binaries uphold expectations in mathematics and motherhood that show mathematics to be more aligned with men and masculinity (Hottinger, 2016) and mothering to be the work of women, and femininity (Odenweller & Rittenour, 2017). As Mendick (2006) writes in her analysis of the influence of masculinity in mathematics, mathematical

> discourses are oppositional and gendered; they inscribe maths as masculine. Based on this, boys and girls, and men and women, in doing mathematics are doing masculinity, and so it is more difficult for girls and women to feel comfortable with maths, and so to choose it and to do well at it (p. 111).

Expectations of who can and cannot be mathematical, associated with gender binaries, have the potential to shape how people identify themselves within mathematics. Race also plays a role in the expectations of mathematics and motherhood, such that whiteness and the norms of whiteness are privileged. Battey's (2013) analysis of mathematics education through the context of race shows that the field has privileged whiteness and white norms. Motherhood also privileges the actions and identities of white women as mothers (Dillaway & Pare, 2008). The structural influences that shape expectations of mathematics and motherhood along gender and race informed the different experiences of participants. In this section, I share several stories of

the participants that show how these societal demands have impacted their experience and how they interpreted their roles in motherhood and mathematics.

Gendered Expectations

As paralleled in the gendered experiences section of Chapter 6, the assumption that the male partners of Elizabeth, Tara, and Brittany were better at mathematics than them further reflected expectations of mathematics as more masculine and for men. Such as when Brittany referred to a joke with her mom about her challenges with mathematics, saying "I better just marry someone who's good at math so they can help our kids cause I don't know [if] that's gonna be me" (Interview 1). As a subject, mathematics has often been associated with masculinity, and due to gender binaries, meant for men and not women (L.A. Leyva, 2017). The perspectives of Elizabeth, Tara, and Brittany that placed themselves as less capable in mathematics or supporting their children in mathematics than their male partners was thus reflective of societal expectations of who could or should do mathematics, shaping how the participants saw themselves as less capable because of these expectations. While these stories relate to how three participants talked about their association with mathematics now, I also share two stories from participants' pasts that demonstrate a gendered expression of mathematics and motherhood.

Amanda had many stories from her schooling experience and how her own mother talked about mathematics that shaped her early perspective that girls were not good at mathematics. In reflecting about who was and was not viewed as a mathematical person, Amanda shared,

> I feel like it was very gendered when I was a kid. Like I always assumed there were the smart boys in class. And they were just better at math and that maybe it had something to do with me being a girl that I wasn't good at math. My mom would openly talk about

> how she wasn't good at math either. And then I felt like all the kids who were the best in my mind at doing math, that they could, like in elementary school they could do the timed tests and get the most answers down on the paper. And um, they didn't seem to have a problem doing algebra, were like, I can think of 1 or 2 guys specifically that I was always in the same classes with and they were always like the good at math guys (Interview 1).

The perspective of her mother, elements of school mathematics of working quickly on solving problems, and seeing several boys in class that were good at math shaped Amanda's perspective about herself in mathematics. Her experiences align with the prominent divide in mathematics that places men and women as separate, with men being the ones who can do mathematics. Mendick (2006) has pointed to similar tensions in mathematics in Western society, such that "the sociocultural constitution of gender as oppositional, and the connection of this to the series of binary relations through which maths is constructed, makes it more difficult for girls and women to identify as 'good at maths'" (p. 46). Social structures maintain these gendered expectations of mathematics, which can be perpetuated by the perspectives of adults, who are seen doing mathematics, and the norms in classrooms. Each of these elements played a role in Amanda's experience of mathematics as gendered, which in turn shaped her early interpretations of herself as not a mathematics person.

Gendered societal expectations also shape what it means to mother. Many of the participants had experiences where their mothers were in charge of their early education and care (compared to their fathers). Seeing the work of their mothers, coupled with the participants' identification with the role of motherhood, shaped how they interpreted their own activity. Larger societal structures also influenced the expectations of mothers, and do so in similar ways

today. “Domestic work such as childcare, food preparation, and house cleaning has remained women’s responsibility. Even as White middle-class women entered the workforce, they remained responsible for the bulk of domestic work” (Nilliasca, 2011, p. 395). Tara reflected on balancing housework and childcare in her third (and final) interview that implicitly connected to a societal assumption that as the mother she does and is expected to do this work. Tara shared,

> the kids, they learn a lot through play but at the same point like you gotta figure out the structure of the day and like ‘hey I have to do dishes because they need to get done’ at the same point like what are they gonna do? You know. So it’s like ok well then, let’s sing while mommy does the dishes. You know it's just silly things like that that you wouldn’t ever dream about doing or that you know that you need to do just to get through that small section of your day but you know what though? They’re enjoying it so it’s fine.

Tara frequently related her narrative to how I must see this activity as normal, with use of the phrase ‘you know’ over and over, suggesting that her need to take care of the housework and also watch the kids was expected. The assumption that Tara would balance teaching and taking care of the children while at the same time managing the other work of the home is reflective of motherhood expectations in Western society. Tara had internalized the societal expectations of what it meant to mother as part of what she must do and be to fit within motherhood. Tara’s perspective aligns with elements of the identity framework, where past experience and external social expectations shape how people see themselves.

Racialized Expectations

In motherhood and in mathematics environments, whiteness is either assumed or privileged over other forms of mothering activity and engagement in mathematical learning. The racialization of motherhood is highlighted by P. H. Collins (2000) who argues that women are

treated differently in their mothering activity based on skin color. Black women in particular have been stereotyped into (negative) images of a mother including the matriarch and jezebel (Harris, 2015; Harris-Perry, 2011). Western society has often privileged whiteness in motherhood (Dillaway & Pare, 2008). In mathematics there is also a privileging of whiteness, recognizing white men as more mathematical (Hottinger, 2016), and white norms in school mathematics practices (Battey, 2013; McGee & Beale Spencer, 2015). The assumptions and privileging of whiteness are part of the structural fabric of U.S. society that interprets motherhood and mathematics. The participants described a number of stories that showed how whiteness was assumed in what they should be doing as mothers and also their activity in mathematics.

Amanda shared several stories where her schooling experiences and teachers showed that they assumed she was a white student. Her identity as a Native American was often overlooked or lumped into a category of whiteness. In talking about these teachers' assumptions, Amanda shared:

> They didn't know what was going on in my life, you know? And I think if they had known they would have been a lot more understanding. But at the time I was at like a pretty like well-to-do high school. That was like, 95% white, um, very kind of like conservative in the sense that this high school has still come up in lawsuits today for like the way they treat students differently, who present differently, or who do other things differently. And so, I think they just looked at me like every other like majority of student in that classroom [SP: hmm] and just like assumed I was like living a middle class white normative kind of life. And that's not what I was dealing with at the time. And so I think they had just attributed it to me being lazy or not caring or not wanting to do well or

> thinking it was like not serious and not like caring about school at all, which was so far from the truth, it's just I had too much other stuff going on outside of school that I had, I literally did not have the brain power and capacity to devote to school at that point (Interview 1).

