Parents' Socialization of Their Young Children's Interest in Math

Susan Sonnenschein and Rebecca Dowling

University of Maryland, Baltimore County

Susan Sonnenschein, Psychology Department, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, 410.455.2361, 410.455.1055, sonnensc@umbc.edu

Rebecca Dowling, Psychology Department, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, 410.455.3180, 410.455.1055, rebe7@umbc.edu

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Abstract

Children in the U.S routinely score well below children from other industrialized countries on math tests. However, within the U.S., there is significant variability in how well children from demographically diverse groups score on these tests. Children from low-income, Black, and Latino groups, on average, score significantly lower than other children. These differences are evident at the start of formal schooling. Thus, the home learning environment is an important component for children's math development. This chapter focuses on parents' socialization of young children's interest in math. We take the approach that parents' beliefs and practices facilitate children's interest in math which, in turn, fosters their engagement in math activities, and subsequent math development. Given the limited research on math, we also include relevant research on reading. As appropriate, we consider racial/ethnic, SES, and child gender differences in parents' practices.

Parents' Socialization of Their Young Children's Interest in Math

Increasing U.S. children's math skills is an important means of improving their academic and subsequent vocational well-being. U.S. school children routinely earn lower scores on math tests than do children from other industrialized countries. For example, on the 2015 Test of International Math and Science Studies (TIMSS, NCES, 2015a), U.S. fourth graders ranked 14th in math among children from 49 different industrialized countries. Within the U.S., many children fail to demonstrate age-appropriate math skills. According to test scores from the 2015 National Assessment of Educational Progress (NAEP), 60% of fourth graders, the youngest age the test is administered, scored below the proficient range (NCES, 2015b). There also were significant differences across demographic groups in the percentage of children receiving scores in the proficient range. Sixty-five percent of Asian and 51% of White fourth graders received proficient scores compared to 26 % of Latino and 19% of Black fourth graders. Differences in attainment between boys and girls were smaller but still present with 42% of fourth grade boys versus 38% of fourth grade girls scoring in the proficient range. Children from low-SES backgrounds, on average, start school with scores on math standardized tests at least one-half standard deviation lower than children from higher-SES backgrounds (DeFlorio & Beliakoff, 2015; Galindo & Sonnenschein, 2015). On the 2015 NAEP, only 22% of fourth graders eligible for free or reduced lunch, an index of low-SES, received proficient scores in math compared to 45% of those not eligible for free or reduced lunch (NCES, 2015b).

The math skills children display during their first few years of school are critical for their subsequent development throughout school (Duncan et al., 2007; Jordan, Kaplan, Ramineini, & Locuniack, 2009; Siegler et al., 2012), and for obtaining jobs in STEM fields (Blevins-Knabe, 2016; National Mathematics Advisory Panel, 2008). Thus, we need to look for ways to improve children's math skills starting at the time they begin formal schooling or even before (Aunola, Leskinen, Lerkkanen, & Nurmi, 2004). One such way is to consider the important role played by parents in the development of young children's math skills (Ramani & Siegler, 2014; Sonnenschein, Metzger, & Thompson, 2016). Parents' involvement in their children's education is called parents' academic socialization.

Most of the research on parents' academic socialization focuses on how such beliefs and practices are associated with children's academic development. Far less research has addressed how parents' socialization practices impact children's motivation for learning academic skills. This chapter examines available research on that topic (Jacobs, Davis-Kean, Bleeker, Eccles, & Malanchuk, 2005).

Children's motivation is positively associated with their learning and academic development (e.g., Aunola, Leskinen, & Nurmi, 2006; Fisher, Dobbs-Oates, Doctoroff, & Arnold, 2012). The limited research on this topic shows that parents' socialization practices are associated with children's motivations (including their interest in learning) which, in turn, are associated with their academic skill development (e.g., Cheung & Pomerantz, 2012, 2015). A focus on the importance of using home-based activities to foster children's interest in math is consistent with a recent joint position statement by the National Association for the Education of Young Children and the National Council of Teachers of Math (2002) which emphasized the importance of building upon children's natural interest in math to foster their math development.

Children's interest in academically-relevant tasks is positively associated with their subsequent academic performance (e.g., Jacobs et al., 2005; see Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006; Wigfield, Rosenweig, & Eccles, 2017). The positive association between children's interest in a topic and their academic achievement may stem from their interest in a topic promoting deeper levels of processing, increasing time spent on a task, and/or increasing effort and practice devoted to a task (Fisher et al., 2012). It is also important to acknowledge that the relation between children's interest and achievement is bidirectional: interest predicts skills and skills predict interest (Denissen, Zarrett, & Eccles, 2007; Fisher et al., 2012). However, the processes through which interest fosters learning have not been well-investigated but, as noted, there is believed to be an association between children's interest in a topic and their engagement in related activities

Research on young children's math development shows a positive relation between their interest in math and their math skills. For example, Fisher et al. (2012), using an ethnically diverse low-income sample of preschoolers ($N = 166$), found that children's interest in math was moderately associated with

how well they performed on a math test administered at that time. In addition, children's math scores positively predicted their interest in math five months later (see also Doctoroff, Fisher, Burrows, & Edman, 2016). Aunola et al. (2006) studied 196 children from Estonia as they transitioned from preschool through the first two years of elementary school. Children's math skills were assessed in preschool; measures of motivation were added in elementary school. Children's initial math skills positively predicted their subsequent interest in math which, in turn, predicted their subsequent math skills. Similar results have been found with older children (e.g., Cheung & Pomerantz, 2012, 2015). Despite a positive association between children's interest and their academic achievement, such interest unfortunately decreases with age (e.g., Gottfried, Fleming, & Gottfried, 2001; Mazzocco, Hanich, & Noeder, 2012). Thus, it is particularly important to find ways to maximize early on children's interest in math (Gottfried et al., 2001).

