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Cognitive Development



Math talk during informal learning activities in Head Start families



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ARTICLE INFO

Keywords:

Parent input
Numerical knowledge
Head Start
Parent–child interactions
Home experiences

ABSTRACT

Children from low-income backgrounds are at risk for lower mathematical achievement. However, early numerical knowledge amongst children from lower-income families varies widely. Understanding sources of this variation could identify areas to intervene to reduce SES-related differences in math skills. Two sources of this variation were examined in Head Start families: (1) caregivers' and children's talk related to math during a dyadic interaction, and (2) caregiver reports of number-related experiences at home. Frequency of engaging in number-related activities at home predicted children's foundational number skills, such as counting. However, caregivers' talk during the interaction about more advanced number concepts for preschoolers, such as cardinality and ordinal relations, predicted children's advanced number skills that build on these concepts, such as numerical magnitude understanding. Findings suggest that the quantity and quality of number-related experiences that occur in the home can contribute to the variability found in low-income preschoolers' numerical knowledge.

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1. Introduction

Having a strong foundation in mathematics is essential for young children's success in school. Children's early mathematical abilities predict their growth in mathematics (Aunola, Leskinen, Lerkkanen, & Nurmi, 2007; Jordan, Kaplan, Locuniak, & Ramineni, 2007), and their performance on math achievement tests in later elementary school and even into high school (Duncan et al., 2007; Jordan, Kaplan, Ramineni, & Locuniak, 2009; Locuniak & Jordan, 2008). Furthermore, mathematical achievement can influence children's performance in college and future career opportunities (National Mathematics Advisory Panel, 2008).

Given the importance of children's early mathematical development, the wide range of individual variation in children's mathematical knowledge across different socioeconomic (SES) backgrounds is of particular concern. On average the mathematical knowledge of children from low-income backgrounds trails behind that of their peers from middle- and upper-income backgrounds with 4-year-olds from lower-income backgrounds at least seven months behind their peers from middle-income families, on average (Starkey, Klein, & Wakeley, 2004). These differences, however, are not found on all numerical tasks. On nonverbal numerical tasks, the average performance of young children from low-income backgrounds is similar to that of age peers from higher income backgrounds. However, differences are typically found on tasks with verbally stated numbers, story problems, written numerals, as well as higher-level math problems (Dowker, 2005; Jordan, Huttenlocher, & Levine, 1992, 1994). Research also has found SES-related differences in other verbal and symbolic number skills, such as knowing the cardinality principle when counting, identifying written numbers, and solving arithmetic problems (Baroody, 1987; Klibanoff, Levine, Huttenlocher, Vasilyeva, & Hedges, 2006; Saxe, Guberman, & Gearheart, 1987; Starkey et al., 2004). This suggests that SES-related differences are specific to symbolic number skills, which are foundational for later mathematical concepts (Jordan et al., 2009), and are also highly dependent on input, instruction, and experiences (Jordan & Levine, 2009). Therefore, these skills are the focus of the present study.

The goal of the current study was to examine contributors to low-income preschool children's numerical knowledge. Specifically, we examined children's foundational numerical knowledge in verbal counting and identifying numerals, as well as their understanding of more advanced numerical concepts: cardinality, the counting principles, and numerical magnitudes. Even though children from lower-income backgrounds tend to perform lower, on average, than their peers from higher-income homes on numerical knowledge measures, there is a wide range of proficiency in early number skills amongst children from lower-income families. However, very little research has examined children's math-related experiences within families from lower-income backgrounds. Understanding these relations could provide critical information on ways to promote low-income children's early numerical knowledge and potentially their long-term mathematical achievement. Thus, we examined caregivers' and children's math talk during a dyadic interaction and caregiver report of number-related experiences at home as potential sources of this variation in number skills among families from a Head Start program.

1.1. Number related talk and interactions in the early home environment

The sociocultural perspective provides the theoretical framework for this study and for examining how children's early home environment and interactions with adults can influence early mathematical development. Sociocultural theory posits that social interactions with adults play a critical role in children's cognitive development (Gauvain, 2001; Rogoff, 1990; Vygotsky, 1978). In general, play and other informal activities are considered particularly important contexts in which adults provide children with information, support their skill development, and extend their conceptual understanding. Specifically, for the development of mathematical understanding every day, informal activities can provide children with extensive numerical information in the home, such as during cooking, meals, chores, and shopping (Saxe, 2004; Walkerdine, 1988). For example, parents and children could discuss fractions while measuring ingredients, count the number of people at a table, estimate the amount of time it will take to clean a room, or compare the cost of grocery items.

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