Amanda's story of assumed whiteness models cultural assumptions that do not see distinctions between people of color, and a push for cultural assimilation. Gordon's (1961) account of assimilation in American explains how historically "'Americanization'...was essentially a consciously articulated movement to strip the immigrant of his native culture and attachments and make him over into an American along Anglo-Saxon lines" (p. 269). Gordon's focus on immigrants coming to the United States also applies to the forced assimilation into whiteness of Native Americans. In Smith's (2016) discussion of heteropatriarchy and white supremacy, she argues that historically U.S. policies have forced assimilation on Native Americans to associate them with whiteness. This experience also applies to P. H. Collins' (2000) matrices of domination where there is an assumed culture of whiteness that has been in place since colonizers came and tried to assimilate Native Americans into their own culture of whiteness. Amanda may have presented as white, like several other participants of this study, but the assumptions of others silenced her own more diverse perspective and background as a Native American. She was thus not recognized, or listened to, as a 'knower' of her own culture (Dotson, 2011).

Courtney referenced her own experience with regards to assumed whiteness and lack of representation in school to what she expected her daughter, Eva, to also experience. Courtney was one of only a few Black students in her grade and she expected (living in the same community) the same was likely to happen for her daughter. The assumption of whiteness in this

experience related to the expected responsibility Courtney saw in her or her daughter needing to explain or teach others about herself as not-white. In hoping for better opportunities for Eva, Courtney explained:

> but I also think in the back of my mind I always think that I have to include the fact that yes you may not look like all of your classmates and that's ok. Um but how can we use that to teach, to teach them more about you? Or more about African Americans or like try to use that as a learning opportunity and allow her to find her own voice [SP: mhm] and let her know even if she doesn't fit into that specific um, area, that, that doesn't mean…it really doesn't mean anything I mean she's still capable of doing almost whatever, she wants or whatever she puts her mind to at least. So I think it will definitely come into play, it's come into play a little bit but, yeah, I think, I, I'm definitely I wanna be more conscious of it because I wasn't when I was a kid and I wish that I had been cause then I think, I probably speak my mind the least out of all my siblings [laughs] and so, I don't want her to feel like she has to stay quiet, um then she can't speak up when she needs to or wants to (Interview 3).

Courtney framed the hopes she had for her daughter around finding a place for her, knowing that she was still capable even when she did not appear to fit in due to what she looked like. Douglas and Attewell (2017) argue from a class perspective that "in classrooms, the vocabulary and language style of the upper class is used by teachers, and elite knowledge and cultural capital are used as if they were self-explanatory" (p. 650). I would argue that the operation of classroom norms and assumed expectation applies to whiteness as well as class, shaping what is expected of students in their learning. Similar points are made by other scholars in their work that recognized the racialized treatment of schooling, and mathematics education (e.g. Battey, 2013). How

Courtney talked about what her daughter may need to do for her classmates or remember about herself was reflective of the assumed whiteness in school practices.

Racialized experiences extend beyond the classroom and into expected practices of motherhood. Elizabeth recognized the challenges of representation and assumed whiteness in children's books when she wanted to read to her youngest daughter, Talia. In pulling out old classic children's books and books gifted by family members, Elizabeth remarked that she

> was really disappointed at how many books were like white kids in the books. Um whether it was illustrated or whether it was real pictures in them. And so, I set all those aside and I'm, we're giving those away [laughs] cause I, I think more and more how important it is for when {Talia} to open a book to see people like her reflected in that book (Interview 3).

Motherhood, and the activity of mothering, has an inherent association with whiteness in U.S. society such that white mothers and their actions are revered in comparison to mothers of color (Morgan, 2018). P. H. Collins' (2000) matrices of domination highlight the racialized expectations of motherhood such that when the same actions are done by different mothers (a white mother, a mother of color) one is privileged and one is silenced. For Elizabeth, this is made clear in what is assumed within children's books: white characters for white mothers to read to their white children. Such literature is not representative of Elizabeth's daughter. Just as the assumption of whiteness created expectations within school systems as seen from the stories of Amanda and Courtney, it continued to shape expectations of mothering activity through the assumed children's literature that remained overwhelmingly white.

The structural influences in the U.S. around motherhood and mathematics highlight trends in the participant stories around whiteness and women doing motherwork, shaping how

the mothers saw themselves in their mathematical activity with children. The pervasiveness of whiteness in U.S. policy and practice has been documented across literature, and as Marx (2006) argues, “the privileges attached to Whiteness have been, and continue to be, perpetuated in subtle ways through American institutions and popular culture” (p. 52). While Marx’s statement reflects the broader influence of whiteness within U.S. expectations, for this study, the influence of whiteness within mathematics is especially clear. The participants’ experiences in school that shaped mathematics as limited to whiteness and masculinity impacted how they saw themselves as mathematically capable in the present. Douglas and Attewell (2017) argue that “the belief that mathematics requires innate talent is widespread in our culture...it rationalizes the notion that only some students will be able to learn school mathematics successfully and that math courses distinguish these from the less talented” (p. 651). Douglas and Attewell’s claim has a lasting impact on the participants in how they recognized what counts as mathematics, impacting their confidence when society has perpetuated the idea that mathematics was not for them (e.g. Brittany), or forcing them to challenge such narratives to make space for different mathematical identities (e.g. Courtney).

Chapter 8: Conclusion

As this dissertation began with introspection of myself through my past experience and identity in mathematics, I conclude with a new reflection of what is to come and identity as a mother. Through the preparation, data collection, analysis and writing of this study I have also been in the process of becoming a mother. This is not to suggest a more traditional mode of motherhood, or that I managed to complete a dissertation in nine months. While preparing to begin the study of participants and their experiences I was also preparing for adoption, completing training sessions for foster parents, submitting extensive background checks, and meeting regularly with a social worker. These actions of becoming a mother were not visible to my participants as say a pregnant belly might be instead. It is likely that this process that was made real in my eyes through my actions rather than appearance is why I align my conceptions of maternal identity with the work of Ali and colleagues (2013) and Mercer (2004) who stress mother identities as a process of becoming, through mothering actions. While these scholars were speaking more about actions aligning to motherhood after children are born and a person cares for them, I saw a connection to this identity formation in the preparation for parenthood through adoption.

