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SES disparities in early math abilities: The contributions of parents' math cognitions, practices to support math, and math talk

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ABSTRACT

SES disparities in early math achievement are large and persistent across development and yet relatively understudied. Given the early emergence of these gaps, it is unlikely that school factors can explain why low-SES children tend to start school behind their peers in math skills. Rather, we argue that characteristics of parents, including their beliefs about math, their practices to support math, and their language about math concepts, mediate the observed associations between SES and math learning in early childhood. We first review the existing theoretical frameworks that support this conceptualization, including academic socialization, the home numeracy model, and concerted cultivation, with particular emphasis on the intersections and limitations of these past theories for understanding the early emergence of math disparities. We then propose a hybrid conceptualization of these frameworks and review research describing each proposed pathway. Specifically, we describe studies addressing how parents' beliefs, practices, and language might explain SES disparities in children's math achievement. Finally, we review the implications for our conceptual framework, major limitations of this literature, and remaining questions for future studies.

Introduction

Abundant evidence indicates that children in homes of lower socioeconomic status (SES) typically start school behind their peers on a host of domains (Bradley & Corwyn, 2002; McLoyd, 1998). Of particular interest are SES disparities in early academic achievement, as differences in early math and reading skills have profound implications for later educational and vocational outcomes. Although the bulk of research addressing SES disparities in early academic skills has focused on language and literacy skills rather than math abilities (e.g., Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005; Hart & Risley, 1995; Rodriguez & Tamis-LeMonda, 2011), understanding why some children start school less prepared to learn math than their peers is vital. Math is often hierarchically organized, such that early skills lay the foundation for the more advanced skills that follow (Baroody, Eiland, Purpura, & Reid, 2012); thus, disadvantages at school entry are unlikely to dissipate over time (Crosnoe & Schneider, 2010; Duncan & Magnuson, 2011). Rather, math skills at the start of kindergarten are particularly strong predictors of later school success and outweigh other theoretically important factors such as reading and attention (Duncan et al., 2007). Furthermore, these early SES disparities in math may have implications for later social mobility (Crosnoe & Schneider, 2010; Schoenfeld, 2002) if low-SES children do not attain the math skills needed for future labor market opportunities that require math competency (Goldin & Katz, 2009).

Given that disparities in math emerge prior to the start of school, parental characteristics might explain how SES differences in

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math achievement develop. In this review, we examine how parental characteristics may operate as explanatory mechanisms in the associations between SES and math abilities in early childhood by reviewing past theoretical and empirical research describing how parents cultivate their young children's math skills across levels of SES.

Math development in early childhood

Sarama and Clements (2009) identified several domains of math abilities that are relevant for young children, most notably numeracy and spatial skills. Numeracy includes a variety of number-based skills, such as comparing numbers and solving simple arithmetic problems (Sarama & Clements, 2009). During early childhood, measures of numeracy typically address children's knowledge of counting principles and cardinality in particular (i.e., the relevance of the last number word said when counting), as mastering the cardinality principle enables more complex mathematical thinking such as comparing sets of objects (Gelman & Gallistel, 1986; Gelman & Meck, 1983; Sarnecka & Wright, 2013).

Spatial skills typically fall into two categories, spatial orientation and spatial visualization (Sarama & Clements, 2009). Spatial orientation refers to understanding the spatial relations of items, such as the relation between two objects or the position of an object relative to oneself (e.g. remembering where an object is hidden relative to oneself; Lehnung et al., 1998; Lew, Bremner, & Lefkovitch, 2000). Spatial visualization on the other hand entails creating, maintaining, and manipulating a mental image (e.g., predicting what an object would look like if rotated; Kosslyn, 1983). Numeracy skills may rely heavily on these spatial abilities, as quantities appear to be visuo-spatially represented (e.g., numbers are arranged along mental number lines; Ansari et al., 2003; Dehaene, Spelke, Pinel, Stanescu, & Tsivkin, 1999; Zorzi, Priftis, & Umiltà, 2002). Additionally, geometry skills, such as identifying shapes, are often also included under this spatial domain (Clements, Swaminathan, Hannibal, & Sarama, 1999).

Several other theoretically important components of math have been vastly understudied in past work (Sarama & Clements, 2009) and thus are not addressed in detail here. For example, measurement principles, such as comprehension of length, area, and volume, involve the interplay of number sense and spatial skills (Clements & Stephan, 2004). Likewise, little research is available on pattern identification and replication skills, which are honed during early childhood and are theoretically implicated in numerous math skills (Clarke, Clarke, & Cheeseman, 2006).

SES disparities in math skills

Several studies have observed SES disparities in math skills at school entry that do not fade across development. Among a nationally representative sample of children who entered kindergarten in 1998, Duncan and Magnuson (2011) observed dramatic SES disparities in math achievement over time. Comparing the top and bottom 20% of the sample on SES, they found that children in the highest and lowest SES quintiles differed in their math achievement by 1.34 standard deviations (SDs) on average; by fifth grade, this gap had grown slightly to 1.38 SDs, comparable to those gaps seen in reading achievement (i.e., 1.43 SDs in kindergarten and 1.46 SDs in fifth grade). These disparities are even seen among children within the same school, such that a SD difference between classmates in SES related to a 0.3 SD difference in math achievement at the start of kindergarten among this same sample (Cheadle, 2008). When examining disparities within schools, the SES gap almost doubled by the end of third grade. More recent work has replicated these findings among children entering kindergarten in 2010, and suggests that income gaps in math achievement appear to have narrowed slightly in the past two decades (Reardon & Portilla, 2016).

SES disparities in number sense

High-SES children tend to have more advanced number skills, including counting, ordering, and comparing numbers, than their low-SES peers, on average, even before kindergarten (Starkey, Klein, & Wakeley, 2004). In fact, these basic number skills may mediate associations between SES and math achievement during kindergarten and first grade (Jordan, Kaplan, Locuniak, & Ramineni, 2007). SES differences in numeracy skills are particularly pronounced in verbal tasks such as story problems, whereas low-SES kindergarteners do not differ from their more affluent peers in performance on non-verbal and non-symbolic tasks (Jordan & Levine, 2009; Jordan, Huttenlocher, & Levine, 1992). SES disparities in early numeracy are also apparent in number representation skills. Throughout early and middle childhood, mental representations of numbers shift from logarithmic, where smaller numbers are perceived to be further apart from one another along the number line than are larger numbers, to linear, where numbers are equally spaced along the number line (Case & Okamoto, 1996; Dehaene, 1997). More linear representations are associated with enhanced arithmetic skills (Gunderson, Ramirez, Beilock, & Levine, 2012), and yet low-SES children have significantly less linear representations of numbers on average (Siegler & Ramani, 2008). Thus, difficulties with both language and visuo-spatial representations may partially underlie SES disparities in numeracy.

