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The indirect effect of children's gender on early childhood educators' mathematical talk

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HIGHLIGHTS

- This study examined differences in teachers' mathematical talk with girls and boys.
- Differences seem dependent upon the structure of the classroom routines.
- Boys were engaged more often in mathematical talk in the math/science play area.
- Girls were engaged more often in mathematical talk in the house and art play areas.
- Interactions may be building children's notion of mathematics as a male domain.

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ABSTRACT

The purpose of this study is to examine how teachers might engage in mathematical talk differently with boys and girls within an early childhood classroom setting; therefore, possibly building and maintaining the stereotype of mathematics as a male domain. Utilizing a multi-model approach, results suggests minimal differences in the extent in which teachers in this study engaged in mathematical talk with girls and boys in class. However, any noted differences in mathematical talk and questions seem dependent upon the classroom contexts (i.e., whole-class, small group, and center time). Implications and future research will be discussed.

1. Introduction

I set the two red blocks down on top of my tower. Once I am satisfied, I turn to gather more blocks when Jansen takes it upon himself to run his wooden truck through my tower. I am surrounded by my work, standing within the scattered blocks that were once my tower. As I bend to gather blocks to rebuild my tower, I hear a boy's voice behind me, yelling at me. "Get out!" I turn my head to come face to face with Zack. "No!" I said as I stomped my right foot. Zack continued, "You need to go to the book area. No. You need to go to the house area." I ignored him and directed my attention toward rebuilding my demolished tower.

In this vignette, might one argue that Samantha is actively resisting the notion that girls belong in the book area and/or house area rather than in an area where she is mathematically engaged with shapes, spatial skills, and symmetry? How might Zack's comments be positioning him as a "superior" male and Samantha as a "inferior" female? How might the gendered and mathematical discourses of adults in the classroom become actively intertwined with the gendered and mathematical discourses of these children?

At an early age, children become aware of culturally "appropriate" feminine and masculine activities and interests (Huston, 1985; Martin & Ruble, 2004), and are socialized and self-socialized to enact such "appropriate" behaviors (Leman & Tenenbaum, 2011; Orr, 2011; Wilson, 2011). Children typically learn that there are two distinct genders (i.e., male and female) and they belong to only one of them; thus behave, think, and talk accordingly (Martin & Ruble, 2004). For example, Orr (2011) noted that girls were more likely than boys to engage in stereotypical "feminine" behaviors such as reading and chores, while boys were

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more likely than girls to engage in stereotypical "masculine" behaviors such as building and playing sports. As noted by Bigler (1995), such dichotomous categories may increase children's gender stereotyping, which is a notion prevalent in regards to mathematics, with a general societal belief that mathematics is a male-oriented domain (Forgasz, Leder, & Tan, 2014). Particularly, Forgasz et al. (2014) reached this *general* conclusion after surveying 505 participants (aged under 20 to 40+) in nine different countries – Australia, Canada, China, Egypt, India, Israel, Singapore, United Arab Emirates, and United Kingdom.

Children as young as second grade demonstrate on both implicit (not stated) and explicit (self-report) measures this cultural stereotype that "math is for boys" (Cvencek, Meltzoff, & Greenwald, 2011) and this stereotype may only increase with age (Muzzatti & Agnoli, 2007) affecting children's academic self-concept, achievement, and course preferences either positively or negatively (Ambady, Shih, Kim, & Pittinsky, 2001; Steffens, Jelenec, & Noack, 2010). For example, Steffens et al. (2010) concluded that females that held implicit math-gender stereotypes in favor of boys also held low implicit self-concepts in mathematics.

Children's beliefs and achievement in mathematics may be influenced by teachers' own expectations, beliefs, and explicit communication of what is mathematically "appropriate" for females and males within a particular culture or classroom (Fennema & Peterson, 1985; Gunderson, Ramirez, Levine, & Beilock, 2012). For instance, Fennema, Peterson, Carpenter, and Lubinski (1990) discovered that first-grade teachers assigned significantly different adjective descriptions for boys and girls, in which boys were perceived to be more competitive, more logical, more adventurous, more independent in mathematics, volunteer more answers to mathematics problems, and enjoyed mathematics more often than girls. While girls were viewed on the other end of the spectrum, namely less competitive, less logical, and less independent as a few examples. Teachers may unknowingly incorporate personal gender assumptions and biases, those typically embedded in society, into the classroom through verbal and non-verbal cues, thus producing and reproducing the notion of male dominance (Bhana, 2009; Pardhan, 2011). Such implicit mechanisms, for instance that boys possess higher mathematical abilities than girls (Tiedemann, 2000), may encourage boys to be more visible within mathematical practices in the classroom, rendering girls mathematically invisible (Pardhan, 2011). However, we are unaware of any studies that examine how a teacher's mathematical practices and interactions with young children (ages 2–5) in a preschool setting may or may not differ based on one's gender. Therefore, the purpose of this study is to add to this body of research by examining how teachers might engage in mathematical talk differently with boys and girls within an early childhood classroom setting.

