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CHAPTER 8

PARENTAL INVOLVEMENT AND EQUITY IN MATHEMATICS

Susan Sonnenschein and Brittany Gay

There continue to be large and significant income-related differences in the percentage of children in the United States earning age-appropriate math scores as they go through elementary school (Reardon & Portilla, 2016). On the 2017 U.S. National Assessment of Educational Progress, only 22% of fourth graders (youngest grade the test is given) eligible for free or reduced lunch (a marker of low income in the United States) received proficient or higher scores in math compared to 52% of those not eligible for lunch subsidies (National Center for Educational Statistics, 2018). And, as Duncan and Magnuson (2011) discuss, low-income children in the United States entering kindergarten score, on average, one standard deviation lower on math tests than their more affluent peers. School children in the United States also 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; Provasnik et al., 2016), U.S. fourth graders ranked 14th in math among children from 49 different industrialized countries. Decreasing achievement gaps in math, as well as more generally improving children's math skills, are important for

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children's academic and subsequent vocational well-being (Blevins-Knabe, 2016; National Mathematics Advisory Panel, 2008).

Given that demographic group-related differences in children's academic achievement are present at the start of school and generally continue or increase over time (Burchinal et al., 2011; Cheadle, 2008; Sonnenschein & Sun, 2016), we need to consider what math learning opportunities children have at home, even before the start of formal schooling. As Ginsburg, Lee, and Boyd (2008) have noted, even very young children should have many such opportunities. However, just because a child's home environment affords the possibility of such opportunities, it does not mean that these potential opportunities are utilized well or at all. Differences in available opportunities can contribute to the inequitable development of math skills.

Before turning to the main content in this chapter, we need to note that although there are large differences in academic achievement associated with both race/ethnicity and income (NCES, 2018), these two variables are strongly correlated (e.g., Hill, 2001; Reardon & Galindo, 2009) and the income achievement gap in the United States is now larger than the racial/ethnic one (Reardon, 2011). In addition to the strong association between race/ethnicity and income, income and parents' education are highly correlated (Krieger, Williams, & Moss, 1997). Thus, some of the income-related differences in socialization practices may reflect differences in parents' race/ethnicity and education levels. This chapter considers the home learning opportunities available for children's math development. We focus primarily on children from low-income backgrounds because of the critical need to narrow or close achievement gaps. Such a focus allows us to identify areas of relative need as well as potential strengths upon which to build, thus promoting equity (Cabrera, Beeghly, & Eisenberg, 2012). As we will show, both low- and middle-income parents view math as less important than literacy and are less knowledgeable about how to socialize their children's math skills than their literacy skills (Blevins-Knabe, 2016). Nevertheless, despite such commonalities across low- and middle-income parents, there also are key differences in socialization practices between such low- and middle-income parents as well as societal differences (e.g., quality of school attended) to support children's math acquisition. Such differences are potential sources of inequities in children's math development.

We consider parents' beliefs and practices because these are key aspects of parents' academic socialization and pertinent for children's academic development (Serpell, Baker, & Sonnenschein, 2005; Sonnenschein, Metzger, & Thompson, 2016). Income-related differences in any of these components can result in differences in children's math skills. 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. We focus primarily on children prior to the start of formal schooling and shortly thereafter because, as said, group-related differences emerge during preschool and the home influence may be greatest in the early years (Aikens & Barbarin, 2008; Jeynes, 2012). Unless otherwise noted, the research included in this chapter is based on children in the United States; however, we include research with children from other countries as appropriate. We begin with a short summary of the relevant theory that underpins our review and then present pertinent research.

THEORETICAL BACKGROUND

Parents' socialization of their children's math development includes parents' attitudes, values, goals, expectations, and beliefs about education, as well as the opportunities and activities parents make available to their children (Green, Walker, Hoover-Dempsey, & Sandler, 2007; Puccioni, 2015; Taylor, Clayton, & Rowley, 2004). Such socialization by parents can be expressed through beliefs explicitly or implicitly conveyed to their children, through 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 (Sonnenschen, Metzger, & Thompson, 2016). 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). Parents' socialization is associated with children's academic development (Puccioni, 2015; Sonnenschein & Galindo, 2015) through children's interest and engagement in activities (Sonnenschein & Dowling, 2019). The nature of parents' academic socialization is grounded in cultural models shared by members of a cultural group (Keels, 2009; Wong & Hughes, 2006), although some socialization beliefs and practices may also reflect family income and parents' educational levels (Sonnenschein, 2002).