SES disparities in spatial skills

Low-SES children typically perform significantly lower on tasks of spatial orientation and spatial visualization compared to their higher SES peers (Dearing et al., 2012; Levine et al., 2005; Verdine, Golinkoff, Hirsh-Pasek, Newcombe, Filipowicz, et al., 2014; but see Levine, Ratliff, Huttenlocher, & Cannon, 2012). Similar patterns of findings aredemonstrated with geometry, as low-income preschoolers are often less able to name and manipulate shapes or recreate patterns than their peers (Starkey et al., 2004). Interestingly, well-documented gender differences in spatial skills (e.g., Levine, Huttenlocher, Taylor, & Langrock, 1999; Tzuriel & Egozi, 2010) are not detected among low-income children (Levine et al., 2005), adding a further level of complexity to our understanding of how SES relates to spatial skills.

The current review

SES disparities in children's math achievement emerge early, persist throughout later childhood and adolescence, and cannot be fully explained by differences in schooling environments experienced by low- and high-SES children. We argue that these disparities may operate through differences in characteristics of parents, namely their cognitions, practices, and language about math. First, we critically review existing theoretical models that attempt to explain parental influences on children's achievement. We then examine past empirical work addressing how parent characteristics relate to children's math learning and differ by SES. We conceptualize SES as a multifaceted construct representing a family's economic and social resources (Bradley & Corwyn, 2002), with parental level of education and household income included as distinct yet related indicators[1]. Finally, we discuss limitations of the current literature and suggestions for future research.

Theoretical framing

Frameworks connecting parent characteristics to math development

Parents may support their children's burgeoning math skills in myriad ways. For instance, models of academic socialization synthesize two perspectives that describe various way parents promote children's learning, labeled "what parents do" and "who parents are" (Taylor, Clayton, & Rowley, 2004). Under the "what parents do" perspective, parents' active socialization, including their communication style, provision of opportunities for learning in the home, and involvement in their children's education, can foster children's academic success. The "who parents are" perspective, on the other hand, emphasizes the role of parents' beliefs about school, which stem from their own educational experiences. These cognitive aspects of "who parents are" in turn influence practices, or "what parents do," to promote school success. Although this model accounts for the many critical factors that contribute to children's early learning, academic socialization does not address how parents foster children's math skills in particular. Understanding parental support for math is crucial, however, given that parents tend to view math as less important, less frequently engage in practices to support math, and express more uncertainty regarding developmentally appropriate learning for math compared to reading (e.g., Cannon & Ginsburg, 2008; Lefevre et al., 2009; Skwarchuk, 2009).

Only one study has proposed a theoretical account of how parents' practices cultivate children's math abilities in particular. Specifically, the home numeracy model posits that formal activities, or those with the explicit purpose of teaching children math concepts, promote children's formal math skills, whereas informal activities, or those that include math content incidentally, promote informal or non-symbolic math skills (Skwarchuk, Sowinski, & LeFevre, 2014). Furthermore, consistent with academic socialization, the model proposes that parental attitudes about math should relate to children's achievement, as should parental expectations, albeit indirectly through the home environment.

Frameworks for understanding SES disparities in parenting and child development

Neither the academic socialization nor the home numeracy models explicitly address the specific ways that contextual factors like SES should relate to parents' practices or children's achievement. One model that does directly address SES influences on parenting, Lareau's model of concerted cultivation, posits that parents espouse different strategies for childrearing as a function of SES. In her ethnographic field work, Lareau (2003) noted how high-SES parents often engaged in organized, intentional activities to nurture children's development, or concerted cultivation. In contrast, low-SES parents typically engaged in practices that allowed for the accomplishment of natural growth. SES differences emerged in regards to how parents organized children's daily lives, used language, perceived their responsibilities, and created social connections for their children (Bodovski & Farkas, 2008; Lareau, 2002). Lareau's original model addressed the intergenerational transmission of social inequality into adulthood, but concerted cultivation also applies to academic skill development during early childhood (e.g. Cheadle, 2008) and thus may help explain how parents mediate SES disparities in achievement.

It should be noted that within this model, SES is operationalized as a unitary construct, which Lareau (2002, 2003) labels social class, but other research suggests that specific SES components operate through distinct mechanisms to influence children's math achievement. Theoretically, family income may constrain the financial and psychological resources that a parent has at his or her disposal, which may significantly impede parents' provision of home learning opportunities. However, educational attainment may influence a parents' beliefs and knowledge as well as the social connections that are formed when attaining postsecondary education. We argue for more specificity in conceptualizations of SES as well as recognition that both income and education may uniquely and significantly predict both children's math skills as well as parents' cognitions, practices, and language.

From an economic perspective, income represents part of the family's resources that can be used to promote the positive development of its members (e.g., Becker, 1991; Foster, 2002). All parents are expected to attempt to maximize utility in the family system, such as children's health and positive adjustment. However, parents with more constrained resources may be less able to provide children with enriching experiences, purchase materials for children, and spend time with children (i.e., to offset opportunity costs of spending time away from the labor market). In low-income families where such resources are scarce, parents are less able to

[1] Occupational prestige is also theoretically relevant but is less often utilized as an indicator of SES in the extant math literature given difficulties measuring and quantifying this variable, particularly over time.