I highlight here my own process and connection with motherhood not to indicate a legitimacy in my working on a study of mothers. How I have experienced an identity of mother, shifting over time and context, has put into sharper focus my own analysis and understanding of the participants and their experiences. It becomes clear how each person does the work of mothering in different ways, based on their values and experiences, that extends beyond a surface level of one parent letting their children eat sugary cereal for breakfast and another who does not let their children eat processed sugar. The intent behind parent actions cannot be

assumed without the centering of the parents. In the example above, it is not appropriate to think of one parent as ‘good’ and the other as ‘bad’ because of what they feed their children. Perhaps that food item is the only thing the child will eat, or perhaps the child has a particular condition that does not allow their body to digest certain foods appropriately. My experiences specifically in motherhood have shown on a personal level why it is important to consider mother-centered studies of at-home mathematics, because it addresses the gendered nature and expectations of mathematics and why what one mother does will not always be the same as another.

Now that a child has been placed in my care, and that my everyday actions are full of activity associated with mothering, I find myself understanding the participants’ stories with more nuance and care. As a researcher, I was aware of how my own past experience may inform what themes I paid more attention to, what I was more likely to dismiss and thus need to be intentional about in my analysis. As a mother, I am aware of how much difference exists in actions and intentions between mothers due to a plethora of factors that shape a parent’s decisions. For example, I feel deeply in Tara’s statements about being “so tired all the time, but … that’s just motherhood” (Interview 3). My actions of waking up in the night to console and feed a crying infant over the past several months have solidified a deep sense of tiredness that I understand more clearly in Tara’s words. I have experienced my own context of guilt, like that of Elizabeth, who shared feeling “guilty about things that I don’t do well or don’t go well” (Interview 3). When the little one cries and my actions of feeding, changing, and rocking do not help I feel a profound guilt that I cannot figure out what is wrong to help them. This is not to say that because of my own experience in motherhood I perfectly understand the participants’ experiences when they are similar to my own, but that the context of these situations matter greatly. I return to Kondo’s (1990) words about identity and research, that “you are not an ‘I’

untouched by context, rather you are defined by the context" (p. 29). Each parent has their own context, of their past experience, of the expectations of their actions, their own interests, and the interests of their children, that inform how they see themselves within motherhood and mathematics and how they choose to act.

The remainder of this chapter emphasizes the theme and impact of recognizing the intention and variety in mothers' actions with children in mathematics. The findings demonstrated the different contexts of participants' stories from their past experience, personal interests, children's interest, and the role of expectations in motherhood and mathematics influenced by gender and race. Given these findings, I discuss the implications of research that centers a mother's perspective and the impact it can have on mathematical identity, for mothers and their children. I return to limitations of the study that were initially detailed in Chapter 4 and discuss what is necessary for future work to address these limitations. Finally, I make suggestions for future work that can be done in terms of mathematics education research and within a school setting based on the perspectives of mothers and their engagement in children's mathematical learning.

Implications

The results of this study highlight two major takeaways about the participants' experiences with mothering and mathematical activity: that what mothers do with their children in mathematics is layered in context and meaning but rich in content, and that expectations of doing mathematics and motherhood that are steeped in gender binaries and whiteness have an influence on that activity. The personal and the external work in tandem to shape people's perspectives of themselves, their identities. For the participants, how they saw themselves within the spheres of motherhood and mathematics was evident from the influences of their past and

societal expectations. What are set as expectations for mathematics and motherhood can thus have generational implications, becoming internalized in how people see themselves and carry out future actions with their children in mathematical learning. Given the feminist perspective of identity I use for this study, these identities of self in motherhood and mathematics are not set in stone. Identities can change, can be negotiated (Nasir, 2002). Implications for this work reflect the benefit or harm if change is made or not at a structural level to how society views motherhood, schooling and school readiness, parental engagement, and mathematics.

What is the potential harm if future research, if school systems, if societal expectations continue to ignore the diverse perspective of mothers and how they engage with children in mathematics? I return to Dotson's (2011) discussion of epistemic violence on what this may mean for mothers who are silenced, not granted legitimacy for their work. Dotson states that epistemic violence occurs "at the juncture where an audience fails to accurately identify the speaker as a knower" (p. 243) which often results in the silencing of more diverse perspectives. Elements of this silencing, and an internalized belief that one is not good at mathematics, are clear in some of the participants' stories. For example, Elizabeth and Brittany downplayed their activity with children involving mathematical vocabulary and measurement as not mathematical, which highlights the expectation of what counts as mathematics and in effect silences other forms of engagement in mathematical learning. Jay and colleagues (2017) also highlighted this issue in their study of parent engagement, arguing

> that many parents' conceptions of "mathematics" are firmly in line with school-centered definitions—often with a focus on algorithms for solving arithmetic problems—and that this limits the extent to which they recognize the potential to engage with and support their children's learning outside of school (p. 206).

School mathematics becomes the only perspective that is listened to and the variety of engagement and activity that can involve mathematics is not viewed as such by parents. Assumed whiteness and the silencing of perspectives of families of color also comes into play, both in mathematics and motherhood, for the participants. Amanda shared how teachers assumed she was white and made assumptions about her experience, in a way silencing her own perspective as a woman of color. These examples of silencing of perspective for the participants in different ways show the potential for harm in how mothers and their children may be treated through school systems if expectations of mathematics and motherhood in Western society continue to remain rigid, privileging norms and ideals of middle-class, white families. This would produce more of what is visible now, a binary system marking people as good mothers or bad mothers based on whether they do a limited set of activities (Dillaway & Pare, 2008; Roberts, 1993) and as mathematical thinkers or not based on how they engage with the subject (Esmonde et al., 2013). Those who do not fit into such expectations are viewed by others as potentially unfit, or in the words of Dotson (2011), not a knower.

What is the potential benefit if future research, school systems, and societal expectations expand, focusing on the diverse perspective of mothers and how they engage with children in mathematics? With just a shift in motherhood, Laney and colleagues (2015) suggest that

> motherhood, when viewed more accurately, may have more potential to impact not only mothers and children, but the communities in which women mother if women's ways of relating are extended beyond the mothering relationship as some research has seemed to suggest (p. 141).