Income-related differences in what Lareau (2003, 2011) called concerted cultivation also has been used to account for socialization differences and related achievement gaps. Lareau (2011) studied 12 low- and middle-income families. Middle-income parents in Lareau's (2011) study engaged in concerted cultivation whereby they actively and purposely fostered their children's growth through the provision of academic and leisure activities. In contrast, according to Lareau (2011), low-income parents engaged in a philosophy of child-rearing more consistent with the "accomplishment of natural growth." Rather than parents seeking enrichment activities for their children, the children engaged in more spontaneously occurring activities or "hung out"

with their families or other children. Although Lareau's notion has found support (e.g., Bodovski & Farkas, 2008), some researchers question whether the income-related differences in approaches reflect differences in access to economic opportunities more than differences in child-rearing philosophy (Sonnenschein, Metzger, & Gay, 2018; Yeung, Linver, & Brooks-Gunn, 2002).

Although the home has a major influence, children's development also occurs in other overlapping contexts which can directly and indirectly influence what occurs at home and, therefore, impact children's development (Bronfenbrenner & Morris, 2006; Garcia Coll et al., 1996). As will be discussed in a subsequent section, outreach by children's schools and establishing shared understandings between schools and families is particularly important for promoting children's academic development (Epstein, 2001; Green et al., 2007; Mapp & Kuttner, 2013).

Parents' Academic Socialization

Given that income-related differences in children's math skills are evident at the start of school, it is reasonable to assume they may be due, at least in part, to the amount, type, or nature of home-based experiences (Vandermaas-Peeler & Pittard, 2013). Galindo and Sonnenschein (2015), using a large nationally representative data set, found that home learning opportunities (a composite of parents' expectations for their children's development, involvement at child's school, and frequency of child's engagement at home in various academically related activities) significantly attenuated the relation between income and kindergarten children's end-of-year math scores, after controlling for children's math skills at the start of kindergarten. However, Galindo and Sonnenschein (2015) did not directly compare the amount of home learning opportunities children from different income groups experienced. Research which has done such comparisons has not found a consistent pattern of income-related differences in the frequency with which children engage in math-related activities. For example, Tudge and Doucet (2004) did not find significant income-related differences in children's home-based math experiences whereas Ramani and Siegler (2008) did. Given such inconsistencies across studies, we need to consider not only the frequency of children's math-related experiences but other components of parents' academic socialization.

Parents' Beliefs

Parents have specific beliefs about children's development and their role in the development that predict the experiences they make available to

their children (Sonnenschein, Metzger, Dowling et al., 2016) which subsequently predict children's development (Keels, 2009; Serpell et al., 2005). Much of the research on parents' beliefs has been based on middle-income families or has not distinguished between middle- and low-income families. However, there do seem to be some systematic differences associated with income in parents' expected timelines of their young children's math acquisition and parents' beliefs about how children acquire math skills.

Research by Sonnenschein and colleagues showed that parents from economically diverse backgrounds strongly support the importance of having their children engage in math activities at home and assisting their children with such engagement (Sonnenschein et al., 2012; Sonnenschein, Metzger, Dowling, Gay, & Simons, 2016). However, these parents more strongly endorsed the importance of such engagement for reading than math (see Blevins-Knabe, 2016 for review). Sonnenschein et al. (2012) found a positive relation between a diverse group of parents' endorsement of the importance of children engaging in math activities at home and children's doing such activities. Relatedly, Skwarchuk (2009), with a small sample of middle-income families ($N = 25$), found that mothers' views about how good they were at math and how enjoyable they found math was positively related to their preschool children's math scores on a measure administered by the researchers (see also Skwarchuk, Sowinski, & LeFevre, 2014, $N = 183$).

There are differences in the expectations that parents from low- and middle-income children have for when and how their children will acquire math skills. Summarizing across several studies, parents (typically mothers) from low-income families have less realistic timelines for when their children should be displaying specific math skills than parents from middle-income families (DeFlorio & Beliakoff, 2015; Starkey et al., 1999). Such unrealistic expectations may lead to practices not wholly consistent with children's knowledge base and, therefore, lead to more stressful interactions.

