

## **MOTHER-CENTERED UNDERSTANDING OF MATHEMATICAL INTERACTIONS WITH CHILDREN: PURSUING POSITIVE INTENT**

Sam Prough  
University of Wisconsin-Madison  
sprough@wisc.edu

*How past research considers the influence of parents on their children's mathematical understanding does not often focus on the experience and intent of the parents themselves. In a cross-case analysis, I address how two mothers' experience shapes their mathematical positioning and the resulting interactions with their children in the subject. The attention on parents in mathematics takes on particular gendered roles, which is not often considered in research. There are more complex factors that shape how parents see and interact with mathematics. This study begins to show what alternative possibilities exist for engagement by U.S. parents in the content that still positively support children's early learning.*

Keywords: Informal Education; Gender and Sexuality; Affect, Emotion, Beliefs, And Attitude

### **Objectives**

Mathematics is taught and learned across a wide array of environments and situations, certainly not limited to the school classroom. Parents are often involved in early childhood mathematics learning through authentic engagement in everyday activities. However, across studies on parental influence on children's learning is the assumption of mother as a proxy for parent (Posey-Maddox, 2017). In research and media, mothers are frequently assumed to be doing the work of parenting. Maloney and colleagues (2015) claim that "parents are their children's first and most sustained teachers" (p. 1480). This statement coupled with the assumption of mothers doing the work of parenting implies that *mothers* are these first teachers. What is missing across literature on parents involved in mathematics learning is a focus of perspective on the parents and exploration of the parental (or specifically maternal) intentions.

The connections between parenting and mothering create additional tensions within the often-masculinized environment of mathematics. Mathematics is often framed as being for men and unwelcoming to women (e.g., Connell, 2010; Hottinger, 2016). Given the parallels between women and mothers (Arendell, 2000), potentially negative assumptions are made about mothers engaging with their children in mathematics. I explore the following questions: How does past experience in mathematics impact mothers' interactions with their child's early learning? What does this say about a mother's intent to support mathematical learning? Exploring the factors that direct mothers' action in mathematics provides a richer context for researchers in understanding parents' action in mathematical learning.

### **Background Literature**

To understand how experience impacts mothers' interactions in mathematics requires an exploration of the larger context of motherhood expectations, parents' experience in mathematics, and the types of alternative activities parents can use to engage their children in early mathematical learning. The expectations within motherhood show what societal factors function to direct a mothers' actions in mathematical engagement. For example, adults in the United States believe that the more time women spend with their children, specifically giving their time to their children's development, the better mothers they are (Dillaway & Pare, 2008; Gorman & Fritzsche, 2002). These beliefs frame a

societal expectation that mothers should be caring for and teaching their children, which mothers may identify as an obligation in their role as mothers.

Previous research that has studied parents' experience in mathematics has focused on the activities parents might do at home (e.g. Elliott & Bachman, 2018; LeFevre, Skwarchuk, Smith-Chant, Fast, Jamawar, & Bisanz, 2009) or the transfer of parental anxiety, affecting performance (e.g. Maloney et al., 2015). Research indicates a focus on authentic problem-solving (Pattison, Rubin, & Wright, 2016) and hands-on activities (Elliott & Bachman, 2018) in everyday tasks are common strategies for effectively engaging children in mathematical learning. While mathematical activity at home can be enriching for children, many parents do not recognize these problem-solving tasks as forms of mathematics (Goldman, 2005). Rich mathematics learning can happen at home, but much research on parents in mathematics is centered around how their anxiety impacts children's performance, often focused on mothers (e.g. Else-Quest, Hyde, & Hejmadi, 2008; Soni & Kumari, 2017). What is missing from this body of work is analysis from the perspective of mothers, to understand what has shaped their (gendered) experience and how they use it to create the best experiences for their children.