Instead of judgement about what particular activities mothers are not doing, expanding how motherhood is viewed creates opportunity to recognize new activity as mothering and new

possibilities for engaging with children that can be taken up by others. With just a shift in mathematics, Jay and colleagues (2017) found in their study that "as parents became more confident in their own analysis of the mathematics in everyday family life, they developed new strategies for sharing this mathematical thinking and awareness with their children" (p. 201). When different forms of mathematics are granted legitimacy, it changes a person's perspective of their own ability, potentially boosting their confidence. In parents this can mean increased and improved engagement with their children in mathematics. Recognizing other forms of mathematics as legitimate created an initial shift in perspective and confidence for some of the participants as I pointed out activity they talked about or did in observations as richly mathematical. For example, at the end of the study Brittany recognized that she did not have to sit down and teach a mathematics lesson for her kids to be interacting meaningfully with the content. Goldman and Booker (2009) suggest that "learning about and acknowledging the kinds of problem solving that families do can open up opportunities for parents to interact productively with their children's mathematics learning" (p. 369). The possibilities for changing parent perspectives suggest a stronger relationship with mathematics learning at home that may ultimately benefit children's school mathematics learning.

In considering the harm or benefit based on whether change occurs is also situated within expectations of school readiness for children and its ties to parental engagement. School readiness for children research discusses the need for some baseline mathematics to be successful in early schooling (Duncan et al., 2007) but who is responsible for teaching this content? The underlying assumption is parents, particularly mothers, are doing this early teaching. Sheridan and colleagues (2010) describe school readiness "as starting at home, well before a child enters a formal child care or preschool setting" (p. 126) and Chazan-Cohen and

colleagues (2009) describe the need for "a home environment that encourages exploration and learning" (p. 959) to support children's development for school. Before school begins the emphasis is placed on what happens at home, supported by parents. Expectations of school readiness are embedded when I discuss the change that is needed in systems of expectations and how U.S. society thinks about motherhood and mathematics. Readiness for children should not have assumptions of only occurring at home, led by parents. As Smith (2016) suggests about the concept of family "not seen as islands on their own" (p. 271) preparation of children for school does not need to be the sole activity and responsibility of parents.

While I have discussed the implications in terms of parents and their engagement with schools, it was important to focus the study on mothers in this context. Many of the existing studies on at-home mathematics and engagement with children in mathematical learning focus more broadly on whole families or all parents (Pea & Martin, 2010; Skwarchuk et al., 2014). However, as I detailed in Chapter 2 and Chapter 3, the roles of parents are highly gendered, such that motherhood is associated with femininity (Odenweller & Rittenour, 2017; Paechter, 2006) and femininity exists in opposition to masculinity (Connell, 2010). Gender binaries perpetuate a separation of activity and expectations for mothers and fathers (Wittig, 1992). The binaries related to gender that extend to parental roles extend to mathematics, such that mathematics is most frequently associated with that which is masculine (Hottinger, 2016; Mendick, 2006). Because mothers are associated with the feminine and mathematics is associated with the masculine, there is a gap in immediately recognizing mothers as capable of rich mathematical activity with their children. The tensions this divide creates for mothers doing mathematics is similar to the tensions created for girls doing mathematics in school, where to do 'school' is associated with femininity and to do math is associated with masculinity. As Hottinger (2016)

highlights, “this results in a very complex set of practices in mathematics classrooms that praise girls for following the rules yet define success in mathematics by a student’s desire and ability to challenge accepted practices in the field” (p. 18). In mothering, mothers are expected to do more of the domestic work and help care for children. While these practices also involve their early education, which includes mathematics, the separation in expectations for mathematics and that which is feminine makes it more challenging for mothers to be seen and see themselves as engaging with mathematics successfully. Thus, it matters more to show how *mothers* are doing meaningful mathematical work with children and that such work be acknowledged as legitimate mathematics. When I discuss the impact of shifting our perspectives of motherhood and mathematics from how we center their experiences as valid and identify the richness of their activity, it is a response to the continuing tension between mathematics and femininity.

Limitations

Chapter 4 detailed several limitations of the study in relation to participants and the COVID-19 pandemic that impacted study design and data collection. I reiterate and expand on some of these limitations here to place the implications I described above in context and also frame why certain work in the future is needed. I highlight three major areas that created limitations for this study: the challenges of conducting research, particularly with mothers, during the COVID-19 pandemic, the absence of class and queer diversity in the sample, and the racial diversity of the sample. I point specifically to these limitations not to delegitimize the experiences of the participants and what they shared but to highlight the importance of this perspective as a slice of U.S. motherhood experiences, not representing all mothers’ experiences and actions with their children in mathematics.

COVID-19 created several challenges within this study that are similar to other challenges in research conducted in 2020. In Chapter 4, I detailed limitations with participant recruitment, in-person activities, and data collection methods. While data collection and adaptation of in-person activities became opportunities for new and more flexible processes within the study, I want to highlight the gendered components of participant recruitment and COVID-19. The pandemic has highlighted the expectation that mothers are meant to care for children, even when they are working at the same time. As families moved to remote work and schooling it was mothers who took on most of the burden of their children's schooling (C. Collins et al., 2020, p. 9). For participants, this mostly meant an absence of out-of-home childcare and the need to manage watching children and working simultaneously. Several people who had agreed to participate in the study were not able to complete it because of the demands of working and childcare. Elizabeth and Tara specifically mentioned changes in their activity that increased their childcare expectations. Carli's (2020) study of COVID-19's impact on gender equality found that

> Whether fathers are at home because of telecommuting or the pandemic, working at home increases their contributions to childcare and other domestic duties. But women continue to do more than men and more often disrupt and reduce their work hours to attend to their children, which could lower their performance and productivity relative to men (p. 651).

Gendered expectations for mothers and fathers have become more transparent during this pandemic, showcasing the burden of managing work and childcare for mothers. In regards to the present study, such limitations mean that few participants had full-time, regular work schedules. There are many mothers in the U.S. who work full-time on regular schedules, who are likely to

have different experiences and interactions with their children in mathematics. This study, in part due to COVID-19, did not capture these perspectives.

Another limitation to the study relates to the lack of class diversity of the sample. All of the participants identified as middle-class. As detailed in Chapter 2 and Chapter 3, many of the expectations of mathematics and motherhood are centered around the norms of white, middle class families (Dillaway & Pare, 2008; Delpit, 2012). While not all of my participants were white, they did benefit from their location within the middle-class. A feature of (middle-class) motherhood expectations is having mothers take on some or most of the childcare (Gorman & Fritzsche, 2002) which is not the norm in working-class or upper-class families, who may rely on outside family support or paid support, respectively. As C. W. Cooper (2009) talks about diversity in the parents but a lack of acknowledgement of their diversity in schools, she points out that

> Today, despite that a large percentage of U.S. mothers of all racial and cultural backgrounds work outside the home, traditional norms of parental involvement in schools are upheld. In addition, middle-class, white mothers (employed and stay-at-home) continue to possess more racial and class privilege than most other types of parents in public schools (p. 381).