Sonnenschein and colleagues looked at three approaches parents report taking to fostering their children's math skills. These were adapted from work on literacy socialization by Serpell and colleagues (2005). An engagement approach focused on making activities interesting for the child, a skills approach emphasized using flashcards, workbooks, and similar activities to foster skills acquisition, and a daily living approach focused on using everyday activities available in the environment (e.g., teaching math through setting the table). The majority of low-income families (60%) emphasized a skills approach. Such an approach was not positively related to children's math acquisition. Far fewer low-income families emphasized the other two approaches (engagement 19%; daily living 20%) for fostering math skills (Sonnenschein, Metzger, Dowling et al., 2016). Parents who emphasized using daily living to foster their children's math skills reported their children were more likely to engage in math activities at home (Sonnenschein et

al., 2012). Stipek, Milburn, Clements, and Daniels (1992) found that low-income parents favored a more traditional didactic means of instruction for their young children than middle-income parents. And, Starkey and colleagues (1999) reported that low-income parents, in contrast to middle-income parents, view teachers as more responsible than the home for young children's math instruction (see also Serpell et al., 2005).

Home-Based Opportunities

We consider three forms of learning opportunities, parents' as role models (Simpkins, Fredricks, & Eccles, 2015; Sonnenschein, Metzger, & Thompson, 2016), children's engagement in math or math-related activities (Galindo & Sonnenschein, 2015; LeFevre et al., 2009), and the amount of math talk children hear (Gunderson & Levine, 2011; Levine, Suriyakham, Rowe, Huttenlocher, & Gunderson, 2010).

Parents as Role Models

Although the importance of social learning has long been acknowledged (Bandura, 1986), an understanding of its role in children's math acquisition is limited. Research on math, with a primarily middle-income sample, shows a positive association between parents serving as role models of math engagement and the frequency with which preschool through first graders engaged in math activities at home (Sonnenschein et al., 2012). However, that study did not include measures of children's math skills. Sonnenschein, Metzger, and Thompson (2016), using a sample of low-income Black and Latino parents of preschool through first-grade children, found that children's engagement in math activities was significantly associated with parents serving as role models of engagement. Although parents reported that their children observed them engage in math activities, on average, several times a week, most parents did not view their children observing them engage in math activities as a source of learning math skills. Thus, they may be missing an opportunity to socialize their children's math development.

Children's Engagement in Math Activities

It is important to understand the nature of children's math engagement at home because many researchers, but not all, have found positive relations between the frequency of math engagement and children's subsequent math skills (see Blevins-Knabe, 2016 for a review). Most of the studies

used primarily middle-income children (e.g., LeFevre, Polyzoi, Skwarchuk, Fast, & Sowinski, 2010; Skwarchuk, 2009) but Sonnenschein, Metzger, and Thompson (2016) also found positive associations between frequency of math engagement at home and children's math skills in preschool with a low-income sample. However, it may not be just the frequency of math engagement that matters, but which specific activities the child engages in. Nguyen et al. (2016), using a large dataset with low-income and minority children, found that preschool children's counting skills (e.g., recognizing that numbers represent quantities and have magnitudes, one-to-one correspondence, knowing number names and their order, and cardinality) was the best predictor of their fifth-grade math skills. More specifically, children's advanced counting skills (e.g., being able to count from a number not one) was a better predictor than more basic counting skills. Relatedly, Skwarchuk (2009) found that parents' reports of children engaging in tasks that involved more complex numeracy activities, as opposed to simpler ones, was related to children's math scores.

There are three issues to consider about children's math engagement at home: the frequency of engagement, the types of activities, and the nature of interactions. Much of the research on frequency of engagement asks parents to indicate which math activities children engage in and then computes some summary score (e.g., DeFlorio & Beliakoff, 2015; Sonnenschein et al., 2012). Such scores show that children engage in math activities monthly to weekly, with low-income children engaging in these activities less frequently than middle-income children (DeFlorio & Beliakoff, 2015). Tudge and Doucet (2004) conducted one of the few observational studies of the frequency with which children engaged in math activities. They observed low- and middle-income preschool-age children for a week at home and at child care. Although the overall frequency of engagement in math activities was quite low, there were no income-related differences. The infrequent engagement in math activities found by these various researchers may not be sufficient to optimize children's math skills. Based on research on children's literacy development, Serpell et al. (2005) found that children whose reading skills improved significantly from the beginning of first grade to the end of third grade engaged in daily reading at home with a variety of different genres.

Another way of considering children's math engagement is to look at the type of math activities children engage in. LeFevre and colleagues (e.g., LeFevre et al., 2009; Skwarchuk et al., 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 were not the main purpose of the activity. Both

forms of engagement predicted children's math skills, albeit different aspects of their math skills.