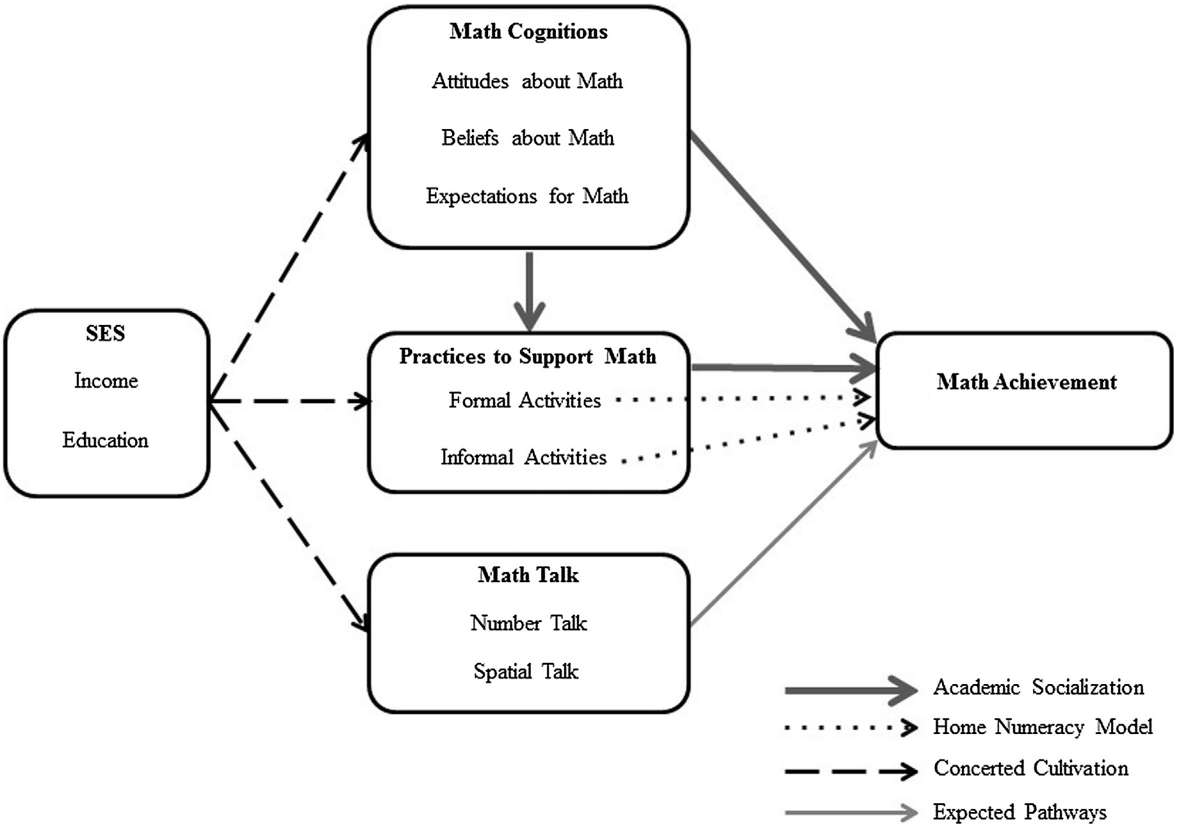

Fig. 1. Proposed hybrid conceptualization of the development of SES disparities in math through parental characteristics, including proposed pathways from academic socialization, the home numeracy model, and concerted cultivation.

invest time and money in their children (Duncan, Magnuson, & Votruba-Drzal, 2014). Resource scarcity also may increase parents' stress, resulting in strained relationships, family discord, and emotional distress, which in turn disrupts parenting routines and continuity (e.g., Conger & Dogan, 2007; Conger & Donnellan, 2007). Thus theoretically, income could directly limit a family's financial resources and indirectly limit parents' psychological resources.

Less is known about the mechanisms through which educational attainment might operate to enhance children's learning, which is concerning since education is often more predictive of children's math skills than parent occupation or income (e.g., Cheadle, 2008; Reardon, 2011). On the one hand, parents' educational attainment may have provided an opportunity to acquire cultural capital, such that higher education shapes parents' educational values and parenting strategies (e.g., DiMaggio, 1982; Domina & Roksa, 2012). Parents with higher levels of education may also interact with children in qualitatively different ways than do parents with less education, such as by using more complex language or engaging more directly in children's learning at home and at school based on their educational experiences (e.g., Fan & Chen, 2001; Harris, Terrel, & Allen, 1999; Hart & Risley, 1995; Magnuson, 2007). Thus, income and educational attainment may each influence parenting through distinct mechanisms. Taken together, these theoretical frameworks strongly suggest that beliefs and behaviors of parents could mediate income and education disparities in math achievement. Our hybrid model (see Fig. 1) pulls from these existing theories to posit that parents' beliefs about math, practices to expose children to math, and talk about math enrich children's early math skills. However, relations between parent characteristics and math learning may significantly differ according to parents' income and education.

Parents' math cognitions

For the purposes of this review we categorize parental cognitions about math in three ways: attitudes about math, beliefs about math, and expectations for children's math learning. *Attitudes about math* are defined as parents' feelings about math, including enjoying or liking math and math anxiety, which are often tightly connected to their past experiences with math or perceived math abilities. We also include math anxiety in this discussion of math attitudes, despite some conceptual differences between math anxiety and simply disliking math (Ashcraft, 2002; Maloney & Beilock, 2012). Parents' *beliefs about math* refer to beliefs about how children learn math, including the role of parents and schools, the importance of math, and what math learning activities should look like for young children. Finally, *expectations for math* refer to parents' goals for their children's math skill acquisition.

Attitudes about math

Only a handful of studies have addressed how parents' own attitudes towards math might relate to their children's math abilities. Among parents of preschoolers and kindergarteners who reported having more positive experiences in math courses in school, their children displayed more advanced number skills (LeFevre, Polyzoi, Skwarchuk, Fast, & Sowinski, 2010; Skwarchuk et al., 2014; but see Sonnenschein et al., 2012). Relatedly, parents' math anxiety was a negative predictor of first and second graders growth in math (Maloney, Ramirez, Gunderson, Levine, & Beilock, 2015), suggesting that parents with high math anxiety might engage in less effective or less frequent math discussions with their children compared to parents with low math anxiety. However, the nature of these pathways from parental math anxiety to children's achievement is still unclear. Although some studies find that children's math anxiety mediates these associations (e.g., Soni & Kumari, 2017), others find that parental math anxiety predicts children's math abilities only when children also have high levels of math anxiety (Casad, Hale, & Wachs, 2015). Furthermore, behavior genetics studies indicate that math anxiety and math achievement are heritable (Hart, Petrill, Thompson, & Plomin, 2009; Wang et al., 2014), which complicates these past findings given relations between parents' and children's math anxiety and children's math skills (e.g., Soni & Kumari, 2017).

These attitudes about math and experiences with math also differ across levels of SES. Among both Greek and Canadian parents, attitudes about math were related to parental educational attainment, such that parents with higher levels of education typically reported more positive views of math, such as enjoying math more or doing well in math classes (LeFevre, Fast, et al., 2010). Similarly, other studies have demonstrated that parents with lower levels of occupational prestige were more likely to have had difficulties with math in school than parents with more prestigious occupations (Niklas & Schneider, 2014).

However, no research to date has accounted for an important confounding variable, parents' own math skills, in these associations. Parents' attitudes about math may be related to their math abilities, such that parents who were more successful in math would likely have more positive attitudes about math. In addition, parents' histories of math achievement may have also contributed to their postsecondary educational attainment and career pursuits in adulthood. As will be discussed in greater detail below, since identifying heritability of math skills from parents to their children has been challenging (Braham & Libertus, 2017), correlations between parents' attitudes and children's math skills could be attributable to parents with better math skills sharing more positive attitudes about math and also having children with stronger math skills.