All the participants spoke about their direct actions with children and how they engaged in childcare in some way. However, for other families this may not be the norm. Future research would benefit from looking at mothers of working-class and upper-class families to understand how mathematics is engaged.

All of the participants that completed the study were heterosexual or part of more traditional families (with one mother and one father). What is also missing from this sample are

mothers in queer relationships and consideration of how that experience potentially shapes their actions. Similar to being middle-class, there is an assumption within motherhood of heterosexuality. Wittig (1992) argues that heterosexuality is viewed as a universal, with certain forms of language that reinforces this assumption in people and families that renders the experience of lesbians and gay men invisible. Nilliasca (2011) and Smith (2016) discuss how pervasive heteropatriarchy in Western society assumes heterosexuality and thus expects particular roles for those in a family; it expects that families be led by men and women take care of the domestic labor. Elements of these roles and actions were more apparent in some of the participants that took on the assumed role of domestic care at home. However, the assumed division of care for a family of what men and women must do breaks down in queer families where there may be only fathers or only mothers. Smith (2016) argues for a need to change how society understands motherhood and family in relation to pervasive heterosexuality, such that

> We should challenge the 'concept' of family itself. Perhaps, instead, we can reconstitute alternative ways of living together in which 'families' are not seen as islands on their own. Certainly, indigenous communities were not ordered on the basis of a nuclear family structure - [this] is the result of colonialism, not the antidote to it (p. 271).

Given Smith's call for change, how do the dynamics of family life change the interactions with children and experiences in mathematics? Courtney, for example as a single parent, relied on a community of people to help support her daughter's growth. Courtney's experience thus shows possibilities of family life not constrained to an 'island on their own.' While Courtney was the only single parent from the participants, her experience cannot act as a generalization of all families outside of the father-mother-children model. Future research would benefit from

drawing attention to the families of queer couples and how they still engage meaningfully with their children's learning.

A final limitation to highlight is the racial diversity of the sample. While I have participants of different family make-ups and racial backgrounds, these participants do not represent all of the racial backgrounds of mothers in the United States nor do they cover the perspective from others of the same racial backgrounds. Amanda does not represent the voice of all Native American mothers, Tara and Elizabeth do not represent the perspectives of all trans-racial families, Brittany's experiences do not capture the experiences of all white families, and Courtney does not stand to represent all Black mothers. Thompson's (1981) argument about generalizations is an important reminder of what the participant perspectives mean and do not as "we are too easily led to generalize from our own experience and to take for granted that it was shared in other social groups or at other periods" (p. 293). While I have used this argument for myself to be careful with generalizations of my own experiences in connection to the participants' experiences, it also applies when thinking of these participants and their impact on what mothering means in mathematics. They show what new activities and forms of engagement are possible but do not stand as the only forms of mathematical activity and experience. In considering these participants and their roles in motherhood and mathematics, I return to how people are shaped by experience and self-authoring, such that there is not one set perspective of mother, of mathematician. Young (1994) explores the concept of seriality for gender, not one set perspective of woman, that I apply to the seriality of the identities of mother and mathematician. Young (1994) highlights how it is not possible to conceive of women as having a specific set of attributes that all women would share, given the diversity of people and their experiences. I extend her discussion of an impossibility to define women in one set way to apply to other

identities, such as mothers and mathematicians. As such, these participants do not capture the only ways to be mothers and to do mathematics. What is needed is more research that considers diverse mothers and their experiences, centering their perspectives. Not as a way to capture essentialized pockets of how families will act but to obtain further ways that families legitimately engage with mathematics. Doing so can enable the development of responsive plans back into the classroom that honors the knowledge and experiences of these families.

Future Work

I recommend two directions for future work in the area of parent engagement with early childhood mathematics based on the findings of this study: one based in research and one based in practical application with schooling. Within research, more work should be done that is parent-centered, considering their perspectives and intent in particular activity to better understand why and how parents engage in mathematics with their children. Research must center parents' experiences, particularly because previous research has most commonly focused on the perspective of schools and teachers (Jay et al., 2018). Within a more practical application is a need for future work that makes better connections between families and schools. I argue that more attention to meaningful home visits will strengthen the relationship between teachers and parents, while centering perspectives of learning from families. As Johnson (2014) argues, "home visits can be viewed as a vehicle for disrupting the institutional power imbalance that requires parents to come to school to feel—and be viewed as—'involved'" (p. 362). This would also be a move away from work that most frequently centers mathematics schooling as primary sites of knowledge, while relegating family mathematics learning to the background (Sheldon & Epstein, 2005). These suggestions for future scholarship and school changes stem from the findings in the participants' stories. The participants demonstrated a rich level of mathematical

engagement already with their children that they often dismissed as not mathematical or not mathematical enough because of existing expectations of what limited content should count as mathematics. Additionally, the choices the participants made in the types of activities they did and the feelings associated with them were steeped in their own experiences and expectations from U.S. society. These elements are not clearly considered in research and school-family partnerships, but have the possibility to help mothers (and parents in general) see themselves as mathematically capable and make stronger connections for mathematics learning between schools and families.

Research in parent engagement of mathematics learning has called for more collaborations with parents, with families (Civil & Bernier, 2006; Wilder, 2017). Such calls to connect with parents and understand their perspectives have been present in research for almost the last 20 years. As Sheldon and Epstein (2005) claim, this is in part because "researchers and practitioners have given relatively little attention to developing connections between schools, families, and communities as components of mathematics reform" (p. 196). Paying little attention to families, to parents, does not position them as knowers, even though it has also been argued that parents are children's first teachers (Starkey & Klein, 2000). Research that centers parents, as knowers, as early teachers, grants legitimacy to the actions of adults who do the work of raising children. Civil and Bernier (2006) have stated a call that "more research is needed that views parents as intellectual resources and the associated challenges and possibilities that accompany the framework" (p. 328). Focusing on parents can provide more nuance into their decisions and actions at home, as shown in the decisions for why Elizabeth focused heavily on reading activities, and why Courtney so easily incorporated mathematical questions at every opportunity, when working with their children. Mathematical activity that occurs at home covers

broad contexts, that can be more clearly recognized when research focuses on a parent perspective. Whyte and Karabon (2016) also argue that early education research should support collaboration between schools and families for better learning for students. Parent-centered research creates opportunities for new forms of learning mathematics that can be connected to the learning that happens at school.