### **Theoretical Framework**

I use positioning theory to frame mothers' experience in mathematics and how they represent themselves today in actions with their children. This theory uses experience and broader context to position people or be positioned as mathematical or not. Positioning theory thus becomes a way to understand the influences across cultural norms, history, experiences, and interactions with others (Harré & Van Langenhove, 1999). How mothers are positioned and position others will speak to a larger context of expectations for mothers in mathematics and what they do to still support their children in learning. Positioning oneself as mathematically able or not is frequently paralleled with concepts of power and agency (e.g. Kotsopoulos, 2014; Langer-Osuna, 2017). Using these themes of agency in positioning in mathematics education can support the agency mothers may have in positioning themselves to teach their children.

### **Methods**

I use life history to capture the experience of my participants as a means to express the complexity of their experiences, informing their actions. Life history, an analysis of life stories, provides context to the situation and factors that make up the decisions of someone's life. "Life stories express our sense of self: who we are and how we got that way" (Linde, 1993, p. 3). This methodology supports a more intentional exploration of mothers and the reasons behind their mathematical interactions, which is frequently missing in mathematics education literature. Additionally, life stories can be characterized "as relational, as both personal and social, and as grounded in places" (Steeves, Clandinin, & Caine; 2013, p. 225). Life history offers a way to examine the connections to social and personal expectations more explicitly.

Two white, middle-class mothers, Ella and Corinne (names have been changed), who are roughly the same age, have young children, and spouses working in similar jobs, are the participants for this study. Their current life situations are similar, but their past mathematical experience and current interactions with their children differ in interesting ways. A comparison of their positioning in relation to their experiences demonstrates how mothers in different situations use available resources to provide the best mathematical opportunities they can for their children. Both participants were interviewed, with a focus on stories about their past mathematics experience and the current mathematical interactions they have with their children. Particular attention is given to the context of their stories, relating to feelings, relationships, and reflection. Interviews were audio-recorded and transcribed. A final meeting with each participant was made to go over their stories from the

transcription, in order to confirm the stories best represented their experience. Interviews were then coded for themes around their positioning as mathematical thinkers, gendered roles as women and mothers, and the resultant activity they had with their children in mathematics.

## Results

The difference in past experience and positioning of each mother frames how they see themselves today and ultimately engage with mathematics learning for their young children. While the specific activity differs, both mothers demonstrate attempts for positive and authentic engagement in activity. Ella came from a larger Midwest town, with an interest in reading and sports. The stories Ella shared continually related to her lack of confidence in her mathematical ability and in activity with mathematics today. In many stories related to her schooling, Ella described how teachers would put her on the spot to solve problems and she could not keep up with other students, never seeing herself as the smart one in class. Gendered roles from her past show how mathematics was understood and supported by her father, but not by her mother:

My mom's like me, she was, my mom was probably fine with elementary school but when I got past that she was like "you have to ask your dad." And my dad, he's an engineer, so he's got a great math brain.

Ella frequently connected to her mother and her lack of fluency in mathematics problem solving. Her experience with her parents in gendered roles of mathematics support extended to how she expected her and her husband to divide work in supporting their children's learning, saying "I feel like when we got married it just like, we fall into certain roles." She claimed it was more likely that her husband would help their children with math and she could assist them in other learning.

The interactions Ella currently has with her daughter in mathematics are focused primarily on counting activities. She explained how her daughter learned to count higher than expected by stating, "we count a lot, at home. Like, she learned to count to 13 because every time we'd go up and down the stairs we would count the stairs." Ella's experience working directly with mathematics and her daughter is based on activities that have an authentic connection to their everyday lives. In moments where Ella wants more mathematical exposure for her daughter, she relies on resources in other areas, such as math-focused games from the library, and specific initiatives directed to her husband about helping in mathematics.