This chapter will review the literature on parents' academic socialization of young children's math skills by addressing how socialization practices foster children's interest and engagement in math activities. We take the view that parents' beliefs and practices foster their children's interest in math which, in turn, is associated with the frequency of their engagement in activities and the type of activities engaged in. Such engagement then is associated with children's math development. Our conceptualization is consistent with the theoretical framework and research by Eccles and her colleagues (e.g., Wigfield et al., 2017). The body of research on this topic which is directly relevant is small. Of that which is relevant, more research has focused on reading than math, and has used children older than the focal age-group (ages 3-8) in this chapter. Accordingly, research on reading *and* math, where relevant, will be included. Most of the research has been conducted with children in the U.S. As appropriate, however, research with children from outside the U.S. will be included. Note that findings with children outside of the U.S. reveal a similar pattern of associations to findings with children in the U.S. (e.g., Neuenschwander, Vida, Garrett, & Eccles, 2007).

We begin this chapter with a brief review of theories relevant for understanding how parents may influence their children's motivation and learning. We then present research on parents' academic

socialization and its relation to children's academic development followed by a review of how parents' practices foster children's interest and engagement in math. We next compare beliefs and practices and patterns of development across demographic groups, focusing specifically on race/ethnicity, SES, and gender. We conclude with a section on future directions for research and how to help parents foster their children's interest in math.

Relevant Theories and Theoretical Approaches

Parents' academic socialization and motivational theories are two important theoretical views or approaches for understanding how children's math skills develop. Both are discussed further in the remainder of this section on theories. As we discuss in this chapter, there are important racial/ethnic and income group-based differences in children's math development. Therefore, it is critical to keep in mind sociocultural theories that stress the importance of heritage influences and the larger social structure when examining family practices (Vygotsky, 1978; Wong & Hughes, 2006).

Parents' socialization of their children's interest and academic development. Parents' academic socialization includes parents' attitudes, values, goals, expectations, and beliefs about education, as well as the opportunities and activities parents make available to their children (Puccioni, 2015; Taylor, Clayton, & Rowley, 2004). Such socialization by parents can be expressed through beliefs explicitly or implicitly conveyed to their children, differential rewards for certain behaviors, parents' reactions to children's academic successes and failures, provision of artifacts and opportunities to engage in activities, and children's observation of parents as role models of positive engagement in academic endeavors (Jacobs et al., 2005; Sonnenschein et al., 2016). Such socialization beliefs and practices not only provide children with learning opportunities, they also convey to children the importance parents attach to their children's education and academic progress (Sonnenschein, 2002). As will be discussed in subsequent sections, parents' socialization is associated with children's academic development (Puccioni, 2015; Sonnenschein & Galindo, 2015) through children's interest and engagement in activities. The nature of parents' academic socialization is grounded in cultural models shared by members of a cultural

group (Keels, 2009), although some socialization beliefs and practices also may reflect family income and parents' educational level (Sonnenschein, 2002).

Children's motivation. Although there are many theories of motivation that are germane for children's development (see Wigfield et al., 2006 for review), we summarize here two key theories most pertinent for how parents socialize their children's interest in math development, Eccles' parent socialization model and Pomerantz' motivational development model.

***Eccles parent socialization model*.** The overarching motivational model by Eccles and her colleagues (e.g., Frederick & Eccles, 2002; Wigfied et al., 2006) focuses on children's expectancy to succeed and subjective task-values. The model addresses whether and why a child would want to engage in a task. As shown in Figure 1, the parent socialization component of the model is multi-faceted. Characteristics of the parents, family, and the child are associated with parents' general beliefs and behaviors as well as those specific to the child. Parents' behaviors and beliefs, in turn, are associated with children's behaviors and motivation. The model has been extensively explored with research on children's academic motivation and engagement in academic (reading, math) and leisure activities (sports, music). For example, Simpkins, Frederick, and Eccles (2012), using data from the Childhood and Beyond study, a longitudinal investigation starting when children were in kindergarten and going through twelfth grade, found that mothers' beliefs predicted their behaviors which, in turn, predicted their children's subsequent motivational beliefs and behaviors. In addition, mothers' behaviors mediated the association between mothers' and children's beliefs. Similarly, children's beliefs mediated the association between mothers' and children's behaviors (see also Simpkins, Fredricks, & Eccles, 2015).

Unfortunately, most of the research coming from Eccles and colleagues' lab has been conducted primarily with White families. The model may well apply to other racial/ethnic groups but it is important to explore whether, in fact, it does. The research exploring Eccles' model also typically does not include preschool children. We return to this point later in the chapter.