To establish strong connections between schools and families, based on parent-centered research, I suggest an extension of home visits as a practical application. The work on home visits in research and in practice is not a new concept but continues to remain a common area when bridging family and school partnerships (Meyer, Mann, & Becker, 2011; Wright, Shields, Black, & Waxman, 2018). In the spirit of Marta Civil's work that focuses on parents' funds of knowledge, home visits can be used to strengthen relationships with families, learning from them and their mathematical practices, and building family mathematical contexts back into the classroom (Civil, 2002; Civil, Bratton, & Quintos, 2005; Gonzalez, Andrade, Civil, & Moll, 2001). In their project that focuses on parents' everyday mathematics, Gonzalez and colleagues (2001) highlighted that "as teachers validated household praxis as being imbued with resources worthy of pedagogical notice, parents came to authenticate their own skills as meaningful and productive" (p. 118). What parent-centered studies in mathematics education have shown for parents' confidence and engagement with mathematics is parallel to the engagement and confidence of the participants in the current study. I call for similar practical action to what Civil suggested in 2002:

> that through an authentic two-way dialogue in which these different forms of discourses and knowledge (community knowledge, school knowledge) and their associated values are brought into the open for scrutiny, we may in fact have a route towards the

> transformation of the educational experience for all, but in particular of the groups that have consistently been left behind in the academic journey (p. 146).

I suggest a similar call to action as what Civil suggested almost 20 years ago because issues within the expectations of mathematics and motherhood persist, leaving behind some of the same people in the 'academic journey.' Home visits, which are used often in early childhood to understand what academic knowledge children already know, can serve a deeper purpose in strengthening the connection between school and families.

Home visits as a practical solution to listening to families does not come without its own challenges. While home visits as framed in the work of Marta Civil are opportunities to learn from parents and their experiences, it requires parents to trust and accept the people coming into their homes. Teachers are often agents of power in this relationship, that can create tension in how families see what they are going to do in their home. As Whyte and Karabon (2016) highlight in their study of teacher and family relationships:

> The family thought Ann was going to be inspecting the physical environment of their home, were uncomfortable with it, but let her in their house anyway. The family's willingness to comply with Ann's unique request demonstrates the power a teacher holds (p. 216).

In another situation it is possible that a family would completely refuse a teacher to come into their home for similar reasons to what happened with Ann in Whyte and Karabon's (2016) study. While the suggestion of home visits is to learn from families, how they are enacted and understood by teachers and families respectively needs careful attention. Sheridan and colleagues (2010) highlight this challenge in existing early childhood work because they "fail to fully tap the potential of parents as *partners in* (rather than recipients of) the educational enterprise" (p.

129). At its most basic level, the use of home visits should be framed for teachers and for parents as an opportunity to learn from parents and position them as legitimate agents in their children's learning.

What is potentially learned about parents and families through home visits can impact the school curriculum to best support family contexts. Meyer and colleagues (2011) argue that "the information gained in a home visit can be utilized as a means by which teachers can plan curriculum best suited to the individual needs of children in their classrooms" (p. 192). In a small thought experiment, I will briefly detail what practices or activities I would use if I had a preschool mathematics class that contained Elizabeth's daughter, Talia. Since I spoke extensively with participants and observed some of their activity, I have ideas about what is important and of interest to them that I can incorporate into a mathematics curriculum. Elizabeth spoke extensively about her and her children's love of reading, and how she engages them with books everyday but struggles to find texts that have characters that look like her youngest, Talia. Additionally, Elizabeth spoke about how she does not see herself incorporating much mathematics into reading unless it is more straightforward counting. Given these brief points, I would engage in mathematical modeling and vocabulary in reading for Talia. Additionally, I would use books that show Hispanic characters in positive ways to better empower Talia. Since I know that Elizabeth's children were adopted, I would be intentional to incorporate books that show diverse families. From the observations, I know that Talia really enjoyed playing with Legos. I would incorporate the use of blocks and Legos to work on early mathematical skills such as building patterns, measuring Lego tower heights, and beginning addition with adding one more to Lego towers. These are beginning suggestions of what I could incorporate into mathematical learning that honors the experiences and contexts of a child's learning at home.

There are differences to every family and their actions. Home looks different for families of different structures, class, race, and genders. I chose Elizabeth's daughter as an example specifically because of the different structure of her family than the other participants and the common activities in early education that center families (such as activities on family trees, and who one looks like in their family). Assumptions made by others about what family life must be like can impact what they take up or not into their school curriculum. My call for home visits is to establish a process that more appropriately listens to the experiences of parents and brings these experiences into the classroom in context.

Closing Remarks

The stories of Amanda, Elizabeth, Tara, Brittany, and Courtney show what can be learned by recognizing the differences of parents, where they come from, and the activities they choose to engage in with their children. The benefits of listening closely to the stories of parents allow researchers and educators to understand new forms of mathematical application, new forms of parenting that are based on values and experiences of that family. This study has shown the many things that can have a profound impact on a person's mathematical learning: societal expectations, family, and teachers. Keeping these influences in mind has the potential to shift mathematics education in important ways, building from the contexts and experiences of students and families, enriching learning in meaningful ways and legitimizing an array of mathematical activity. Such change has the potential for providing ways, not only for mothers like those in this study but also for their children, to be seen and see themselves as capable mathematics thinkers.

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Appendices

Appendix A - Interview and Debrief Questions

First Interview - Past Life Experience of the Mother

These are semi-structured questions. They are a guide when a guide is needed in conversation, to generate more thought or ideas. They may not be asked in this order, some may not be asked at all, and additional questions may be posed based on what is brought up by the participant in conversation.

1. What was your life like growing up?
    a. What stories stand out to you from your childhood? Interactions with family? Interactions with friends?
    b. Where did you grow up?
    c. What was your relationship like with your family? With your friends?
    d. Do you see any of these details about your life growing up influencing your experiences around math? How?
2. What stands out to you about your experience with math growing up?
    a. What were some of your earliest experiences? (For each story):
        i. How did that make you feel?
        ii. Where did this happen?
        iii. Are there people related to this memory? Tell me more about them.
        iv. How do you make sense of this experience now? [Such as why it happened or themes across experiences]
    b. What were some of your experiences in school like? (For each story):
        i. How did that make you feel?
        ii. Where did this happen?
        iii. Are there people related to this memory? Tell me more about them.
        iv. How do you make sense of this experience now? [Such as why it happened or themes across experiences]
3. ARTIFACTS: Do you have any writing or pictures that you think supports some of the stories you've shared today? Would you be willing to share them with me?
    a. What can you tell me about this artifact?

