Type: Poster Presentation
Title: The M in STEM: Parents' Support of Early Math Development Depends on Children's Gender
Author(s): Olivia Rastatter, Lillian Urness, Ashli-Ann Douglas, and Bethany Rittle-Johnson (Vanderbilt University)

<olivia.c.rastatter@vanderbilt.edu>

Abstract:
Preschoolers' early math skills are predictive of their later math and broader academic achievement (Duncan et al., 2007, Jordan, Kaplan, Olah, & Locuniak, 2006; Aunola, Leskinen, Lerkkanen, & Nurmi, 2004). However, when children enter kindergarten, they have disparate mathematics skills (Elliott & Bachman, 2018), pointing to differences in the math input that they receive from their parents (Dearing et al., 2012). A key factor that explains some of this variability in parents' math input is their beliefs about math (e.g. Missall et al., 2015). Some parents believe that math is unimportant for and uninteresting to their preschool children (Cannon & Gibsburg, 2008), and believe that boys are better at math than girls (Belk, 2014; Lummis and Stevenson, 1990).

The current study focuses on parents' input and beliefs about magnitude comparison (the ability to compare the size of numbers) which is considered the "core" of numerical development (Siegler, 2016). Unfortunately, parents provide magnitude comparison input infrequently (Ramani et al., 2015). We ask about the connections between child gender, parents' beliefs about their child's magnitude comparison ability and the importance of their child being good at magnitude comparison, and the frequency of parents' magnitude comparison input:

1. Is there a gender difference in parent belief about their child's magnitude comparison ability and the importance of it?
2. Does the gender of the child influence parents' magnitude comparison input?

Participants were 59 parent-child dyads which consisted of a 3- to 5- year-old child (54% male) and a parent (75% female). Parents were mostly White (78% White, 10% Black, 3% Asian or Pacific Islander; 9% Biracial) and educated (every parent, except for one father, had a high school degree or GED, and 96% of mothers and 93% of fathers continued their education after high school).

Parents completed a survey regarding their beliefs about their child's magnitude comparison and other academic skills and the importance of these skills before and a week after participating in a twenty-minute, videotaped play session. They rated their beliefs on a 7-point Likert scale (1 = not good at all or not very important; 7 = very good or very important). During the play session, parents and children played the card game *War* and a card game of their choice for approximately five minutes each in a counterbalanced order. Then, parents were given oral and written information about the importance of magnitude comparison, along with examples of how to support their children's use of their magnitude comparison skills in everyday tasks. Lastly, the dyads played *War* and the other card game after the information. Parents' talk during card play was coded in 10-second intervals for symbolic and non-symbolic magnitude comparison input.

First, we conducted independent samples t-tests to compare the beliefs parents held before the play session based on child gender and found no significant differences (see mean ratings in Table 1). Specifically, there were no significant difference in parents' belief about child current ability, $t(57) = .99$, $p = .33$, $d = 0.06$, child future ability, $t(57) = 3.72$, $p = .71$, $d = 0.10$, or child innate ability, $t(57) = .25$, $p = .81$, $d = 0.06$. There was also no difference in parent's ratings of the importance of their child's magnitude comparison skills, $t(57) = .67$, $p = .51$, $d = 0.169$, or how useful they think magnitude comparison skills will be for their child, $t(57) = -.29$, $p = .78$, $d = 0.44$.

Lastly, we conducted independent samples t-tests to examine the frequency of magnitude comparison input provided by parents of girls and parents of boys. Before receiving the information, there was was no significant difference between the input of parents of girls (M = 27% of the 10-second intervals, SD = 9%) and parents of boys (M = 23%, SD = 9%); $t(57) = -1.49$, $p = .141$, $d = 0.44$. However, after receiving the information, parents of girls provided significantly more magnitude comparison input (M = 33% of the 10-second intervals, SD = 18%) than parents of boys (M = 23%, SD = 10%); $t(57) = 2.613$, $p = .01$, $d = 0.66$.