Pomerantz' motivational development model. Pomerantz and her colleagues have discussed how parents' involvement in their children's education fosters children's skills and motivational development (e.g., Pomerantz & Grolnick, 2017; Pomerantz & Moorman, 2010). Although the two components are related, we focus here on their motivational model. The motivational model draws heavily upon the self-determination theory of Deci and Ryan (e.g., Grolnick, Deci, & Ryan, 1997) which highlights the importance of children's feelings of competence, autonomy, and relatedness. Pomerantz and colleagues suggest that parents provide their children with a context to foster motivation and learning through the opportunities they provide their children and the nature of interactions when choosing and engaging in activities. Through engagement in certain activities children develop feelings of competence and the belief that they exert autonomy in choosing their activities. Pomerantz and Grolnick (2017) described four ways that parents can interact with their children to promote motivation for engaging in activities: Supporting children's autonomy, providing them with a structured rather than chaotic environment, being affectively positive rather than negative or critical, and focusing on the process of learning (e.g., the child's efforts) rather than performance outcomes (e.g., whether the child succeeded or not). Such interactive patterns not only increase children's motivation but also increase children's learning and academic outcomes.

Pomerantz's motivational model is a more recent one than Eccles' model and there has been far less research done on it. Although Pomerantz and her colleagues discuss what parents can and should do to foster their children's motivation, much of their empirical work has addressed how parent involvement fosters' adolescent engagement and academic success. Their studies have included children of middle school age and older. Using Chinese and U.S. adolescents, they have shown how parents' involvement facilitates children's academic achievement through children's internalizing their parents' views which, in turn, fosters children's self-regulation and academic achievement (e.g., Cheung & Pomerantz, 2012; 2015). Whether these findings apply to younger children is still an empirical question.

Research on Parents' Socialization of Children's Academic Skills

There is a large body of research showing that parents' academic socialization predicts the frequency of children's engagement in academic activities and their subsequent reading and math skills (e.g., Senechal & LeFevre, 2002; Serpell, Baker, & Sonnenschein, 2005; Sonnenschein et al., 2016). Much of the earlier research focused on children's reading development but the corpus of work on children's math development has grown substantially over the past few years. We present research from both domains because many of the findings from research on reading may be relevant for our understanding of the socialization of math. Both math and reading can be considered forms of language; therefore, similar socialization practices may be relevant for each. Given that both math and reading are important academic domains, parents may emphasize the two more than other nonacademic domains. Finally, children can have significant exposure to both math and reading through engagement in daily living activities. We first present research on reading and then turn to research on math.

Research on parents' socialization has shown that parents' beliefs, the types of activities they provide to their children, and the nature of their interactions with their children are positively associated with children's reading development. For example, Serpell et al. (2005) conducted a 5-year longitudinal investigation of literacy development with low- and middle-income Black and White families in Baltimore, MD starting when children were in prekindergarten. There were three particularly interesting findings. One, parents' views of how to facilitate their children's reading development was related to the type of activities made available to children, children's frequency of engagement in activities, the nature of the interactions when engaging in literacy tasks, and children's literacy development. A view that learning to read was best facilitated by an approach that engaged the child's interest was positively associated with their literacy skills. An approach that focused on skills inculcation was either negatively related or not related. Two, the frequency with which children engaged in literacy-related activities, and the range of activities in which they engaged, was positively related to their subsequent literacy skills (see also Huntsinger, Jose, & Luo, 2016). Three, using data from the same longitudinal study, Baker, Mackler, Sonnenschein, and Serpell (2001) found that the nature of the reading interaction (affective

quality and the amount of talk that goes beyond the immediate context) in first grade was associated with the frequency of children's reading age-appropriate chapter books in second grade.

Sonnenschein et al. (2016) assessed academic socialization beliefs and practices of Black and Latino parents of Head Start preschoolers as well as measured the children's language, early reading, and math skills. Consistent with findings by Serpell et al. (2005), parents' endorsement of an approach that fostered their children's engagement was positively associated with children's early literacy skills. In addition, parents' serving as role models of engagement in literacy activities was positively associated with children's engagement in such activities and, in turn, was positively associated with their receptive and expressive language skills. We discuss the pattern for math found by Sonnenschein et al. (2016) when we discuss parents' socialization of their children's math development.

Senechal and LeFevre (2002) considered the type of activity children engaged in and its relation to children's literacy development. They conducted a 5-year longitudinal study of children and their families beginning when the children were in kindergarten. Most of the families in the study were White and came from middle- to upper-middle income backgrounds. There were different patterns of association depending upon the type of activity children engaged in and the language or literacy outcome being assessed. Children's exposure to books was related to their vocabulary and listening comprehension. In contrast, parents' reports of purposely teaching children to read and write was positively related to their children's early literacy skills.

Parents emphasize and value reading more than math (Sonnenschein et al., 2016), with the differences in emphasis across domains greater for Black than Latino parents. Given such an emphasis by parents, it is not surprising that children engage in reading more than math activities (e.g., Anders et al, 2012; Sonnenschein et al., 2016). Findings showing associations between the frequency of children's engagement in math-related activities at home and their early math scores are mixed. On the one hand, many researchers do find such a pattern. For example, Sonnenschein and Galindo (2015), using the 1998 ECLS-K dataset, found that engaging in a broad array of math-related activities at home was positively associated with kindergarteners' math scores (see also Kleemans, Peeters, Segers, & Verhoeven, 2012;

Niklaus & Schneider, 2013). On the other hand, some researchers do not find such a pattern (see Blevins-Knabe, 2016, for a review). Blevins-Knabe (2016) suggested the difference in findings may stem from variability in outcome measures and how early math skills are conceptualized, variability in how math-related activities are defined, and parents' lack of knowledge of what activities children engage in. Despite some variability in patterns across studies, Blevins-Knabe (2016) concluded that more studies find an association between parents' beliefs, practices, and children's math skills than do not.