Second Interview - Current Mathematical Practices

These are semi-structured questions. They are a guide when a guide is needed in conversation, to generate more thought or ideas. They may not be asked in this order, some may not be asked at all, and additional questions may be posed based on what is brought up by the participant in conversation.

1. What are some experiences or stories you have related to math recently?
    a. How does that make you feel?
    b. Where did this happen?
    c. Are there people related to this memory? Tell me more about them.
2. What are some things you do as a family around math? (For each story):
    a. How does the task make you feel?
    b. Does someone in particular usually do that task?
    c. Where do you usually do this?
    d. Why do you do this activity? [Asking about its importance for the participant or importance as defined by others]

3. What moments do you see yourself interacting with your children in mathematics? (For each story):
    a. How does that moment make you feel? What do you think others may think of this activity?
    b. Where did this take place? When did this happen? How were you feeling at the time?
    c. Are there other people related to this moment? Tell me more about them.
    d. Why did this occur? What did you hope to get out of this moment?
4. Are there other stories or important details that you want to share about your math experience that we have not covered?
5. ARTIFACTS: Do you have any writing or pictures that you think supports some of the stories you've shared today? Would you be willing to share them with me?
    a. What can you tell me about this artifact?

Debrief Questions

These are questions to address after a shadowing activity. They are meant to further elaborate what happened in the activity and contextualize actions. These are semi-structured questions. Other more specific questions about the activity, clarifying what happened, may also be asked.

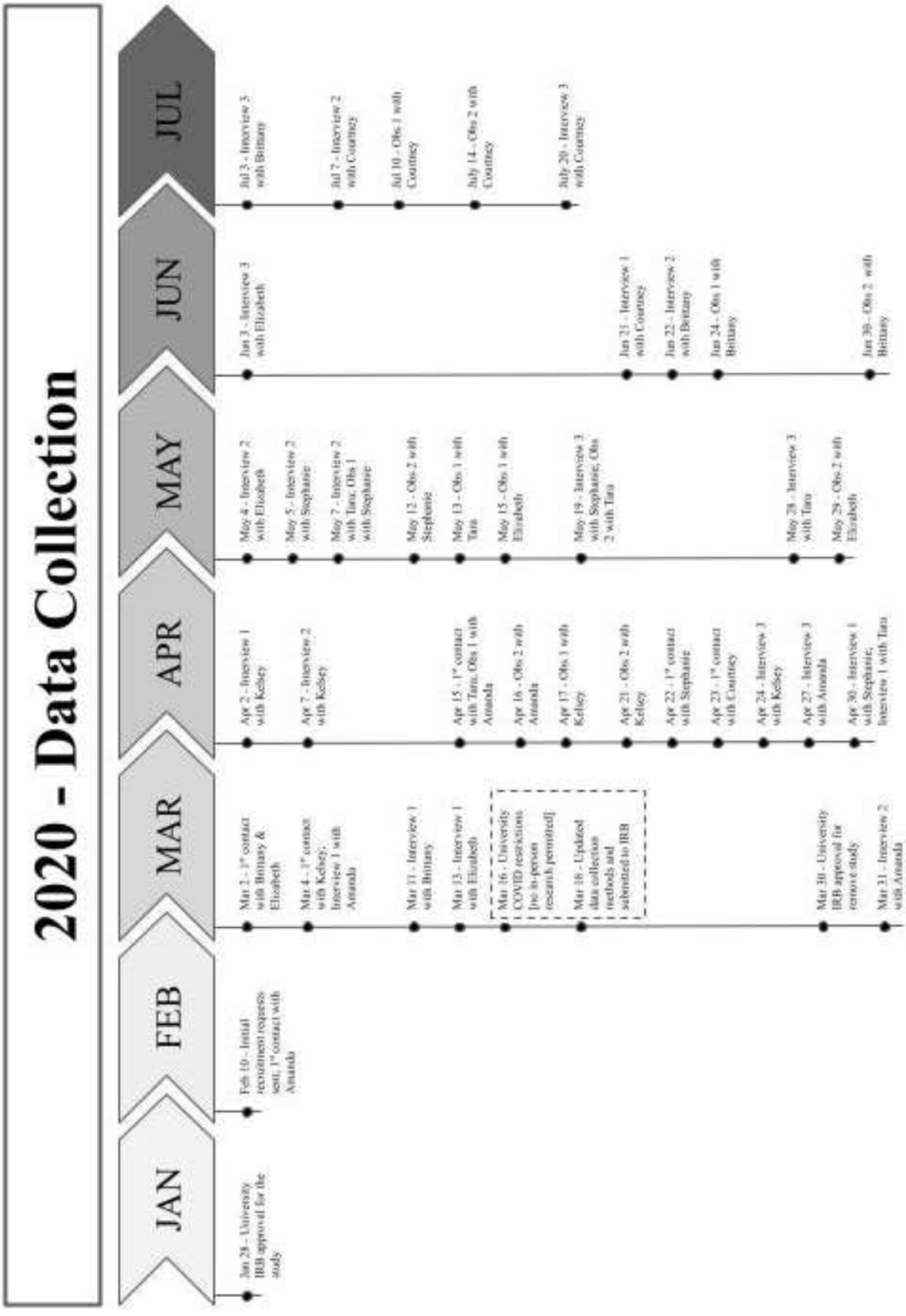
1. How would you describe what happened today?
    a. Is this an activity you do regularly? (If yes, how did it go in comparison to other times you've done this?)
    b. Are their others who typically participate in this activity?
    c. How did this activity make you feel?
2. Why do you do this activity?
    a. [Dig further into influences and value systems around the activity]
3. What mathematics do you think was involved in this activity?
    a. I noticed [ ] in the activity, which I see as using [ ] mathematics. Are there other moments in similar activities that you see yourself doing this too?
4. What things come to mind now that you see yourself interacting with your children in mathematics? Are these activities you thought of before?

Third Interview - Authenticating and Details

This interview is meant to get more context on particular situations from the last two interviews and confirm that the narratives accurately represent the participant.

1. In the [first/second] interview, you shared a story about [ ]. Can you tell me more about that moment?
    a. Ask clarifying questions, for detail related to the experience. Attention to questions about when and where this happened, how it relates to other experiences, and the connection to other people related to the story.
    b. If applicable: ask for more details about an artifact shared that accompanied the story.
2. Now we want to look at the narratives from across the interviews. I want to make sure that you feel the narratives best represent you. Please look over this short narrative from what you've said in a past interview:
    a. Do you see yourself represented in this narrative?
    b. Are there details you would like to add, change, or delete?