The significant gender difference in the frequency of parents' magnitude comparison input only after the intervention suggests that parents who engaged in the session with their daughters had a stronger impetus to aid the development of their daughters' magnitude comparison skills than parents who engaged in the session with their sons. This could be because they think their daughters need more assistance, or because they believe their daughters have a greater ability to improve. The current study suggests that parents of preschool boys should be more intentional about assisting their sons with magnitude comparison skills. Our non-significant findings about gender differences in parents' beliefs about magnitude comparison might suggest that factors other than math-gender stereotypes among parents explain variability in the math input that they provide their preschoolers. The previous research that demonstrated math gender stereotypes among parents were done with parents of older children than the current study (Belk, 2014; Lummis and Stevenson, 1990), so it may be that parents develop these beliefs as their children age beyond preschool. Overall, the current study has implications for how preschool and elementary teachers interact with parents and with children of different genders. Specifically, teachers might need to be intentional about telling parents that all children (regardless of their gender) can benefit from math support at home. It may also be beneficial if teachers make parents aware of possible gender biases (Eccles, 2005). Finally, the current study highlights the need for more research on the factors that explain the variability in parents' support of children's early math knowledge, and how parents' math-related beliefs about their children change across formal schooling.

Table 1

Parents' rating of their child-specific beliefs about magnitude comparison before they received information about it

	Rating Mean (Standard Deviation)	
Belief about Children	Girls	Boys
Current ability	4.59(1.34)	5.00(1.76)

Future ability	5.89(1.09)	6.00(1.19)
Innate ability	4.93(0.96)	5.00(1.30)
Importance of ability	6.15(1.03)	6.31(0.86)
Usefulness of ability	6.70(0.67)	6.66(0.60)

References:

Aunola, K. Leskinen, E., Lerkkanen, M.K., and Nurmi, J.-E., (2004). Developmental dynamics of math performance from preschool to grade 2. *Journal of Educational Psychology*. *96*(4), 699-713). https://Doi.org/10.1037/0022-0663.96.4.699

Belk, M. S. (2014). *Parental beliefs mediating the occurrence of stereotype threat effects in young children* (Ph.D., Fielding Graduate University). Retrieved from https://search.proquest.com/docview/1504274577/abstract/1042397BC71437CPQ/1

Cannon, J., & Ginsburg, H. P. (2008). "Doing the math": Maternal beliefs about early mathematics versus language learning. *Early Education & Development*, *19*(2), 238–260. https://doi.org/10.1080/10409280801963913

Dearing, E., Casey, B. M., Ganley, C. M., Tillinger, M., Laski, E., & Montecillo, C. (2012). Young girls' arithmetic and spatial skills: The distal and proximal roles of family socioeconomics and home learning experiences. *Early Childhood Research Quarterly*, *27*(3), 458–470. https://doi.org/10.1016/j.ecresq.2012.01.002

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., … Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, *43*(6), 1428–1446. http://dx.doi.org.proxy.library.vanderbilt.edu/10.1037/0012-1649.43.6.1428

Eccles, J.S. (2005). Influences of parents' education on their children's educational attainments: The role of parent and child perceptions. *London Review of Education, 3*(19), 191–204. https://doi.org/10.1080/14748460500372309

Elliott, L., & Bachman, H. J. (2018). SES disparities in early math abilities: The contributions of parents' math cognitions, practices to support math, and math talk. *Developmental Review, 49*, 1–15. https://doi.org/10.1016/j.dr.2018.08.001

Gunderson, E.A., Ramirez, G., Levine, S.C., Beilock, S.L. (2012) The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles*. *66*(4), 153-156. https://doi.org/10.1007/s11199-011-9996-2

Jordan, N. C., Kaplan, D., Ramineni, C., & Locuniak, M. N. (2009). Early math matters: Kindergarten number competence and later mathematics outcomes. *Developmental Psychology, 45*(3), 850–867. https://doi.org/10.1037/a0014939

Lummis, M., & Stevenson, H. W. (1990). Gender differences in beliefs and achievement: A cross-cultural study. *Developmental Psychology*. *26*(2), 254-263.

Missall, K., Hojnoski, R. L., Caskie, G. I. L., & Repasky, P. (2015). Home numeracy environments of preschoolers: Examining relations among mathematical activities, parent mathematical beliefs, and early mathematical skills. *Early Education and Development*, *26*(3), 356–376. https://doi.org/10.1080/10409289.2015.968243

Ramani, G. B., Rowe, M. L., Eason, S. H., & Leech, K. A. (2015). Math talk during informal learning activities in Head Start families. *Cognitive Development*, *35*, 15–33. https://doi.org/10.1016/j.cogdev.2014.11.002

Siegler, R. S. (2016). Magnitude knowledge: The common core of numerical development. *Developmental Science*, *19*(3), 341–361. https://doi.org/10.1111/desc.12395