Consistent with what has been shown for reading, parents beliefs about how children learn math and their role in such learning is related to the frequency with which children engage in tasks and their math development. Sonnenschein et al. (2012) interviewed a racially/ethnically diverse group of parents of preschool through first graders. Parents' beliefs about math development and their role in fostering it were significantly related to the frequency with which children engaged in math activities. More specifically, the frequency of such engagement was related to the frequency with which children observed their parents do math activities, to parents' beliefs about using daily living activities to foster math learning, and their beliefs about the importance of children doing math at home. Sonnenschein et al. (2016) used a previously described dataset of low-income Black and Latino parents of preschoolers to explore components of parents' beliefs and children's math activities and math skills. They found that parents as role models of math engagement, based on how much they enjoyed engaging in math activities and how frequently their children saw them doing so, predicted children's engagement in math activities and their early math skills. *Some* interesting differences occurred in how parents described the best ways to socialize their children's reading and math development. About 20% of the parents discussed the importance of using daily living activities to foster their children's math skills. No one mentioned using daily living activities for fostering reading.

As previously noted, many researchers, although not all, find positive associations between the frequency of children's engagement in math activities and their math skills (e.g., Huntsinger et al., 2016; Kleemans et al., 2012; LeFevre et al., 2009; Vandermaas-Peeler & Pittard, 2014). Several researchers have explored the types of math-related activities children engage in or the quality of the interactions they

have with their parents when they do engage in such activities. For example, LeFevre and colleagues (e.g., LeFevre et al., 2009; Skwarchuk, Sowinksi, & LeFevre, 2014) explored children's engagement in what they called formal and informal math activities. Formal activities involved direct instruction in numbers or some form of numerical knowledge. Informal activities were board games or activities that could involve numbers but that was not the main purpose of the activity. Engagement in formal activities predicted subsequent math knowledge but engagement in informal activities did not. It is quite possible, however, that it is not the type of activity (formal or informal) children engage in but what takes place during the activity that is relevant. Metzger, Sonnenschein, Galindo, and Patel (2015) asked first through fourth graders to describe what they did when engaging in cooking and grocery shopping, two activities thought to have opportunities for fostering math development. Most of the children reported they engaged in non-math activities (reading labels, picking out items) when they assisted their parents with cooking or grocery shopping.

Other research shows that playing math board games can be an effective tool for acquiring math skills. Ramani and Siegler (2008) used math board games that they created to successfully train children's early numeracy skills (see also S.K. Cheung & McBride, 2017). Ramani & Siegler (2008) trained children to count the spaces in a specific way on a linearly arranged board game. Not only did children show growth from pre- to post-training in their early math skills, but low-income children in the training condition improved their early math skills to the level displayed by middle-income children. Additional evidence about the importance of the nature of the interactions rather than just the type of activities comes from the work of Vandermaas and her colleagues (Vandermaas-Peeler, Boomgarden, Finn, & Pittard, 2012; Vandermaas-Peeler, Ferretti, & Loving, 2012) who found that without specific instruction on the importance of using math language when playing math-related games with their children, and guidance on what to say, most mothers did not highlight the math content of games or activities for their children.

Ramani, Rowe, Eason, and Leech (2015) using a low-income sample of preschoolers, found that the nature of mothers' math-related talk was positively associated with the specific types of math that children learned. That is, mothers whose talk included more advanced math concepts had children who

displayed more advanced math knowledge. Levine, Suriyakham, Rowe, Huttenlocher, and Gunderson (2010) found a similar pattern with preschoolers whose understanding of cardinal numbers was associated with the nature of the math talk they heard from their parents.

In sum, research shows that the beliefs parents have about how their children learn and their role in such learning, the type and amount of activities engaged in, and the nature or quality of the interactions are related to the frequency of children's engagement in activities and their subsequent math development. Parents also emphasize reading more than math and children engage less frequently in math than reading activities. Equally importantly, parents often report not knowing what to do to facilitate their children's math development (Cannon & Ginsburg, 2008). They also seem not to know how to highlight the pertinent math content in math-related activities, at least without specific instruction (Vandermaas-Peeler, Boomgarden et al. 2012; Vandermaas-Peeler, Ferretti et al., 2012). We turn next to how parents socialize their children's interest in learning, specifically their interest in learning and engaging in math activities. Such socialization is critical for increasing children's engagement in math activities and their acquisition of math skills (Wigfield et al., 2006).

Research on Parents' Socialization of Children's Interest in Math

Parents can socialize their children's interest in learning by providing a cognitively stimulating environment (Gottfried, Fleming, & Gottfried, 1998) and by the nature of their interactions with their children (e.g., Doctoroff & Arnold, 2017; Sonnenschein & Munsterman, 2002). Unfortunately, this is still a relatively understudied topic, particularly for math development. However, as discussed before, the principles that apply to reading also may apply to math. Similarly, the research described in prior sections that addressed how parents socialize their children's engagement with tasks should be applicable. That is, expressing a set of beliefs about the importance of engaging the child's interest in learning and providing opportunities for engagement in a broad array of activities (Serpell et al., 2005) was relevant for children's reading development. Focusing on math, Sonnenschein et al. (2016) found that low-income Black and Latino parents who enjoyed engaging in math activities and whose preschool children

frequently saw them engage in such activities had children who themselves more frequently engaged in such activities.