Corinne grew up in a small Midwest town, with a love of mathematics and learning, encouraged by her parents and supported by teachers. The stories Corinne shared related to her interest in math and dedication to engage her children in math at every available opportunity. Similar to Ella's experience, Corinne's parents had an influence on her mathematical positioning, but it was her mother who associated with mathematics and her father who was hesitant: "My mom was an accountant. So we already had like the math background and she pushed school, like school was a pretty high priority in my house. Like math just came very easy to me." The gendered roles of her parents' connection to mathematics, coupled with the positive positioning of Corinne as mathematical, supported Corinne's current activity with mathematics and her children. She is engaged often with her children in mathematical tasks and sees that as an important feature for parents who know math, connecting to a shared future role in teaching for her and her husband, where they both have mathematical backgrounds.

The activities Corinne uses to engage her children in mathematics have similar authentic connections to everyday life. However, Corinne feels comfortable asking her children questions in the moment and engaging in mathematics across any activity where a mathematical opportunity may present itself. She shared the following story about her youngest daughter:

I was cutting up a banana for her and counting as I did it and I would pause and she would sometimes fill in the next number and I was like oh, okay you know way more than I thought you did, you can just count things.

Corinne's comfort in asking her children mathematics questions allows for opportunities to push for deeper connections in authentic settings, extending from counting to arithmetic and geometric reasoning.

### **Discussion and Implications**

The experience and action of both Ella and Corinne demonstrate the impact of family and teacher positioning on a person's association with mathematics. Ella's association with her mother, who did not connect with math, and repeated interactions with teachers and peers that she was not learning math quickly enough have shaped how Ella characterizes herself today as uncomfortable with the subject. Corinne's past connections with her mother, who did connect with math, and the repeated affirmations by teachers of her success have shaped Corinne's continued positive associations with the subject. Literature on mathematical development in children often stresses the influence parents and teachers can have (e.g. Maloney et al., 2015; Pea & Martin, 2010). While this influence is apparent in how Ella and Corinne position themselves today, it also informs the influence of their mathematical activity with children. In this sense, mathematics interaction by parents can have a generational impact.

How Ella and Corinne interact with mathematics and their children today has marked differences, and reflects on their prior experience in the subject. Ella relies on outside or common resources, such as directives for her spouse or everyday tasks, to support engagement in mathematics for her daughter. She uses these elements as a way to counteract her positioning of uncertainty and discomfort with the subject. Corinne relies on authentic moments in everyday tasks to ask more math-specific questions of her children, divided equally with her mathematically-capable spouse. Her actions reflect similar exposure to the subject she received from her mother and repeated positioning by parents and teachers as mathematically capable. While there are variations in the kinds of activities Ella and Corinne choose, both reflect positive forms of mathematical engagement.

Ella and Corinne's interactions with children are based on authentic activity. As Pattison and colleagues (2016) suggest, this attention to authentic, at-home mathematics learning in diverse settings effectively supports mathematical reasoning. In both cases, the mothers are seeking out positive forms of mathematical engagement with their available resources and reflective of the positioning that they have. These interactions may have elements of difference, but they both rely on the use of everyday activity and are done with the best of intentions for their children. The cases of Ella and Corinne demonstrate alternative understanding of mothers' engagement with mathematics and recognition of context informing their interactions.

While there are limitations in the current study due to a lack of diversity in the participants, this study acts as a gateway to further exploration of parents (not just mothers) and their mathematical interactions. Literature that addresses Black mothers' perspectives in engagement to promote academic success for their older children (e.g. Jackson & Remillard, 2005; McGee & Beale Spencer, 2015) offer further validation to the possibilities of mothers' positive interactions in mathematics. Future work can strengthen connections between school and early childhood mathematics while alleviating the assumptions about mothers negatively impacting their children. Additional attention is needed to understand the complexity of experience and the factors that shape parents' positioning and resultant interaction with mathematics.