Beliefs about math

Parental beliefs about the importance of school readiness skills across numerous academic domains often relate to children's academic achievement (Puccioni, 2015; Sy & Schulenberg, 2005). However, studies examining parents' beliefs about the importance of math in particular typically find no associations with children's math achievement during early childhood (e.g., LeFevre, Fast, et al., 2010; Missall, Hojnoski, Caskie, & Repasky, 2014). Although some work has revealed positive correlations between parents' math beliefs and the reported frequency of math activities at home (Sonnenschein et al., 2012), associations appeared to be equally strong across content domains, such that beliefs about learning in general were more strongly related to math activities than were math-specific beliefs (Musun-Miller & Blevins-Knabe, 1998), As such, beliefs about the importance of math may predict math activities in the home, but these associations are not specific to math and do not predict children's actual math abilities. Furthermore, the few studies addressing how SES relates to parents' beliefs about the importance of math generally find null results, with parents rating the importance of math similarly across levels of education and occupational prestige (Musun-Miller & Blevins-Knabe, 1998; Saxe, Guberman, & Gearhart, 1987). These null associations between SES and parents' math beliefs are consistent with other research that detected no significant associations between SES and parents' beliefs about the importance of domain-general school readiness skills (Barbarin et al., 2008; Piotrkowski, Botsko, & Matthews, 2000).

Several studies also demonstrate that parents' beliefs about how children should learn math are also unrelated to math abilities among children between the ages of two and five years of age (DeFlorio & Beliakoff, 2015; Missall et al., 2014; Musun-Miller & Blevins-Knabe, 1998). Despite these non-significant links to achievement, SES does predict what parents believe their role should be and from whom or where children should learn math. Several studies have shown that low-income parents were more likely than middle-income parents to believe that the preschool classroom was more important than the home environment for children's math learning (DeFlorio & Beliakoff, 2015; Starkey et al., 1999), possibly due to low-SES parents' lower self-reported confidence in their teaching abilities (Drummond & Stipek, 2004; Lareau, 1994).

Expectations for math

Abundant evidence suggests that parental expectations for children's long term educational success are positively associated with academic achievement during elementary school (e.g., Fan & Chen, 2001; Jeynes, 2005), but no research has addressed parents' expectations for children's math achievement in the distant future. Rather, parental expectations about children's more immediate math abilities predict children's math skills (e.g., Kleemans, Peeters, Segers, & Verhoeven, 2012). In one study, parents' expectations for what math skills they expected their three- and four-year-olds to learn by age five were uniquely associated with math skills, even after accounting for SES and children's age ($\beta = 0.15$ and $\beta = 0.14$, respectively; DeFlorio & Beliakoff, 2015). Additionally, high-income parents tended to hold higher expectations for their children's math skills than did low-income parents (DeFlorio & Beliakoff, 2015). Notably, however, no research has accounted for reciprocal relations between parents' expectations and children's current abilities (Briley, Harden, & Tucker-Drob, 2014), which is a crucial next step in establishing causal links between parental expectations and children's math abilities.

Despite evidence suggesting that parents' attitudes and expectations about math may play a role in SES disparities in math achievement, it is unclear whether these associations are specific to math. For example, low-SES parents may have had less positive experiences with math, among other school subjects, and may have lower expectations for their children's learning across several academic domains. Research outside of the domain of math has also documented similarly positive relations between expectations and SES (e.g., Davis-Kean, 2005; Stipek, Milburn, Clements, & Daniels, 1992). In turn, parents' beliefs about math may reflect more general educational beliefs, which could predict domain-general academic achievement (e.g., authors, under review). Thus, perhaps SES disparities in beliefs are not specific to math, but more empirical work with stronger causal inference, such as experimental designs, is needed to examine specificity in these processes.

Parents' practices to support math

The home learning environment

Both academic socialization and the Home Numeracy Model suggest that parents' practices at home may support children's math skills (see Fig. 1). Numerous studies suggest that parents' provision of enriching activities in the home, often also collectively referred to as the home learning environment (HLE), can benefit children's cognitive and academic development (e.g., Lagacé-Séguin & Case, 2010; NICHD Early Child Care Research Network, 2004; Taylor et al., 2004). These activities in the home, including reading books and playing board games, also predict math achievement at the start of kindergarten as well as growth throughout elementary school, even after accounting for numerous child, family, and school covariates (Cheadle, 2008; Galindo & Sonnenschein, 2015; Melhuish, Phan, et al., 2008; Melhuish, Sylva, et al., 2008; Zadeh, Farnia, & Ungerleider, 2010).

Decades of research have examined how SES relates to the provision of enrichment activities in the home during early childhood in particular (e.g., Bornstein & Bradley, 2014; Bradley & Corwyn, 2002; McLoyd, 1998). In fact, several studies have shown that HLE activities mediate relationships between SES and math achievement in early childhood (e.g., Galindo & Sonnenschein, 2015; Zadeh et al., 2010). Changes in educational or income level are also associated with changes in the HLE, further bolstering these claims by demonstrating that aspects of SES may be causally related to home enrichment practices. For example, mothers who increased educational attainment when their children were two and three years old used more learning materials in the home and were more responsive to their children at age three compared to mothers who did not increase in education (Magnuson, Sexton, Davis-Kean, & Huston, 2009). In another sample, changes in both household income and parental education from early to middle childhood were uniquely related to changes in the HLE during this time, controlling for changes in family structure and employment (Votruba-Drzal, 2003). However, it remains challenging to disentangle which specific aspects of the home learning environment promote young children's math learning. Measures of the home learning environment typically include very few math activities (e.g., two of seven activities in the study by Melhuish, Phan, et al., 2008), and so it is critical to examine the *home numeracy environment*, or activities in the home that specifically target math learning, independent of these more general features of the HLE.

The home numeracy environment

Parents' practices that expose children to math concepts include a broad array of activities, such as counting, playing board games, and talking about money (LeFevre et al., 2009). Despite the relative infrequency of these activities in the home compared to reading practices (e.g., Anders et al., 2012; Cannon & Ginsburg, 2008; LeFevre et al., 2009), the home numeracy environment may also contribute to early SES differences in math achievement, as suggested by models such as the Home Numeracy Model (see Fig. 1).

The existing correlational research examining associations between the home numeracy environment and math abilities yields inconsistent findings (see Elliott & Bachman, 2018). One early study found that math activities that children engaged in alone rather than math activities with parents were related to children's math achievement (Blevins-Knabe & Musun-Miller, 1996). A handful of correlational studies have since echoed these mixed findings (Missall et al., 2014), as math activities in the home predict only certain types of math skills (e.g., arithmetic but not spatial skills; Dearing et al., 2012) or fail to predict math achievement after controlling for SES, child age, and parental beliefs (DeFlorio & Beliakoff, 2015). However, several studies do find positive links between the home numeracy environment and children's achievement throughout kindergarten and first grade (Kleemans et al., 2012; Niklas & Schneider, 2014).