Sonnenschein and Munsterman (2002) used data from the Early Childhood Project to study reading interactions. The sample of 30 dyads in the Sonnenschein and Munsterman (2002) study came mostly from low-income backgrounds. Of particular interest was the affective quality of the reading interactions that children experienced. The reading interactions were observed the summer before the children entered kindergarten and children's motivations for reading were assessed at the start of first grade. The affective quality of the reading interactions was the strongest predictor of children's reading motivation a year later. Children's reading motivation was associated with the frequency with which children subsequently chose to read (Serpell et al., 2005). In another study focusing on reading development, Doctoroff and Arnold (2017) found that mothers who used an approach to doing homework with their children that fostered feelings of autonomy by offering them choices (e.g., which task do you want to do now) was positively associated with the nature of children's engagement. Such engagement, in turn, predicted children's scores on a standardized measure of reading.

Few studies have focused on how parents and children interact when doing math tasks. Much of the relevant research on factors that foster children's motivation comes from the work of Eccles and her colleagues (see Jacobs et al., 2005; Wigfield et al., 2006 for reviews). This research will be discussed more extensively in the section on gender issues. However, in brief, Eccles' research shows that parents' beliefs are associated with the environment they create for their children which, in turn, is related to children's engagement in activities and subsequent math development. Relevant components of the environment include a positive climate for learning, provision of artifacts to encourage and facilitate children's engagement in math activities, and parents who serve as role models of math engagement.

Aunola, Viljaranta, Lehtinen, and Nurmi (2013) studied Finnish first graders and their mothers to assess the relation between children's interest in math and the nature of the interactions they had with others. Children's interest in math was assessed in the fall and the spring. Mothers kept a diary for a week in the fall and again in the spring about the nature of their interactions with their children on math

homework tasks. There was a positive relation between mothers' reports of supporting their children's sense of competence and autonomy, two key aspects of self-determination theory, and their children's subsequent interest in math after the homework task was completed.

In a study with 11- year- old U.S. children, Else-Quest, Hyde, and Jejmadi (2008) had mothers and their children complete a math homework task together. They found a positive association between parents' and children's displays of interest in the homework task. In addition, children's interest in the homework task predicted their scores on a math test administered after the homework task engaged in by mothers and their children.

In sum, there has been limited research that directly addresses how parents socialize their children's interest in math. The available research, as well as that conducted with reading, shows that providing a cognitively stimulating environment (Gottfried et al., 1998), pleasant interactions (Aunola et al., 2013; Sonnenschein & Munsterman, 2002), role models of parents enjoying and being interested in math tasks (Else-Quest et al., 2008; Sonnenschein et al., 2016), and encouraging children's feeling of autonomy in choosing tasks (Aunola et al., 2013) are related to children's interest in learning and engaging in academically-relevant tasks.

Race/Ethnicity Differences in Parents' Academic Socialization of Children's Math Interest and Skills

Demographic group differences in children's math skills are a well-established finding in the literature. Black and Latino children, on average, earn lower scores than White or Asian children (Sonnenschein & Sun, 2016; see Cross, Woods, & Schweingruber, 2009 for review) although there is some evidence that the size of the gaps recently have decreased (Reardon & Portilla, 2016). These group-related differences in math scores are evident by the start of kindergarten or even earlier (Burchinal et al., 2011; Sonnenschein & Sun, 2016). Although influences on children's math skills are multi-determined, an increasing number of studies have focused on parents' beliefs and practices as one means of understanding group-based differences. However, little research has addressed whether there are

racial/ethnic differences in how parents socialize children's motivation to engage in math activities or whether the associations between children's interest and outcomes differ across racial/ethnic groups.

Most parents, including those from different demographic groups highly value education for their children (Sonnenschein, 2002) and express high aspirations for their children's future academic success (Sonnenschein & Galindo, 2015). Nevertheless, children from Asian and White families engage in academically-relevant activities more than do children from Black and Latino families (e.g., Cheadle & Amato, 2011; Sonnenschein & Sun, 2016). Sonnenschein and Galindo (2015), using data from the nationally representative 1998 Early Childhood Longitudinal Study-Kindergarten cohort (1998 ECLS-K), found that Black and Latino kindergartners engaged in math-relevant activities less frequently than White children, whereas Parmar, Harkness, and Super (2008) found that White children (N = 24), ages 3-6 years, engaged in academic types of activities less than Asian children (N = 24). Similarly, using the 1998 ECLS-K, a much larger data set, Sy and Schulenberg (2005) found that White parents emphasized academic skills for their kindergartners significantly less than Asian parents.

The differences in academically relevant experiences across groups may reflect differences in cultural beliefs. Chinese parents emphasize the importance of children earning high grades in school (Zhou & Lee, 2014) and the relevance of effort for school success (Hsin & Xie, 2014). They also engage in more systematic or direct instruction at home (Huntsinger & Jose, 2009; Sy & Schulenberg, 2005). These socialization practices are positively associated with children's math skills (Huntsinger & Jose, 2009).

Sonnenschein et al. (2018) compared the socialization beliefs and practices of non-U.S. born Chinese and Latino immigrants who were parents of children in prekindergarten through first grade. Consistent with what has been reported by others, Chinese parents reportedly engaged in more systematic instruction. They also discussed the need to modify the nature of children's instruction as their skills changed. Latino parents stressed the importance of children engaging in math activities at home but did not report the same systematic, planned nature of engagement as Chinese parents.