Research suggests that both low- and middle-income children may not frequently (or frequently enough) engage in the math activities most conducive to their math development. For example, Skwarchuk (2009) asked 25 parents to rate the frequency of various math activities their children engaged in. Such activities were not in keeping with the ones experts rated as most likely to foster children's math skills. On the other hand, counting is a commonly reported activity. Sonnenschein, Metzger, and Thompson (2016) asked Black and Latino low-income parents to rate the frequency with which their children engaged in various activities thought to involve some form of math. Fifty-seven percent of each group reported that their children engaged in counting activities each day. And, as Nguyen et al. (2016) found, preschool children's counting skills are predictive of their math skills later in elementary school. Other activities noted by these parents were asking about quantities, using tv remotes, and watching math television programs. DeFlorio and Beliakoff (2015) also found counting to be one of the most common activities among preschool low- and middle-income children. Despite the prevalence of counting, we do not know exactly what the children did when they were counting with their families at home or what skills they acquired.

Relatively few studies have compared the nature of home math activities children from low- and middle-income families engage in. Ramani and Siegler (2008) found that low-income children reported playing linear board games significantly less frequently than did middle-income children. Playing such games foster children's number sense. In fact, increasing low-income children's exposure to linear board games in a school-based intervention closed the income gap in children's number sense (Ramani & Siegler, 2011). Saxe, Guberman, and Gearhart (1987) found that low-income families of preschoolers were less likely to engage in more complex math activities than were middle-income families. And, DeFlorio and Beliakoff (2015) found that low-income children engaged in made-up games involving math, used math in the home routine, read math-related books, and used computers with math software less frequently than middle-income children.

As research on literacy shows, the nature of the interaction matters. Sonnenschein and Munsterman (2002) found that children whose reading interactions were affectively positive were more likely to engage subsequently in reading activities which, in turn predicted their reading skills (see also Baker, Mackler, Sonnenschein, & Serpell, 2001). Not much work has looked at the quality of math interactions that children have at home. This is particularly important because knowing that an activity can involve math does not necessarily mean parents focus on that when interacting with their children. 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 that they engaged in non-math activities (reading labels, picking out items) when they assisted their parents with cooking or grocery shopping. Relatedly, research by Vandermaas-Peeler, Boomgarden, Finn, and Pittard (2012) found that interactions between parent and child in activities that should involve math are more likely to happen if parents are explicitly told to focus on math and how to do so (will be discussed in more detail in a subsequent section; see also Vandermaas-Peeler, Ferretti, & Loving, 2012). Lukie, Skwarchuk, LeFevre, and Sowinski (2014) showed that preschool children were more likely to engage in math-related activities with their parents when both were interested in the activity and engaged in collaborative types of interactions.

Math Talk

Although children from low-income backgrounds generally score lower on math tasks than middle-income children (DeFlorio & Beliako, 2015), such differences are more likely to occur on verbally-based math tests than on ones with lower language demands (see Ramani, Rowe, Eason, & Leech, 2015 for review). And, as Purpura and Reid (2016) have shown with a preschool sample, the amount and type of talk specifically focusing on math that children hear is positively related to their early math skills (see also Elliot, Braham, & Libertus, 2017). In fact, such talk at home predicts preschool children's math skills even one year later (Susperreguy & Davis-Kean, 2016). Therefore, it is important to consider the specific math language stimulation that children receive at home because low-income children generally receive significantly less exposure to oral language than their middle-income peers (see Hindman, Wasik, & Snell, 2016 for review).

Three key findings emerge from research on parents' use of math language at home (see Ramani et al., 2015 for review). One, there is significant variability across parents, regardless of income group, in how much math talk they engage in, although even at its most frequent, it is relatively low. The few studies that have compared the amount of math talk between low- and middle-income groups find that middle-income parents engage in more math talk (e.g., Blevins-Knabe, 2016; Vandermaas-Peeler, Nelson, Bumpass, & Sassine, 2009). In addition, parents' views of their math skills are related to the type and amount of math talk they engage in with their young children (Elliott et al., 2017). Two, the type of math language used by parents (e.g., numeral identification, cardinal numbers) is positively related to children's specific math skills. For example, Gunderson and Levine (2011), in a longitudinal study, documented the math talk of mothers when

children were between 14 and 30 months old. Children then were tested on their knowledge of cardinal values when they were 40 months of age. Parents who engaged in more math talk involving counting or labeling sets of objects, particularly larger sets of objects (between 4 and 10 visible items) had children who subsequently displayed greater knowledge of cardinal values. Three, parents are most likely to use math language when given instruction or guidance on what to do, when reading math books with their children, and when the topic being discussed does not readily lend itself to other forms of discourse. For example, Vandermaas-Peeler, Boomgarden, and colleagues (2012) observed a group of 25 middle- to high-income mothers engage in a cooking task with their preschool children. Mothers who were told to include additional mathematics in the activity provided significantly more numeracy guidance and created more opportunities for their children to practice advanced mathematics than mothers in a control group. This is consistent with findings from Cannon and Ginsburg (2008) who found that middle-income mothers reported not knowing what to do to teach their young children math.