Some of these inconsistencies may stem from the various types of math activities included in measures of the home numeracy environment. In one examination of the heterogeneity of math activities, LeFevre et al. (2009) identified factors of practices to support math in the home, two of which were formal (i.e., practicing number skills and using number books) and two of which were informal (i.e., math games and math applications) and more consistently related to children's math skills (LeFevre et al., 2009). In contrast, more recent work suggests that formal math practices may be more strongly related to children's math skills (LeFevre, Fast, et al., 2010; Huntsinger, Jose, Larson, Balsink Krieg, & Shaligram, 2000; Huntsinger, Jose, & Luo, 2016; Manolitsis, Georgiou, & Tziraki, 2013; Skwarchuk et al., 2014). Moreover, there is emerging evidence that informal activities may promote specific types of math skills rather than performance on broader assessments of math achievement, such as foundational number skills (i.e., counting and identifying numbers) but not advanced number skills (e.g., cardinality and comparing numerals; Ramani, Rowe, Eason, & Leech, 2015) or non-symbolic or informal math skills, as suggested by the home numeracy model (Blevins-Knabe, Whiteside-Mansell, & Selig, 2007; Skwarchuk et al., 2014; but see Huntsinger et al., 2016, and LeFevre et al., 2009). However, formal and informal activities are not measured or defined consistently across studies (see Elliott & Bachman, 2018). Some of these inconsistent findings may stem from variability in the types of activities included in formal and informal practices across studies, possibly due to reliance on empirical methods of dimension reduction (e.g., exploratory factor analysis) rather than utilizing theoretical definitions of formal and informal practices, which remain underdeveloped. Furthermore, relatively little attention has been paid to the developmental nature of these processes, although some evidence suggests that formal practices are more predictive of math skills among four-year-olds than three-year-olds (Thompson, Napoli, & Purpura, 2017). Thus, a clearer conceptualization of formal and informal practices, as well as more work examining how children with different levels of math ability benefit from these activities, is warranted.

Despite these complicated findings in past correlational studies, several interventions have demonstrated that math activities in the home can influence children's math abilities. Past interventions have included parent programming aimed at increasing math activities at home (Niklas, Cohrssen, & Tayler, 2015; Starkey & Klein, 2000), providing parents with math-related materials (e.g., storybook apps; Berkowitz et al., 2015), and manipulating the amount of mathematical content in typical play activities such as cooking and baking (Vandermaas-Peeler, Boomgarden, Finn, & Pittard; 2012) and have all led to increases in children's math skills. It is noteworthy that this experimental work has yielded more consistent findings than past correlational studies. Correlational and experimental work may target different types of practices. Parents typically prioritize basic math knowledge over more complex concepts (Anderson, 1997; Starkey & Klein, 2000), whereas intervention programs may promote activities that include more complex math content and thus might be more strongly related to children's learning (Skwarchuk, 2009).

In the limited body of research linking SES to the home numeracy environment, SES is typically associated with both the quantity and quality of math activities in the home, albeit somewhat inconsistently. In one of the first empirical examinations of SES disparities in parents' math practices, Saxe et al. (1987) observed minimal differences in the frequency of math activities in the home in a sample of two- and four-year-olds and their parents. However, middle-class families, or families with higher parental occupational prestige, typically engaged in qualitatively different types of activities than their working-class peers, including engaging in a broader range of activities and activities with more complex goals. Thus, although the overall quantity of numeracy activities did not vary across SES in this sample, higher SES children were exposed to higher quality numeracy activities compared to lower SES children. DeFlorio and Beliakoff (2015) also found small but significant SES differences in parent-reported math activities in the home ($d = 0.37$), with SES operationalized as eligibility for subsidized preschool. In this study, SES was also related to the range of activities to support math. Of 13 math activities, middle-SES children participated in 6.8 activities on average in the first year of preschool and 6.7 in the second year compared to 5.5 and 5.8, respectively, for low-SES children (DeFlorio & Beliakoff, 2015). Thus low- and high-SES children may receive different frequency exposure to math content at home in early childhood.

SES may also predict the formality of numeracy activities that parents provide. Several studies have found negative associations between SES and the formality of activities, such that high-SES parents are more likely than low-SES parents to prioritize informal learning opportunities over more formal ones. In one study, middle-SES parents reported embedding math into daily activities more so than low-SES parents and also engaged in more made-up math games and incorporated math into routines, whereas low-SES parents were more likely to set time aside to work with children directly to improve math skills with SES operationalized as eligibility for subsidized preschool (DeFlorio & Beliakoff, 2015). These findings are consistent with research examining the HLE more generally that demonstrates that maternal education relates to informal but not formal domain-general learning activities (Stipek et al., 1992). These SES differences in formal and informal numeracy activities provide a strong impetus for understanding how these varied components of the home numeracy environment predict math achievement. If informal activities are in fact more strongly predictive of children's math abilities, as some studies have shown (e.g., LeFevre et al., 2009), differential participation in such activities across levels of SES may explain disparities in achievement. However, these findings are somewhat unexpected given that formal math activities are more consistently related to math abilities (e.g., LeFevre, Fast, et al., 2010; Manolitsis et al., 2013; Skwarchuk et al., 2014).

It is important to note that positive associations between SES and the home numeracy environment are not consistently found in the literature. In their naturalistic observations of three-year-olds and their parents, Tudge and Doucet (2004) found that engagement in math activities, including discussions of math content with a parent and playing with books or toys that include numbers, did not differ across comparisons of middle-class and working-class families. However, math activities were quite rare in this analysis and did not occur at all for around 60% of the sample, which may explain these null findings. Some of this inconsistency may also stem from how SES relates to formal math activities in particular. For example, LeFevre, Fast, et al. (2010) found that among Canadian parents, formal math activities were actually negatively related to parent education, although this association only reached conventional significance levels after accounting for parental beliefs and literacy practices and was not observed among Greek parents (LeFevre, Fast, et al., 2010). Thus high-SES parents may actually engage in fewer formal math practices. However, negative associations were also found among a sample of German kindergarteners between occupational prestige and relatively informal math activities in the home (Niklas & Schneider, 2014).

Thus although higher SES families appear to engage in more math activities in the home, particularly in informal contexts, these findings are not consistently replicated. Part of the issue may lie in the limited number of studies examining these processes, underscoring the need for more work examining how SES relates to parents' practices. This body of literature also includes substantial variability in cultural contexts, which may also explain why findings have been somewhat mixed. Finally, few studies account for both parental education and income by including measures of both constructs in analyses simultaneously. If these components of SES are differentially related to parents' practices, studies may find varied associations between SES and home numeracy practices depending on which indicators of SES are used.

Specific activities in the home environment

In addition to composite measures of the home numeracy environment, several specific activities in the home have been identified as predictors of math skills. Exposure to board games, including the amount of time playing games and the range of games, is correlated with preschoolers' numeracy skills in particular (Benavides-Varela et al., 2016; Ramani & Siegler, 2008). In fact, playing with board games may improve children's number sense, including representations of numbers, counting skills, and number identification (Ramani & Siegler, 2008; Siegler & Ramani, 2008; Whyte & Bull, 2008; but see Cankaya, LeFevre, & Dunbar, 2014). Furthermore, the work of Ramani and Siegler found that children attending a primarily middle-class preschool played board games more frequently and played a wider variety of board games and card games than children attending Head Start (Ramani & Siegler, 2008). However, exposure to board games in the context of an experimental manipulation narrowed the gap in number sense skills between these groups to non-significance (Siegler & Ramani, 2008). As such, differential experiences with such activities may contribute to the development of SES gaps in number skills.