Despite the extensive research comparing and contrasting parents' socialization practices across different racial/ethnic groups, little research has addressed group-related differences in parents' socialization of children's motivation for engaging in academic activities. Some theorists have suggested that Latino parents' socialization focuses on motivational practices by telling their children about the sacrifices they have made for them to do well in school (see Sonnenschein et al., 2018 for review). However, research has not investigated whether such a focus is related to children's academic motivation, specifically their interest in math. Sonnenschein et al. (2018) did not find that Latino parents discussed such motivational practices or their children's interest in learning. In contrast, the Chinese parents in that study, while emphasizing the importance of children practicing math skills, also emphasized the need to make tasks interesting or their children would not want to do the tasks.

With few exceptions, there has been little research investigating whether the pattern of associations between parents' socialization and children's outcomes vary across demographic groups, and even fewer studies that consider children's motivation (cf. Cheung & Pomerantz, 2012, 2015). The more general research on associations between parents' socialization and children's outcomes shows a mixed pattern of findings. Keels (2009) found group-based differences in the strengths of associations between White, Black, and Latino parents' beliefs and practices and children's outcomes using data from the Early Head Start Research and Evaluation study. Sonnenschein and Galindo (2015), using the 1998 ECLS-K dataset, found similar differences in group-related associations between White, Black, and Latino parents' beliefs and practices and their kindergarten children's math skills (see also Sonnenschein & Sun, 2016). Associations between Latino parents' socialization of their children's math skills and children's outcomes were weaker than associations found with Black and White families. These patterns may reflect limitations in the set of beliefs and activities assessed by the datasets. That is, there may not have been questions pertinent for Latino families. Sy and Schulenberg (2005), also using the 1998 ECLS-K, did not find group-related differences in the associations between Asian and White parents beliefs/practices and their kindergarteners reading and math scores.

In sum, there are clear demographic group-based differences in how parents socialize their children's math development. Research linking these group-based differences in practices to children's skill development is more limited; however, such research generally shows a positive association between practices and children's outcomes. There is even less of a focus on the association between parents' socialization practices and children's motivation. Future research is needed on this topic.

SES-Related Differences in Parents' Academic Socialization of Children's Math Interest and Skills

There is a fairly large literature documenting SES-related differences in children's math skills (see DeFLorio & Baliakoff, 2015 for a review). Given that these differences are evident at the start of school, it is reasonable to assume they may be due in part to the amount, type, or nature of home-based experiences. However, research has not found a consistent pattern of such SES-related differences in the frequency with which children engage in math-related activities. For example, neither Tudge and Doucet (2004) nor DeFlorio and Beliako (2015) found a difference in the number of math-related activities children engaged in. On the other hand, Saxe, Guberman, and Gearhart (1987) and Ramani and Siegler (2008) did. Research focusing on SES has not sufficiently addressed the nature of the interactions nor has it considered how parents socialize their children's interest in math.

Gender Differences in Parents' Academic Socialization of Children's Math Interest and Skills

Whether there are gender-related differences in children's math skills has long been a focus of inquiry with research revealing mixed findings (see Cross et al., 2009, for a review). On the one hand, as noted previously in this chapter, the 2015 NAEP math scores, consistent with those from past years, show that a slightly higher percentage (about 4%) of fourth grade boys than girls scored in the proficient range. Girls are still less likely than boys to enroll in more advanced math courses and pursue STEM careers (Ceci, Williams, & Barnett, 2009; Sadler, Sonnert, Hazari, & Tai, 2012), however, such differences may be decreasing (Kena et al., 2015). On the other hand, some researchers do not find such a pattern of differences or find them only for certain math skills (Jacobs et al., 2005; Jordan, Kaplan, Olah, & Locuniak, 2006). For example, Lachance and Mazzocco (2006) found no gender difference in children's math skills with a group of children (N = 200) followed from kindergarten through third grade. In a 1990

meta-analysis, Hyde, Fennema, and Lamon found what they called trivial differences favoring boys. In a more recent set of analyses, however, Hyde, Lindberg, Linn, Ellis, and Williams (2008) found no such differences.

A separate line of research has addressed whether there are differences in boys' and girls' motivational beliefs about math. There do appear to be differences, with boys exhibiting more positive views about their competency and displaying greater interest in math than girls in first grade. However, these gender-related differences decrease as the children proceed through school (Frederick & Eccles, 2002; Ganley & Lubienski, 2016; Simpkins et al., 2012).

Given the mixed pattern of findings on gender-related differences in math beliefs and skills, and its developmental trajectory, it is important to consider whether there are differences in how parents socialize their sons' and daughters' math development. This is a particularly important, although somewhat understudied topic, given that gender-related differences in STEM vocational choices continue despite decreasing gender-related differences in children's actual math skills (Jacobs et al., 2005).

An early line of research addressed whether parents differentially viewed their sons' and daughters' success in math. For example, Yee and Eccles (1988) asked 48 parents of boys and girls in junior high to attribute the source of their children's success in their math classes. Mothers were more likely to attribute their sons' success to talent and their daughters' success to effort. Such attributions may be associated with implicit or explicit messages that parents give their children or with different practices which, in turn, may be associated with children's beliefs about themselves and their math competencies (Jacobs & Bleeker, 2004).

Jacobs and Bleeker (2004) used data from the Childhood and Beyond dataset to investigate whether parents differentially socialized their children's math skills depending upon the gender of the child, and whether such practices were associated with children's subsequent interest in math. Almost all the families in the study were White. Parents were more likely to provide their sons than daughters math toys and artifacts. Parents' provision of math-related toys and other artifacts as well their participation in

math-related activities in early elementary school were positively associated with children's interest in math in middle school.