## References

- Arendell, T. (2000). Conceiving and investigating motherhood: The decade's scholarship. *Journal of Marriage and the Family*, 62, 1192–1207.
- Connell, R. W. (2010). The social organization of masculinity. In C. R. McCann & S.-K. Kim (Eds.), *Feminist theory reader: local and global perspectives* (Second, pp. 232–243). New York, NY: Routledge.
- Dillaway, H., & Pare, E. (2008). Locating mothers: How cultural debates about stay-at-home versus working mothers define women and home. *Journal of Family Issues*, 29(4), 437–464.
- Gorman, K.A., & Fritzsche, B.A. (2002). The good-mother stereotype: Stay at home (or wish that you did!). *Journal of Applied Social Psychology*, 32(10), 2190–2201.
- Elliott, L. & Bachman, H.J. (2018). How do parents foster young children's math skills? *ChildDevelopment Perspectives*, 12(1), 16-21.
- Else-Quest, N. M., Hyde, J. S., & Hejmadi, A. (2008). Mother and child emotions during mathematics homework. *Mathematical Thinking and Learning*, 10(1), 5–35. <https://doi.org/10.1080/10986060701818644>
- Goldman, S. (2005). A new angle on families: Connecting the mathematics of life with school mathematics. *Learning in Places: The Informal Education Reader*, 249, 54–76. <https://doi.org/10.1038/367685a0>
- Harré, R. & Van Langenhove, L. (Eds.) (1999). *Positioning theory: Moral contexts of intentional action*. Oxford; Blackwell Publishers.
- Hottinger, S.N. (2016). *Inventing the mathematician: Gender, race, and our cultural understanding of mathematics*. Albany, NY: SUNY Press.
- Jackson, K., & Remillard, J. T. (2005). Rethinking parent involvement: African American mothers construct their roles in the mathematics education of their children. *The School Community Journal*, 15(1), 51–73.
- Kotsopoulos, D. (2014). The case of Mitchell's cube: Interactive and reflexive positioning during collaborative learning in mathematics. *Mind, Culture, and Activity*, 21(1), 34–52. <https://doi.org/10.1080/10749039.2013.790905>
- Langer-Osuna, J. M. (2017). Leading a group discussion: authority, positioning, and learning in problem-based mathematics classrooms. In *TeachingWorks* (pp. 1–13).
- LeFevre, J., Smith-Chant, B.L., Skwarchuk, S-L., Fast, L., Kamawar, D., & Bisanz, J. (2009). Home numeracy experiences and children's math performance in the early school years. *Canadian Journal of Behavioural Science*, 41(2), 55-66.
- Linde, C. (1993). *Life stories: The creation of coherence*. New York, NY: Oxford University Press.
- Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science*, 26(9), 1480–1488.
- McGee, E., & Beale Spencer, M. (2015). Black parents as advocates, motivators, and teachers of mathematics. *The Journal of Negro Education*, 84(3), 473–490.
- Pattison, S., Rubin, A., & Wright, T. (2016). Mathematics in informal learning environments: A summary of the literature. In *Math in the Making* (pp. 1–11).
- Pea, R., & Martin, L. (2010). Values that occasion and guide mathematics in the family. In W. R. Penuel & K. O'Connor (Eds.), *Research on learning as a human science* (Vol. 109, pp. 1–29). New York: Teachers College Press.
- Posey-Maddox, L. (2017). Schooling in suburbia: the intersections of race, class, gender, and place in black fathers' engagement and family-school relationships. *Gender and Education*, 29(5), 577–593.
- Soni, A., & Kumari, S. (2017). The role of parental math anxiety and math attitude in their children's math achievement. *International Journal of Science and Mathematics Education*, 15(2), 331–347. <https://doi.org/10.1007/s10763-015-9687-5>
- Steeves, P., Clandinin, D.J., & Caine, V. (2013). Stories to live by: Composing identities. In D.J. Clandinin, P. Steeves, & V. Caine (Eds.), *Composing lives in transition: A narrative inquiry into the experiences of early school leavers* (pp. 225-240). United Kingdom: Emerald Group Publishing Limited.