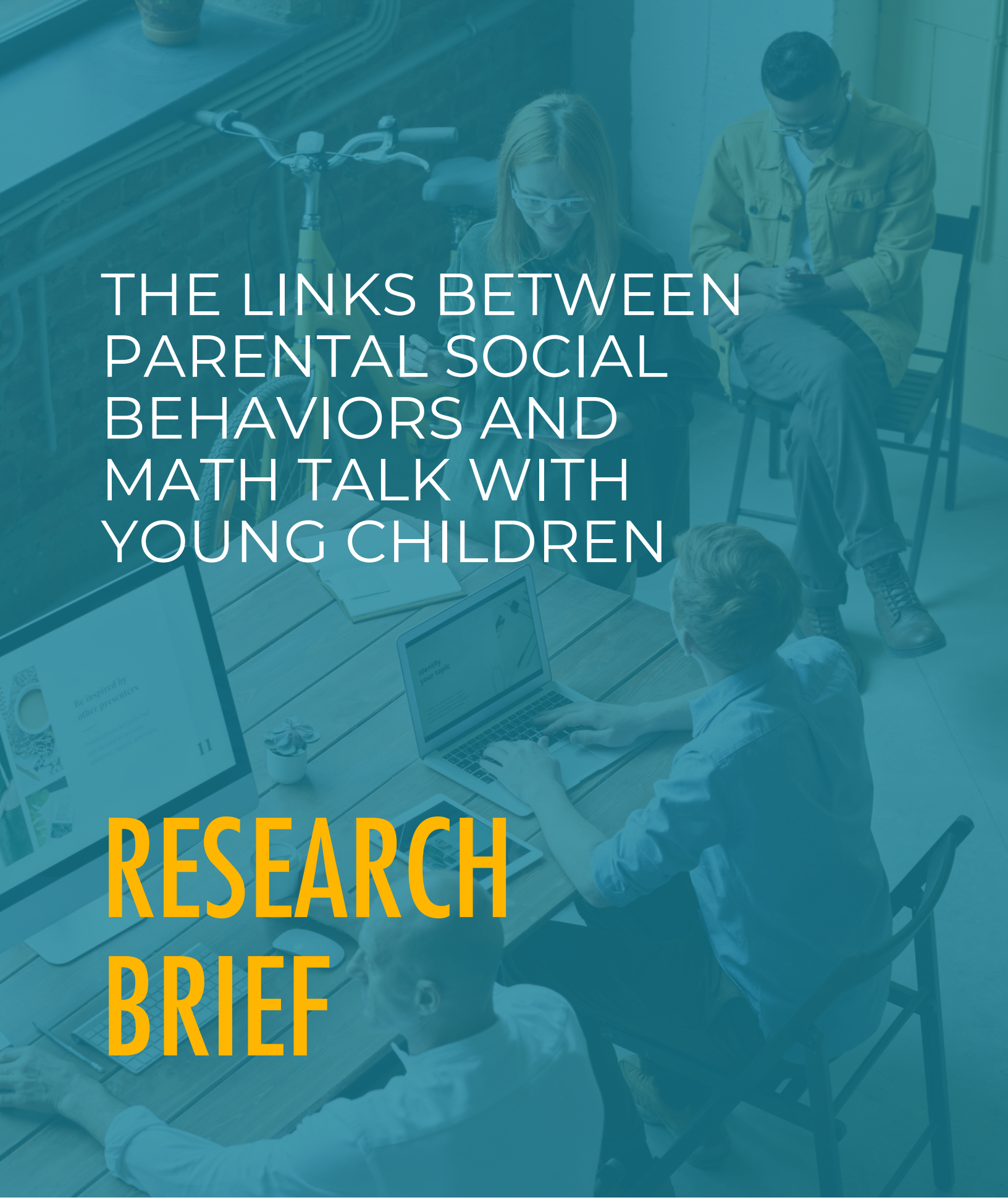

THE LINKS BETWEEN PARENTAL SOCIAL BEHAVIORS AND MATH TALK WITH YOUNG CHILDREN

RESEARCH BRIEF

Center for Family Math

ABOUT AUTHOR

Dr. LaTreese V. Hall is an Assistant Professor of Developmental Psychology at Saint Xavier University, where she leads the GLAD Lab (Gamification, Learning, and Development). Her research explores how games and playful interactions can support children's learning and development. Dr. Hall designs and evaluates gamified interventions that help adults engage more effectively with children, aiming to strengthen cognitive development and promote joyful, meaningful learning experiences.

LaTreese V. Hall

Assistant Professor of Developmental Psychology at Saint Xavier University
Ph.D., Florida International University
You can connect with Dr. Hall on LinkedIn at www.linkedin.com/in/latreese-v-hall-ph-d-466080161

OVERVIEW

Understanding parent-child interactions can help develop and improve strategies for parents, teachers, and practitioners to support children's early math development. To that end, this brief summarizes recent research about conversations between children and their parents, and whether these conversations support the development of number and spatial skills. Among other conclusions, its primary finding suggests that children perform better in these tasks when parents use supportive language that fosters autonomy and that these effects differ when doing different types of tasks.

Key takeaway(s)

- Children learn through making mistakes - instead of focusing on or highlighting children's mistakes, parents can support math learning by actively listening to how children are reasoning about mathematics and offer redirection.
- **Do** encourage positive, supportive, and autonomy-granting language (e.g., active listening, independence encouragement, praise for hard work) during play-based activities.
- **Do** recognize that parental math talk may vary depending on the task and the child's gender, requiring tailored strategies in different settings.

Key Research Questions

1. Do parents who use higher amounts of supportive language (e.g., praise, repeating what child says, describing child behavior) also use a higher amount of talk about numerical concepts (e.g., counting, adding, subtracting, comparing amounts) and spatial concepts (e.g., shapes, sizes, locations, directions)?

2. Do parents who use more negation talk (e.g., corrections and criticisms) engage in less numerical and spatial talk with their children?

ABOUT THE PROJECT

Methodology
Dr. Hall and her team at Florida International University conducted observational studies with 51 caregivers and their 4- to 7-year-old children at the Project on Language and Spatial Development lab, led by principal investigator, Dr. Shannon Pruden. Parents and children interacted for ten minutes during two distinct activities: a structured Lego-building task (Figure 1) and a semi-structured drawing task. The team then analyzed parental language during these tasks to identify any relations between parents' use of prosocial or negation talk and their production of numeracy and spatial talk. Table 1 provides definitions of these different types of talk parents may engage in with a child during play.