Existing research has also highlighted two activities that may promote spatial skills: blocks and puzzles. Several correlational studies suggest that playing with blocks may promote children's spatial development (DeFlorio & Beliakoff, 2015; Verdine, Golinkoff, Hirsh-Pasek, & Newcombe, 2014), especially when parents provide support during these activities (Ferrara, Hirsh-Pasek, Newcombe, Golinkoff, & Lam, 2011). However, little is known about how income and education relate to the frequency or quality of block play. Puzzles may also offer an opportunity for children to learn spatial concepts (Verdine, Golinkoff, Hirsh-Pasek, & Newcombe, 2014). Levine et al. (2012) found that the frequency of time spent playing with puzzles predicted children's later spatial abilities, and family income was positively associated with puzzle play time ($d = 0.66$). A similar, non-significant trend emerged for parental education ($d = 0.54$), but these components of SES were not analyzed simultaneously, and so it is unclear whether each was uniquely associated with puzzle play.

Taken together, this evidence suggests that parental SES may predict parents' practices in the home that can foster math learning, including the home learning environment, home numeracy environment, and several specific activities. However, three major issues exist in this literature. First, few studies attempt to disaggregate income and parental education as indicators of SES as predictors of parents' practices despite evidence that income and education uniquely relate to math achievement (Bachman, Votruba-Drzal, El Nokali, Castle, & Heatly, 2015; Cheadle, 2008, Reardon, 2011). Disaggregating SES could offer valuable insights into the potential mechanisms at play in these disparities. Second, most of this work is correlational and cross-sectional. Although experimental manipulations of parental education or income are rare and often impractical, more work utilizing longitudinal designs that help approximate causal inference (e.g., Magnuson et al., 2009; Magnuson, 2007; Votruba-Drzal, 2003) could help strengthen claims that SES influences parents' practices to support their children's math abilities. Finally, it remains unclear whether these processes are unique from SES disparities in broader parenting practices. Associations between SES and the home learning environment are well documented (e.g., Bradley & Corwyn, 2002) and could explain why some parents engage in more math activities than others. In fact, in one study of first grade girls and their parents, associations between SES and activities to support math and spatial skills in the home were mediated through general home learning practices, such that higher-SES parents engaged in more math activities because they provided more learning opportunities in general, on average, compared to lower-SES parents (Dearing et al., 2012). As such, future research should examine whether math activities in the home are uniquely related to parental education and income or whether these associations simply reflect more general SES differences in parenting.

Parents' math talk

Although specific types of activities in the home appear to support children's math achievement, interactions about math also occur outside of activities that are explicitly mathematical (e.g., Anderson, Anderson, & Shapiro, 2004), and measures of how frequently parents' engage in math activities do not indicate whether parents and children are in fact discussing math concepts. One approach to address these concerns is to examine parental talk about math regardless of the context in which it is embedded. The evidence regarding math talk is quite consistent: children with parents who discuss math more frequently tend to perform better on various measures of math ability, although no studies have yet examined whether these associations reflect causal relationships. Associations are present for both number and spatial talk, two of the most frequent ways that parents talk about math during early childhood (Anderson, 1997).

Number talk

Parents vary substantially in how often they talk about numbers with their young children (e.g., Levine, Suriyakham, Rowe, Huttenlocher, & Gunderson, 2010). In their naturalistic observations of parents and children, Levine et al. (2010) found that the number of number words used by parents between 14 and 30 months was predictive of children's understanding of cardinality at 46 months after accounting for SES and overall parent talk ($\beta = 0.34$). However, some types of number talk may be more beneficial than others. In Levine and colleague's original sample, number talk about present objects with large sets (i.e., greater than three) was most strongly related to children's skills ($\beta = 0.38$; Gunderson & Levine, 2011). Another study found that advanced number talk, including discussions of cardinality, ordinal relations, arithmetic, and magnitude, was more predictive low-SES preschoolers' complex number knowledge (e.g., cardinality, magnitude comparisons) than more fundamental number talk in the context of counting and number identification (Ramani et al., 2015). Pairing fundamental and advanced number talk also appears to benefit children (i.e., hearing the count list and cardinal value labels; Mix, Sandhofer, Moore, & Russell, 2012).

To date, two studies have examined how SES relates to number talk. Levine et al. (2010) found that number talk was significantly related to a composite measure of income and education ($r = 0.30$), and partially mediated associations between SES and children's number sense, such that the inclusion of number talk reduced the coefficient of SES on children's cardinality understanding by 22%. Additionally, Vandermaas-Peeler, Nelson, Bumpass, and Sassine (2009) found that high-income parents initiated conversations about numeracy significantly more frequently on average than did low-income parents in the context of both reading and unstructured play.

Spatial talk

Additionally, parents' talk about spatial concepts predicts children's spatial skills. Pruden, Levine, and Huttenlocher (2011) also demonstrated that children of parents who used more varied spatial language showed more advanced spatial skills even when controlling for overall child and parent language. These associations were mediated through the child's spatial language, suggesting the importance of the child's role in the construction of spatial knowledge. Other studies have since replicated and extended these findings, with parent-reported spatial talk related to three-year-olds' spatial replication skills and math abilities, even when accounting for children's vocabulary ($r = 0.33$ for spatial skills and $r = 0.42$ for math; Verdine, Golinkoff, Hirsh-Pasek, Newcombe, Filipowicz, et al., 2014). Furthermore, pairing spatial talk with gesture appears to confer an additional advantage for children (Cartmill, Pruden, Levine, & Goldin-Meadow, 2010). Notably, however, no work has examined SES disparities in parents' spatial talk.

Additional concerns regarding math talk

Several limitations of this literature merit discussion. No studies have employed experimental designs to detect whether language may be causally related to math abilities, despite evidence that parents' math talk is malleable to training (Hojnoski, Columba, & Polignano, 2014). Although some research has utilized longitudinal designs to strengthen causal inference, experimental manipulations of math talk are needed to establish causality in these processes. Notably, several important confounds have yet to be addressed in this body of work, such as children's abilities or interest in math, that might elicit parents' math talk. Additionally, much of the existing research is drawn from a single sample (e.g., Cartmill et al., 2010; Gunderson & Levine, 2011; Levine et al., 2010; Pruden et al., 2011), warranting replication in larger and independent samples.