PARENTING IN CONTEXT

The larger context of children's environments, such as the surrounding community, also needs to be considered. Many children from low-income backgrounds live in homes where there are more toxins, have poorer health care, experience food insecurity or poor nutrition, live in neighborhoods higher in crime and lower in supportive resources, and are under more chronic stress (e.g., Evans, 2004; Evans & Kim, 2013; Duncan & Murnane, 2015; Fiese, Gunderson, Koester, & Washington, 2011; Rothstein, 2013). These factors negatively impact a child's availability for learning and for parents being able to offer their children optimal learning opportunities. Moreover, the stresses associated with financial issues may negatively impact the quantity and quality of parents' interactions with their children (family economic stress model; Conger & Elder, 1994; Masarik & Conger, 2017). Relatedly, parents from low-income backgrounds may have fewer economic resources to devote to their children's development (Yeung et al., 2002). In fact, as Duncan and Murnane (2015) suggest, more affluent parents, unlike low-income ones, now devote a larger absolute and relative amount of their incomes to facilitating their children's development than they did 25 years ago (see also Reardon, 2011).

Despite the importance of the home for children's development, what occurs at school and relations between home and school should also be considered. As many have noted, there are opportunity gaps—conceptualized as limitations in the resources and experiences available at home *and*

school—for many children from low income backgrounds (Flores, 2007; Welner & Carter, 2013). Schools serving primarily low-income children tend to have fewer qualified teachers, relatively more children with behavior problems and inattention (Duncan & Murnane, 2015), and lower quality instruction than schools serving more affluent families (Sonnenschein, Thompson, Metzger, & Baker, 2013). Such factors limit the learning opportunities in school, and more pertinent for this chapter, the nature and outreach from schools to home. This is of particular concern for low-income children whose parents may rely more heavily than other parents on their children's teachers for information about what math activities to do with their children (Sonnenschein et al., 2018).

As Epstein (2001) argued, the home and school constitute "overlapping spheres of influence" on children's outcomes. Schools provide important sources of information for parents about how well their children are doing, pertinent content, and information about how to engage children in learning (Sonnenschein, Stapleton, & Metzger, 2014). However, low-income families may feel less welcome than other families in their children's schools, may have less available time to attend school events, have less knowledge of school customs and mores, and more generally, less social capital (Green et al., 2007; Mapp & Kuttner, 2013).

INTERVENTIONS

Research on ways to improve young children's math skills have focused on math curricula in the schools (e.g., Klein, Starkey, Clements, Sarama, & Iyer, 2008), and ways to improve the math experiences that middle-income children (e.g., Niklas, Cohrssen, & Taylor, 2016; Vandermaas-Peeler, Boomgarden et al., 2012) and low-income children have at home (e.g., Sonnenschein, Metzger, & Thompson, 2016). We focus here on interventions involving low-income children. However, it is important to realize that many of the difficulties low-income parents face in implementing recommendations go beyond the actual math intervention. An intervention can improve children's math skills, but it may not be compatible with parents' beliefs, knowledge, available time, or other aspects of their lives (Furstenberg, 2011; Green et al., 2007). If that is the case, it will not be implemented or implemented with fidelity.

There have been fairly few interventions focusing on what low-income parents can do to improve their children's math skills. Berkowitz et al. (2015) compared math skills between a randomly assigned intervention and control group of 587 low- and middle-income first graders. Children and their families received iPads in which they read math stories and received a set of math questions to ask. Such interactions were associated

with growth in children's math skills from fall to spring. The authors suggested that by telling parents what questions to ask, they increased parents' knowledge, especially important for parents whose own math knowledge may be limited, and thereby decreased their anxiety about math. In a related vein, Starkey and Klein (2000) found parents of Head Start children were willing and able to support their children's math skills at home, once they had received sufficient training. The training included eight sessions over a 4-month period for parents and their children. Starkey, Klein, and Wakeley (2004) found that a combination of a special math curriculum, teachers' professional development, and a parent training component was instrumental in improving low- and middle-income preschool children's math skills.