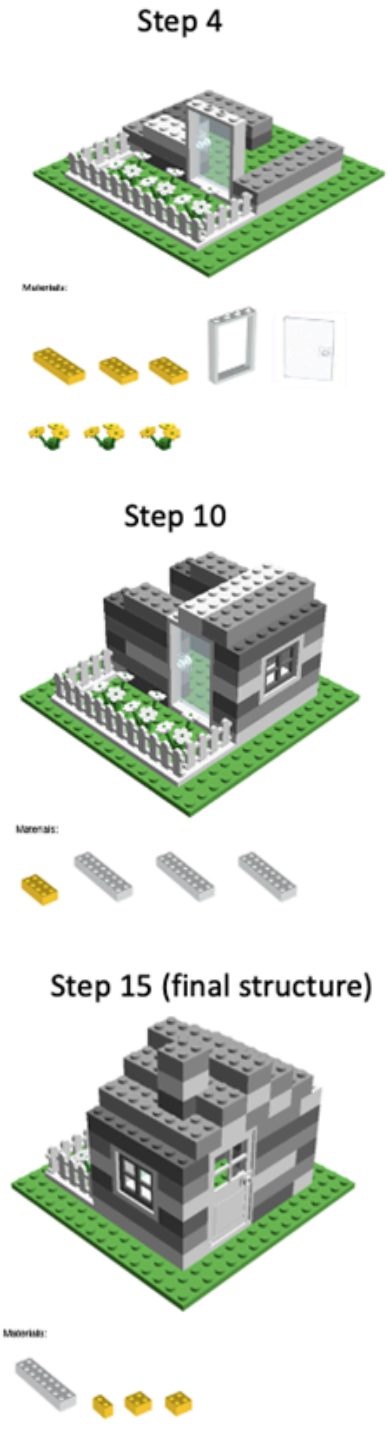

Figure 1. Steps 4, 10, and 15 of the structured LEGO activity. Families were provided with custom-made pictographic instructions–similar to the types of instructions found in a LEGO set–and worked together for 10 minutes to build the final structure while they were observed for verbal social behaviors. The task was intentionally designed to be too difficult for children to complete alone so we could observe how parents interact with their children while building collaboratively.

ABOUT THE PROJECT

Table 1. Observed language variables, definitions and examples.

Category	Definition	Example [Spanish Translation]
Prosocial Talk		
Behavior Descriptions	Non-evaluative, declarative sentences or phrases in which the subject is the other person, and the verb describes that person's ongoing or immediately completed (< 5 sec.) observable verbal or nonverbal behavior.	You're building a truck. [Estás construyendo un camión] You're putting the green block on. [Estás poniendo el bloque verde.]
Praises	Verbalizations expressing a favorable judgment of an attribute, product, or behavior of the child.	You did a great job of building the tower. [Hiciste un gran trabajo al construir la torre.]
Reflective Statements	Declarative utterances that have the same meaning as child utterances. The statement may paraphrase or elaborate child's utterance not change the meaning.	Child: I put the window and the flower here. Parent: You put the window and the flower beside each other. [Niño: Pongo la ventana y la flor aquí. Padre: Pones la ventana y la flor una al lado de la otra.
Negation Talk	Verbal expressions of disapproval of the child's choices or attributes. This also includes sarcastic or rude verbalizations.	That's not quite right, sweetie. [Eso no está del todo bien, cariño.] You're working too slowly. [Estás trabajando demasiado lento.] Uh oh, you put it on the wrong side. [Uh oh, lo pusiste del lado equivocado.]
Numerical Talk		
Counting	Number words produced in an ordered sequence.	One, two, three. [Uno, dos, tres.]
Cardinality	Use of number words that refer to the total number of elements in a set.	We have four blocks. [Nosotras tenemos cuatro cuadras.]
Arithmetic	Addition or subtraction of numbers.	You have to add one more. [Tienes que añadir uno mas.]
Ordinality	Indicating the position in a series.	This is the first step. [Este es el primer paso.]
Magnitude	Comparison of amounts.	I have more cars than you. [Tengo más coches que tú.]
Numerals	Providing labels of printed numerals.	This is the number 3. [Este es el número 3.]

ABOUT THE PROJECT

Table 1. (Continued)

Category	Definition	Example [Spanish Translation]
Spatial Talk		
Dimensions	Use of words to describe the size of 2- and 3-D objects, people, or spaces.	That one is the big block. [Ese es el bloque grande.]
Shapes	Words that describe the standard form of enclosed 2- and 3-D objects and spaces.	You are driving in a circle. [Estás conduciendo en un círculo.]
Spatial Features/ Properties	Words that describe the features and properties of 2-and 3D objects, people, spaces, and the properties of their features.	This is the flat block. [Este es el bloque plano.]
Locations and Directions	Words that describe the relative position of objects, people, and points in space.	Draw the tree on top of the hill. [Dibuja el árbol en la cima de la colina.]
Continuous Amounts	Words that describe amount of continuous quantities.	The fence should go in this section. [La valla debería ir en este tramo.]
Orientations	Words that describe the orientation or transformation of objects and people in space.	Rotate that piece upside down. [Rota esa pieza al revés].
Spatial Patterns (not included in analyses)	Words that indicate a person may be talking about a spatial pattern.	Long, short, long. [Larga, corta, larga.]
Deictics (not included in analyses)	Words that rely on context to understand their referent.	Put that one right here. [Pon ese aquí].