Studies addressing the frequency of parental math talk also rarely capture the quality and style of these interactions. Several qualitative analyses have revealed substantial variability in how parents use math language in the home, including who initiates discussions and whether the goal of the activities is explicitly didactic (Anderson, 1997; Aubrey, Bottle, & Godfrey, 2010). However, past quantitative studies do not generally include many of these factors. For example, no studies have addressed whether children are actively engaged during this talk, and yet abundant research on early language acquisition underscores the importance of joint attention for vocabulary learning (e.g., Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998; Morales et al., 2000; Tomasello & Farrar, 1986). Comparable processes would likely be at play as children acquire math-related vocabulary, but limited research has examined the dyadic nature of these interactions. Similarly, the importance of context more broadly, such as whether math talk during book reading operates similarly to math talk during board games, remains unknown.

One additional concern lies in the distinction between math activities and math language. Only one study has examined the unique contributions of math activities and math language and found that, across several models, math activities and math talk were never both significant predictors of various math outcomes (Ramani et al., 2015). The observed associations between the math activities and math abilities could be attributable to a higher frequency of math talk among families who engage in math activities more often. In other words, associations between math activities and achievement may be fully mediated by parental language, given that math activities that do not include mathematical discourse would be unlikely to predict achievement. However, parent-child conversations about math arise organically even in activities that are not explicitly math-related (Anderson et al., 2004; Vandermaas-Peeler, Nelson, & Bumpass, 2007), and thus these types of interactions would not be captured by measures of parent-child math activities in the home.

Finally, the research addressing how SES relates to parental language about math is particularly sparse despite abundant work documenting substantial SES differences in parents' language use more broadly. Low-SES parents and particularly parents with low levels of education typically use less language overall with their children as well as simpler language, including fewer unique words, more basic syntax, and less variety in sentence structure, than do high-SES parents (e.g., Hart & Risley, 1995; Hoff, 2013; Huttenlocher, Vasilyeva, Waterfall, Vevea, & Hedges, 2007). In fact, language input from parents fully explains large and well-documented SES disparities in children's early vocabulary (Hoff, 2003, 2013). Although models of concerted cultivation would suggest that higher SES parents may use more number words (see Fig. 1), more work examining SES disparities in math talk is desperately needed, particularly in how distinct components of SES relate to parents' math talk.

Implications and conclusions

In the current review, we argue that parents' cognitions, practices, and language mediate associations between SES and children's math achievement in early childhood (see Fig. 1). Empirical evidence largely supports these claims. SES is positively associated with parents' attitudes about math and expectations for children's learning, both of which predict children's math abilities. Lower SES parents may also think about math differently than do high-SES parents, but these beliefs do not consistently relate to math achievement and so are unlikely to explain SES disparities. Additionally, several studies have documented SES differences in the home learning environment, the home numeracy environment, and specific activities that involve math, such that low-SES children may be exposed to less math content and lower quality math content in the home than are high-SES children, which may explain SES differences in achievement. Finally, the small body of literature addressing parental language consistently demonstrates that number talk and spatial talk predict children's number and spatial skills, respectively, but few studies have addressed whether SES predicts parents' number talk.

In contrast, no research has directly examined which components of SES are operating within these associations. Few studies have disaggregated income and education and examined the unique effects of each, despite theoretical evidence that these factors function through distinct mechanisms (e.g., Conger & Donnellan, 2007; DiMaggio, 1982; Foster, 2002) and empirical evidence that they differentially predict achievement (Cheadle, 2008; Reardon, 2011). Existing theoretical accounts would suggest that parents' beliefs and language would be more strongly related to parents' educational attainment rather than to their income. Parents' conceptualizations of school may be drawn from their own experiences, which would likely be more related to educational background than to income and availability of resources (Taylor et al., 2004). Experience with higher levels of education might change parents' mentality toward education and expose them to different ways of thinking about parenting (e.g., DiMaggio, 1982; Domina & Roksa, 2012). Thus, education could influence parents' beliefs, as suggested by academic socialization, as well as their communication styles in ways that promote the discussion of mathematical content. However, family resources such as income would be unlikely to constrain parents' beliefs or language use, and so if SES differences are seen in these factors but not attributable to income, parental education may play a larger role.

On the other hand, both income and education could be uniquely related to parents' practices. Engaging in practices to support children's math skills requires investing both time, which may be scarce for low-income families who need to maximize their paid labor force participation, and money, such as for purchasing games or toys that include math content (e.g., Duncan et al., 2014; Foster, 2002). Parental education could also influence parents' practices if parents with varying levels of education are differentially motivated or involved in their children's learning and thus engage in distinct types of activities with children (e.g., DiMaggio, 1982; Domina & Roksa, 2012). Thus, we hypothesize that beliefs and language about math would be primarily related to parental education, whereas both income and education could theoretically predict practices to support math, but these claims should be tested in future work.

Key limitations of the existing literature

Several limitations in the extant body of literature warrant discussion. First, relatively little attention has been paid to the child's role in these processes. Children's math skills or interests could inform parents' cognitions, practices, and language. For example, parental expectations are predicted by children's current academic abilities (Briley et al., 2014), and parents' math talk becomes increasingly complex as children develop and gain additional skills (Durkin, Shire, Riem, Crowther, & Rutter, 1986; Saxe et al., 1987), suggesting that parents may adjust their input based on children's math abilities. Furthermore, numeracy activities in the home are more likely to occur, and perhaps are even more beneficial for children, when parents and children actively collaborate and when parents respond to children's interests (Lukie, Skwarchuk, LeFevre, & Sowinski, 2014). These transactional processes suggest that associations between parent characteristics and children's math skills could be attributable to children's initial math skills and interests. Specifically, if parents increase their expectations of children's skills or math activities, for example, due to their children's interest in math or math ability, observed associations between these parental beliefs or behaviors and later child achievement could be spurious. More studies employing longitudinal designs that examine children's math achievement across development and experimental manipulations of these parental characteristics are necessary to rule out these alternative explanations.

One further complication in this body of work that has not been addressed is the heritability of math ability. Studies utilizing behavior genetic designs (Hart et al., 2009) as well as intergenerational correlational designs (Braham & Libertus, 2017) indicate that parents with stronger math skills are likely to have children with higher levels of math abilities as well. If parents' own math skills influence their attitudes about math or behaviors such as provision of activities or math talk (e.g., Blevins-Knabe, et al., 2007; Elliott, Braham, & Libertus, 2017; Niklas & Schneider, 2014), associations between these parental characteristics and children's skills could be entirely spurious. As such, more studies utilizing genetically informed designs or experimental designs are necessary to detect whether associations between parental behaviors and children's achievement truly reflect environmental influences on children's math abilities.