2. Theoretical framework

As part of this study, we utilize the gender schema theory (Bem, 1981, 1993). The gender schema theory proposes that implicit stereotypes, as defined by the expectations and ideals of one's culture, become internalized by individuals through the socialization process (Bem, 1981, 1993). As gender schemas are developed, they begin acting as a filter that leads females and males to conform to the expectations, behaviors, and actions expected of their *sex,* not based on their gender (Bem, 1981). In other words, males tend to navigate toward "masculine" behaviors and actions and females tend to navigate toward "feminine" behaviors and actions. This "pressure" to conform may lead some children to not explore or pursue behaviors and actions that may interest them, but to settle on options less enjoyable (Bem, 1981; Egan & Perry, 2001). These typically lead to a belief that females and males are more different from one another than they may be, and in regards to this study, that teachers' may verbally exacerbate such "differences," unconsciously, and at times consciously, through mathematical interactions (Gunderson et al., 2012; Scantlebury & Baker, 2007).

We acknowledge that pressure to conform and exhibit gender-congruent behaviors is not necessarily one-dimensional, but multi-faceted (Vantleghem & Van Houtte, 2015). Additionally, we are aware that some argue that girls and boys are biologically or naturally different from one another; for example, boys and girls learn differently (e.g., Gurian Institute, 2013; Sax, 2005). These "differences" have since been translated into classroom practices and advice for teachers when working with boys and girls such as girls prefer to work with one another, while boys prefer to work individually (Sax, 2005). Even though we do not align our perspective with this essentialist viewpoint, we do contend that gender socialization may more or less be influenced by beliefs in biological differences.

3. Method

This study stems from a larger mixed methods research project in which researchers examined the impact of a professional development model on the mathematics environment in Head Start and Early Head Start settings (for children from birth to age five). One particular objective was to increase the amount of mathematical discourse occurring in the classroom environment because past research has shown that the amount of teacher mathematical talk is positively related to children's mathematical knowledge (Klibanoff, Levine, Huttenlocher, Vasilyeva, & Hedges, 2006). As part of the larger project, ongoing video data was collected from five Head Start teachers chosen from participating sites because of their responses on a mathematics belief instrument, *Integrating Mathematics and Pedagogy* [IMAP] (Ambrose, Phillip, Chauvot, & Clement, 2004). As the researchers began to analyze the video data with a phenomenological approach (Moustakas, 1994), a concern related to observations of possible gender issues within mathematics across three specific contexts (circle time, small group time, and center time) emerged. This emerging concern led to the research question guiding the current study.

How, and to what extent, might young female and male children (aged 2–5) be engaged differently in mathematical talk by teachers within an early childhood classroom setting?

The videos were reviewed, documenting any moments in which teachers and students were engaged in mathematical talk, and further transcribed verbatim. The researchers used a multi-model approach (Johnson & Onwuegbuzie, 2004) where qualitative and quantitative analysis approaches are used to examine a single set of data. The researchers first examined the transcripts from classroom videos using two coding instruments (see Section 3.3) and then reexamined the videos with a more critical approach to identify emerging themes related to gender in each context.

3.1. Participants

This study was conducted with Head Start and Early Head Start teachers in Gate County (pseudonym), a county located in a southeastern state in the United States. In Gate County, with an approximate population of 475,000, there are 12 Head Start centers located throughout the county. Even though Head Start is a United States based program for children aged birth to five, such early learning opportunities are prevalent in many international contexts such as the Sure Start program in the United Kingdom or Voor-en Vroegschoolse Educatie (Pre- and Early Primary School Education) in the Netherlands. As noted above (refer to Section 3), a