FINDINGS AND WHY THEY MATTER

Parents' prosocial talk related to the amount of spatial talk they produced while building with Legos and drawing

One of the key findings of this research is that parents' prosocial talk appears to relate to the amount of spatial talk they produced while building with Legos and drawing. Parents who produced higher quantities of prosocial talk (i.e., positive, supportive language) also produced significantly more spatial talk during both activities. Parents who provided encouragement and actively listened and responded to their children created an environment conducive to spatial learning (e.g., "wow, you did a great job putting the window in the middle, where should we put the flowers next?"). Interestingly, we did not find a similar association between prosocial talk and numerical talk which suggests different aspects of math talk may be uniquely associated with different parent communication styles.

These findings are important given the extensive research that shows the use of rich number and spatial language promotes children's early math learning,[1] as well as research that demonstrates more positive parental support is associated with children's development of number and spatial abilities.[2]

Parents' corrections were not related to the amount of spatial or numerical talk they provided during the Lego and drawing task

Our second variable of interest, negation talk (i.e., language that often focuses on corrections or criticisms), did not correspond with either increased or decreased amounts of spatial or numerical talk. Although the lack of a negative impact suggests that math language can still occur alongside corrections, negation is not an effective method to *increase* spatial and numerical talk. Instead, this study aligns with past findings that supportive talk that encourages autonomy is the more effective way to positively impact the development of children's number language and skills.[3]

[1] Levine, S. C., Suriyakham, L. W., Rowe, M. L., Huttenlocher, J., & Gunderson, E. A. (2010). What counts in the development of young children's number knowledge? *Developmental Psychology, 46*(5), 1309. https://psycnet.apa.org/doi/10.1037/a0019671; Pruden, S. M., Levine, S. C., & Huttenlocher, J. (2011). Children's spatial thinking: Does talk about the spatial world matter?. *Developmental Science, 14*(6), 1417-1430. https://doi.org/10.1111/j.1467-7687.2011.01088.x

[2] Casey, B. M., Dearing, E., Dulaney, A., Heyman, M., & Springer, R. (2014). Young girls' spatial and arithmetic: The mediating role of maternal supportive interactions during joint spatial problem solving. *Early Childhood Research Quarterly, 29*(4), 636-648. https://doi.org/10.1016/j.ecresq.2014.07.005; Clements, L. J., LeMahieu, R. A., Nelson, A. E., Eason, S. H., & Dearing, E. (2021). Associations between parents' numeracy talk and management language with young children. *Journal of Applied Developmental Psychology, 73*, 101261. https://doi.org/10.1016/j.appdev.2021.101261

[3] See, for example, Clements, L. J., LeMahieu, R. A., Nelson, A. E., Eason, S. H., & Dearing, E. (2021). Associations between parents' numeracy talk and management language with young children. *Journal of Applied Developmental Psychology, 73*, 101261. https://doi.org/10.1016/j.appdev.2021.101261

MAIN TAKEAWAYS

These findings have three practical implications:

1. Prioritizing positive, supportive interactions that encourage children to take the lead should be central to math interventions involving parents, teachers, and other caregivers.

2. While negation talk is generally less effective than positive, supportive language, it does not appear to have a harmful impact. When used sparingly and paired with encouragement, it may still serve a purpose. In this study, we surmise that because the tasks were difficult, corrections were expected and not off-putting to the children.

3. These patterns held true across different types of tasks (e.g. drawing or building), suggesting broader applications across different types of activities.