It is also not clear whether the existing research demonstrates how SES and parent characteristics relate to math in particular or whether these processes generalize to a wider range of academic outcomes. Some work has addressed these concerns and demonstrates that relations between activities to support math and achievement seem to be unique to math. On the one hand associations between math activities and math achievement persist when controlling for other activities in the home (e.g., Anders et al., 2012; LeFevre, Fast, et al., 2010), suggesting that math activities in particular are predictive of later skills. Additionally, associations between math activities and math skills remain significant when controlling for other cognitive skills (e.g., Kleemans et al., 2012; Manolitsis et al., 2013; Niklas & Schneider, 2014), indicating that these activities uniquely support math learning. Accounting for the associations between math skills and other cognitive factors is particularly important given that math skills do not develop in isolation but rather are integrally linked to other cognitive processes such as language (Ginsburg, 1989; Ginsburg, Lee, & Boyd, 2008; Pappas, Ginsburg, & Jiang, 2003) and executive functions (Assel, Landry, Swank, Smith, & Steelman, 2003; Bisanz, Sherman, Rasmussen, & Ho, 2005; Bull, Espy, & Wiebe, 2008; Krajewski & Schneider, 2009; Raghubar, Barnes, & Hecht, 2010).

Several of the concerns listed above stem from the heavy reliance on correlational research in the extant literature. Although a handful of studies have experimentally manipulated aspects of the home numeracy environment to test for causal links between parents' practices and children's math skills (Berkowitz et al., 2015; Niklas et al., 2015; Siegler & Ramani, 2008; Starkey & Klein, 2000; Vandermaas-Peeler et al., 2012), no experimental evidence exists to link other parental characteristics such as beliefs, expectations, or talk to children's math skills. Additionally, several quasi-experimental studies have demonstrated that income and education influence parental behaviors in general (e.g., Magnuson et al., 2009; Votruba-Drzal, 2003), but no work as examined the causal influence of SES components on practices to support math in particular. More empirical work utilizing causally informed designs (e.g., Miller, Henry, & Votruba-Drzal, 2016) is needed in this growing body of literature, especially given the potentially confounding variables that were not included in the correlational studies reviewed above (e.g., parental math skills, children's interests in math).

Finally, the ways in which beliefs, practices, or language relate to learning could differ depending on children's current math knowledge, but the developmental nature of these associations has been largely unexplored. Specifically, children are likely to be most responsive to interactions that are tailored to their current math knowledge. The work of Vygotsky (1978) suggests that learning is most prolific when children interact with competent individuals at a level just above where they could perform individually, which can increase over time as children acquire new skills (e.g., Jaramillo, 1996; John-Steiner & Mahn, 1996). One study of three- and four-year-old children demonstrated that parental practices were more strongly related to math skills among the older children (Thompson et al., 2017), but more work is still needed to examine how parental cognitions about math, practices to support math, or math talk might be differentially related to achievement depending on initial skill level or across development.

Other contextual factors that predict early childhood math achievement

In the present review we focus exclusively on parents as mediators of SES disparities in math abilities since these early gaps emerge before children enter formal schooling. However, children are often exposed to numerous other contexts outside of the home during early childhood (Kena et al., 2016; Laughlin, 2013), and so a more comprehensive view of these processes could be obtained by examining both the home and child-care environments. Low-SES children are less likely to attend preschool programs or child care centers than higher SES peers, and may also attend lower quality centers (e.g., Capizzano & Adams, 2003; Phillips, Voran, Kisker, Howes, & Whitebook, 1994), which may contribute to variability in math skills prior to the start of school. Furthermore, the potential influence of child care might vary depending on characteristics of the home environment themselves. Child care could compensate for missed learning opportunities at home and thus serve as a protective factor for children at risk of falling behind their peers in math (Christian, Morrison, & Bryant, 1998). Alternatively, child care experience could amplify existing benefits of the home environment (Anders et al., 2012). However, since child-care arrangements are not randomly assigned to families but are selected based on parents' decisions and available resources (Henly & Lyons, 2000; Meyers & Jordan, 2006), the home and preschool environments may reflect overlapping influences on children's math abilities. A parent who frequently engages in math activities at home may intentionally select a child-care center with a similar emphasis, whereas a parent with limited resources that prevent her from engaging with her child might also have fewer high-quality child-care options available, resulting in non-random associations between these environments.

Discussions of race and ethnicity are also notably absent from this review. The Black-White gap in math achievement at school entry, for example, is fairly large; Black children score roughly 0.5 standard deviations below their White classmates in math at the start of kindergarten (Quinn, 2015). Although SES reduces this disparity by around 75% (Quinn, 2015) and remains a significant predictor of math learning within racial and ethnic groups (Bromberg & Theokas, 2013; Carpenter, Ramirez, & Severn, 2006; Cheadle, 2008; Entwisle & Alexander, 1990; Quinn, 2015), associations between race/ethnicity and achievement persist even when controlling for SES. Further, the relative sizes of racial/ethnic disparities are not consistent across levels of SES but rather appear to grow as SES increases, such that the benefits of high-SES are smaller for minority families (e.g., Bromberg & Theokas, 2013; Tate, 1997). Although these questions lie outside of the scope of the present review, greater attention to race should be paid in future work addressing SES disparities given that the complex and multifaceted ways in which SES and race intersect to predict children's math abilities.

Conclusions and directions for future research

The current review presents theoretical and empirical evidence for the claim that parents' beliefs, practices, and language about math help to explain the development of SES disparities in math abilities during early childhood. Despite the methodological limitations and concerns described above, much of the existing research converges on the premise that we must consider the role of parents as a mechanism of SES disparities in math achievement.

More work is needed to replicate findings regarding SES disparities in parents' beliefs, practices, and language to support math with larger samples including more nuanced measures of SES. The relative dearth of research examining variability in these processes across levels of income or education is particularly noteworthy given the extensive work addressing SES differences in parental support for literacy and language skills (e.g., Bodovski & Farkas, 2008; Foster et al., 2005; Hart & Risley, 1995; Newman, 1996). A similarly rich body of literature examining how SES relates to potential mediators of SES disparities in math is needed, especially given the persistence of wide disparities in math achievement (Cheadle, 2008; Duncan & Magnuson, 2011; Duncan et al., 2007).

Finally, more work is needed to disentangle these processes and understand why SES components might relate to parent characteristics. The rationale here is two-fold: identifying the crucial factors that explain how income and education uniquely operate can aid in the development of targeted interventions, but examining the variability in these associations across individuals can also help to detect protective factors that promote resiliency in low-SES homes. The studies reviewed above revealed small to moderate associations between SES and parent characteristics, suggesting that much of the variability in these beliefs, practices, and language are unrelated to SES. Although we argue that parents' may help to explain SES disparities in math abilities, many low-SES parents likely hold strong beliefs about math, engage in high-quality practices to support math, and use rich math language at home. Thus, more research should examine the factors that promote these characteristics within the context of socioeconomic adversity.

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