Using the same longitudinal dataset, Jacobs et al. (2005) found that parents were more likely to provide an environment associated with boys' than girls' interest in math. That is, they provided their sons with more math toys and artifacts and spent more time on math activities with their sons. They also made more positive attributes about their sons' interest and skills. These practices and attributions were positively associated with their children's later math beliefs/motivation and math skills.

In sum, research on gender differences in the association between parents' practices and young children's motivation is limited. The available research has focused primarily on relations starting when children enter elementary school and has not sufficiently addressed children's interest in math but has included a wider array of motivational beliefs. That said, there appear to be gender-related differences in parents' socialization of their children's math interest and engagement. By differentially serving as role models of positive engagement and by differential provision of activities, opportunities, and artifacts, parents may stimulate more of an interest in math for boys than for girls.

Conclusion

Parents' beliefs about how their children learn and their role in such learning, the opportunities and activities they make available to their children, and the nature of their interactions are associated with children's interest in learning, their engagement in academic activities and their learning. Although there are many theories about children's motivation and its relations to learning (see Wigfield et al., 2006 and Wigfield et al., 2017 for reviews), far less theory or research addresses how parents socialize their children's interest, particularly their young children's interest, in engaging in math activities. Two pertinent exceptions are models presented by Eccles and colleagues (e.g., Wigfield et al., 2006) and Pomerantz and colleagues (e.g., Pomerantz & Grolnick, 2017). Both theories discuss the role of parent involvement in fostering children's motivation and engagement in math. However, there are still significant limitations in what we know, as is discussed below. Understanding the role that parents can play in fostering their children's math interest and engagement is important because math instruction is a

large part of children's schooling. Children's success in math in the early grades is associated with their subsequent academic success; math, as one of the STEM fields, plays an increasingly important role in children's future vocational opportunities (Blevins-Knabe, 2016; Cross et al., 2009). Relatedly, children's interest in math and engagement in math activities is associated with their math development (Wigfield et al., 2006)

Research into children's math development is a burgeoning field. Nevertheless, research on how parents facilitate their children's interest in math, particularly their young children's interest, is still limited. Thus, this review included relevant research that was based on an older age group than the focal group in this chapter (children ages 3-8). It also included research on reading. Even though there are some differences in parents' views of the importance of reading and math and children's frequency of engagement in activities in the two domains (Anders et al., 2012; Sonnenschein et al., 2016), it was assumed that many aspects of parents' socialization of reading would be applicable to math (Sonnenschein et al., 2016). On the other hand, it is important for future research to document similarities and differences in parents' socialization across the two domains.

The review of the relevant literature highlights the importance of certain components for fostering children's interest in math and their participation in math activities. These components include: parents' beliefs about math, provision of a broad-array of math-related activities for their children, and interactions that occur in a pleasant climate. Parents who themselves enjoyed math and were role models of positive engagement had children more likely to engage in math activities. Giving children a choice of activities to engage in and taking an approach that focuses on enjoying interactions also is related to children's interest in and engagement in math activities. Despite the increase in research on children' math development and ways to foster such development, there are still clear limitations to our knowledge that future research should address. These are discussed below.

Expanding Eccles' parents' academic socialization model. Much of what we have learned about parents' socialization of children's motivation comes from the work of Eccles and her colleagues (Jacobs et al., 2005). That research is based on the findings from one longitudinal dataset. It is important

that other samples confirm these findings. Relatedly, the Eccles sample included a mostly White sample of which kindergartners were the youngest group of children.

Generalizing findings to a more diverse sample. As discussed, there are many studies documenting racial/ethnic differences in children's math skills (Cross et al., 2009; Sonnenschein & Galindo, 2015). There are also some studies showing group-related differences in home learning opportunities, however, this corpus of work should be expanded given inconsistencies in findings across studies (Blevins-Knabe, 2016). There are two key limitations to work considering racial/ethnic diversity issues. One, little of the work on children's math development has focused on what different groups of parents do to foster their children's interest in learning math. Two, there has been very limited research testing whether the associations between parents' socialization of children's math, their interest, engagement in activities, and their math outcomes is similar across demographically different groups. There seems to be an implicit assumption that it is but such an assumption is unwarranted without empirical evidence.

Generalizing findings to younger children. Differences in children's math skills are evident upon school entry and before. This has caused researchers to emphasize the importance of the home in fostering children's early math skills. However, little research has focused on parents' socialization practices with preschool children, especially for math development and for fostering children' interest in math during those early years. Although the processes that are applicable during elementary school and beyond may well be applicable during the preschool period, we need additional research with this age group to confirm the notion.

Expanding Pomerantz's motivational model. Many of the concerns noted above with Eccles' model are pertinent for Pomerantz's. That is, empirical research on the model has been limited to Chinese and US adolescents. Also, although Pomerantz suggests ways that parents can increase children's interest in math, she and her colleagues have not directly assessed the relative effectiveness of these means.

Increasing our knowledge of what mothers and fathers are doing with their children. Most of the research on parents' socialization, including how parents foster their children's interest in math, has

been based on the role that mothers play with their children. However, the few studies that have included both mothers and fathers have shown some gender-related differences in socialization (e.g., Jacobs et al., 2005). Additional research on this topic is clearly needed.