Appendix B - Data Collection Timeline



Appendix C - Recruitment Materials

Letter to Community Members

Dear Friend,

I am starting my dissertation research on mothers' experience in mathematics and I would love your help in finding some participants. I'm hoping to interview people who mother from a wide variety of backgrounds to understand their experiences in math and what they do with their children in the subject. Since this is my dissertation research, I cannot use people I know directly. However, friends of friends (that would be people you know) are a great set of people with a better likelihood to develop trust between researcher and participant.

Who I am looking for: People who mother young children in the general Madison area with children they see on a regular/daily basis. They should mother at least one child who is not yet in kindergarten. Their experience with mathematics (and even their feelings about it now) does not matter.

What kinds of mothers: Many people can be considered mothers, or doing the work of mothering! Any person who sees themselves as a mother can count. Additionally, people who support close children by mothering can count. This might be people you didn't think of before like: stepmothers, adoptive (official or unofficial) moms, grandmothers, etc.

Please consider sharing the second page of this letter with a person that you think would fit in this study. A possible way to bring this up is to tell your friend that you think they would be a good fit for this study, that you know me, and that they can decide if they're interested on their own. You are welcome to tell them more about myself too. **You should not follow up with them or with me once you give them the information page.** They can decide if they want to ask me for more information or participate.

If you have more questions for me, please feel free to reach out by talking to me in person or via email at sprough@wisc.edu.

Kind Regards,
Sam Prough

Informational Flyer

Exploring Mothers' Stories in Mathematics

University of Wisconsin-Madison

Volunteers Needed for Research Study

Did you have a great math experience as a kid? Or maybe a frustrating one? If you are a mother with children you see regularly, I would love to hear your math stories for this new study!

This research aims to understand connections between mothers' experience with mathematics and the interactions they have with their children. I hope to show the positive ways mothers interact with their children in learning, regardless of the experiences they've had in mathematics.

The study: Conducted in up to 3 one-on-one interviews and up to 2 shadowing experiences (followed by debriefs).

Eligible Participants: I am looking for people who regularly mother children who are not yet in kindergarten.

Compensation: A small stipend of thanks is offered to those who complete the study

Location: Study interviews may be conducted at a location (or locations) of your choice, based on your needs.

All interviews, shadowing experiences, and debriefs can be done virtually, through a platform of your choosing

To learn more about this research, please contact Sam Prough, by email sprough@wisc.edu

This research is being conducted under the direction of Erika Bullock, Department of Curriculum and Instruction

Contact Address:
Erika Bullock
476-E Teacher Education Building
225 N. Mills Street
Madison, WI 53706

Appendix D - Extended Demographic Information

Names and Basic Demographics of All Participants

Participant	Age	Location	Race	Partner Status	Occupation	Children (+Age)	Childcare Support
Amanda	Early 30s	suburban	Native American	Married	Graduate student	Grant (2)	Daycare[a]
Elizabeth	Late 30s	suburban	White	Married	Stay-at-home mother	Talia (2), Luna (7)	None
Tara	Mid 30s	urban	White	Married	Part-time grocery worker	Sasha (18 mo), Peter (3.5)	Parents[a]
Brittany	Early 30s	rural	White	Married	Part-time music teacher	Rosie (2), Bobby (4)	Neighbor friend
Courtney	Early 30s	urban	Black	Single	Teacher	Eva (3)	Sister, parents
Kelsey[b]	Late 20s	rural	White	Married	Part-time music teacher	Amelia (15 mo)	Neighbor friend
Stephanie[b]	Mid 30s	rural	White	Married	Stay-at-home mother	Hazel (8 mo), Lina (3)	None

[a]Due to COVID-19 issues at the time of the study, these options of childcare support were no longer available/being used by the participants
[b]These participants completed all elements of the study but were not used in the study's final analysis due to their extensive overlap with the remaining participants.

Appendix E - Participant Mathematical Activity

Math activity and skills [with non-analyzed participants]

Math skill	Participants	Context
Number recognition	Amanda, Elizabeth, Tara, Brittany, Courtney, Kelsey, Stephanie	Toy cars, walks, crafts, sidewalk chalk, blocks/Legos, play time, board games, pool time, puzzles
Counting	Amanda, Elizabeth, Tara, Brittany, Courtney, Kelsey, Stephanie	Toy cars, walks, books, sandbox, cooking, meal time, crafts, play time, sidewalk chalk, braiding, blocks/Legos, music, church activities, clean up, board games, puzzles
Shape recognition	Amanda, Elizabeth, Tara, Brittany, Courtney, Kelsey, Stephanie	Walks, books, meal time, crafts, play time, books, board games, playdough
Sorting/shape attributes	Tara, Brittany, Stephanie	Crafts, play time
Shape properties	Tara, Brittany	Crafts, play time
Quantity comparison	Tara, Courtney	Crafts, books, play time, rock collection
Fractions	Elizabeth, Tara, Brittany, Kelsey, Stephanie	Cooking, baking
Measurement	Amanda, Elizabeth, Tara, Brittany, Stephanie	Cooking, baking, crafts, play time
Estimation	Brittany, Stephanie	Play time, puzzles[a]
Color	Amanda, Elizabeth, Tara, Brittany, Courtney, Kelsey, Stephanie	Crafts, play time, books, church activities, board games, getting dressed, puzzles, books, blocks, music
Time	Elizabeth, Brittany, Courtney, Kelsey, Stephanie	Music, play time, walks
Operations (+/-)	Elizabeth, Tara, Brittany, Courtney, Stephanie	Crafts, play time, meal time, board games
One more/one less	Elizabeth, Kelsey, Stephanie	Play time, meal time, music

Spatial terms	Amanda, Elizabeth, Courtney, Kelsey, Stephanie	Play time, walks, books, blocks/Legos, music, cooking, baking, puzzles, meal time
Spatial awareness	Amanda, Elizabeth, Brittany, Courtney, Kelsey, Stephanie	Play time, blocks/Legos, sandbox, routines, puzzles, pool time
Patterns/sequences	Amanda, Elizabeth, Tara, Brittany, Courtney, Kelsey, Stephanie	If/then statements, walks, meal time, blocks/Legos, music, books, routines, church activities, play time, getting dressed
Volume	Amanda	Play time, sandbox
Size comparison	Amanda, Tara, Courtney, Kelsey, Stephanie	Walks, crafts, books, playdough, play time, blocks/Legos, puzzles
Money	Brittany	church activities

[a]Contexts that are underlined refer to activities shown or described just by the participants not included in the main study (Kelsey and Stephanie)