Improving parents' knowledge of how to facilitate their children's math development. As discussed earlier in the chapter, parents do not necessarily know what to do to facilitate their children's math development (Cannon & Ginsburg, 2008). They need information about the type of tasks to do with their children and even how to highlight the math aspects of tasks that seem relevant for math development (Vandermaas-Peeler, Boomgarden, et al., 2012; Vandermaas-Peeler, Ferretti, et al., 2012). Educators who work with parents need to inform them about ways to foster their children's math skills, and devise scenarios for what parents should do and say when engaged in such activities.

Research by Sonnenschein et al. (2012, 2016) showed that parents who enjoyed math and provided their children opportunities to observe them engage in math tasks served as good math role models for their children. Being such role models was associated with children's engagement which was associated with their math development. It is not surprising that parents who enjoy math may be better role models for their children's math development. However, researchers and educators should look for ways to assist parents who do not particularly enjoy math to provide positive and appropriate math environments for their children. Providing more detailed scenarios for these parents could be beneficial.

Summary. Providing a stimulating home environment for children is associated with their interest in learning and their subsequent academic development. Parents who serve as positive role models of math engagement and who provide their children with a range of opportunities to engage in math tasks as well as have pleasant interactions with their children when engaging in such tasks have children who express more interest in math and engage more frequently in math tasks. Such engagement, in turn, is related to children's math development.

This chapter focused on the important role that the home environment plays in young children's math development, particularly in fostering their interest and engagement in math. Despite the importance of a home environment that supports and facilitates children's engagement in math activities, the role that

teachers and schools play is also extremely important and should not be undervalued. Not only do teachers provide direct instruction in math, they can compensate when children are not getting sufficient math experience at home, and can provide suggestions for what parents can do at home to foster their children's interest and engagement in math.

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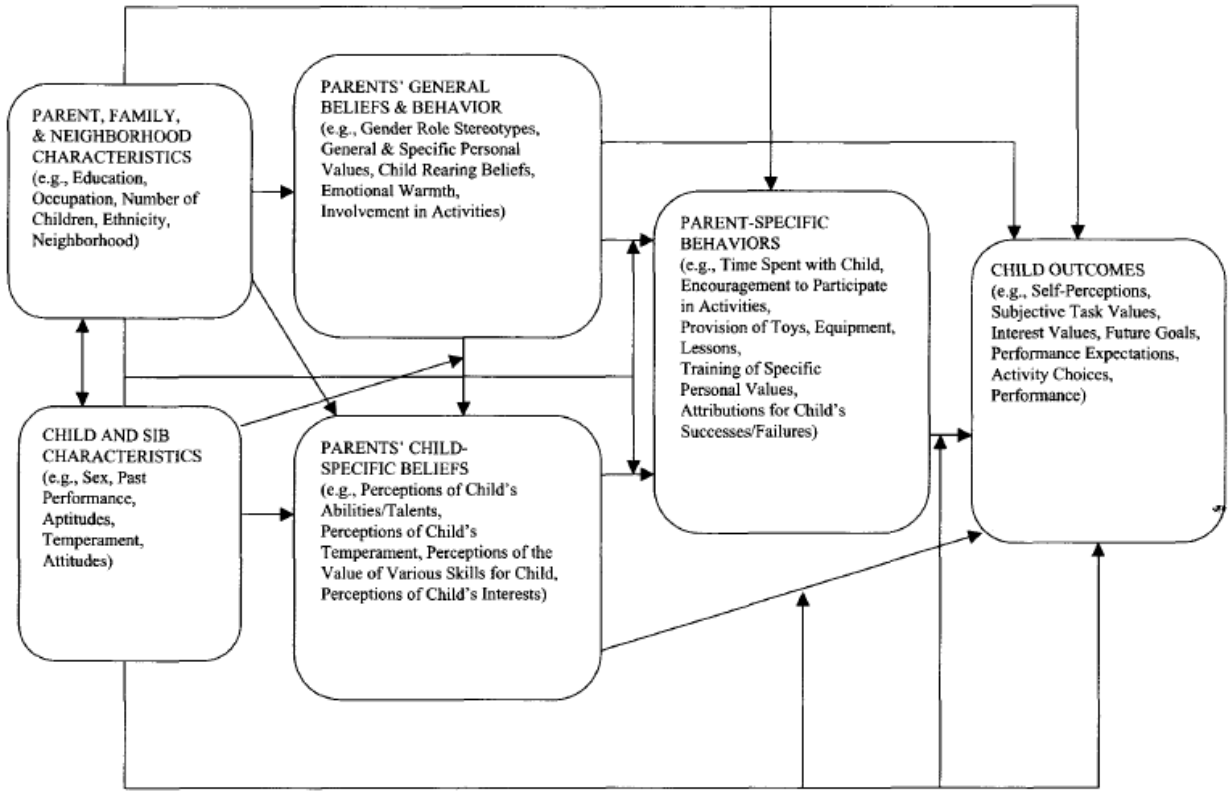

Figure 1: Eccles et al.'s (1983) Model of Parent Socialization. Reprinted from 'I can, but I don't want to': The impact of parents, interests, and activities on gender differences in math (p. 249), by J. E., Jacobs, P., Davis-Kean, M., Bleeker, J. S., Eccles, & O. Malanchuk, 2005. In A. M. Gallagher & J. C. Kaufman (Eds.), *Gender differences in mathematics: An integrative psychological approach* (pp. 246-263). New York, NY: Cambridge University Press.