An intervention by Sonnenschein, Metzger, Dowling, et al. (2016) shows the difficulties one can have in adapting interventions, even when they have been successfully used before. They attempted to "send home" a highly successful classroom-based intervention by Ramani and Siegler (2008) who had preschool children play a linear board game with a trained researcher. Ramani and Siegler's intervention lasted about an hour spread over several days. After training, these children did significantly better on various number sense tasks than children who did not play the game. In fact, after training, low-income children did as well as middle-income children. Sonnenschein, Metzger, Dowling, et al. (2016) trained low-income parents of preschoolers to play the linear board game Chutes and Ladders with their children using the special counting procedure used by Ramani and Siegler (2008). Just providing brief training for parents did not improve children's scores on number sense tasks despite parents believing in the importance of their role in children's learning, liking the task, and thinking their children's math skills improved. Additional research conducted with focus groups suggested parents preferred that their children be trained at school and needed guidance getting their children to sit still to play a board game. When training children at school was combined with training for parents and giving parents guidance in the use of stickers to promote on-task behavior, children showed some small growth from pretest to post-test (compared to a control group).

Summarizing across the studies, there are at least three issues that should be considered in optimizing the effects of math interventions for parents to do at home with their children. One, training needs to be of sufficient length. Two, it is helpful to combine school components with home-based components. Three, as we have discussed here and in the prior section, there may well be obstacles that go beyond the actual targeted intervention that can interfere with compliance. That is, parents may not have sufficient available time to do the required tasks.

CONCLUSION

This chapter explored reasons why low-income children in the United States, on average, start school with significantly weaker math skills than their more affluent peers (Duncan & Magnuson, 2011; Reardon & Portilla, 2016). We focused on children's home experiences and documented similarities and differences in such experiences between low- and middle-income children. Two trends emerge from the literature. On the one hand, there are many similarities between low- and middle-income children and their families in the socialization of children's math development. Regardless of income, children do not engage in math activities or talk about math at home as often as might seem optimal, parents view math as less important than reading, and many parents lack knowledge of what to do to foster their children's math skills (Blevins-Knabe, 2016; Cannon & Ginsburg, 2008; Sonnenschein, Metzger, & Thompson, 2016; Vandermaas-Peeler, et al., 2012).

On the other hand, despite some similarities across groups, there are many differences in the nature and amount of math socialization that occur, which favor middle-income children. In other words, low-income children experience gaps in the opportunities for learning math that are available to them at home *and* at school (Rothstein, 2013). At home, low-income parents, in contrast to middle income parents, may be less knowledgeable about math and how to facilitate it, engage in less math talk, know less about what to expect of their children, and emphasize a means of instruction (e.g., skills approach) that is less effective (DeFlorio & Beliakoff, 2015; Ramani & Siegler, 2008; Sonnenschein, Metzger, & Thompson, 2016). Unfortunately, the schools that low-income children attend, on average, are limited in the resources they can provide and do not compensate for some of the limited opportunities found at home (Rothstein, 2013). In addition, many low-income parents do not have the time to attend school events or feel comfortable there when they do (Green et al., 2007; Weiss et al., 2003).

Despite these opportunity gaps found at home and school, there are strengths within the families that can be used as foundations to build upon (Cabrera et al., 2012). Parents view it as their role to assist their children with math activities at home (Sonnenschein, Metzger, Dowling et al., 2016) and they turn to teachers for knowledge about what to do (Sonnenschein et al., 2018).

In designing interventions for parents to use to facilitate their children's math development, we need to make such interventions congruent with parents' beliefs about their role in their children's learning, involve schools in the training, and provide enough training for parents to feel confident in their mastery of the relevant skills (Mapp & Kuttner, 2013; Sheldon & Epstein, 2005). However, we need to keep in mind that low-income families experience many significant daily stressors, such as working several jobs to

pay bills, living in high crime areas, and others (Duncan & Murnane, 2011; Rothstein, 2013) that may make math socialization a less compelling priority. In fact, some have suggested that more systemic forms of remediation are needed than just academic training, if one is to close the income-based achievement gap (Curto, Fryer, & Howard, 2011; Duncan, Magnuson, & Votruba-Drzal, 2014; Furstenberg, 2011).

Limitations in Current Research and Future Directions

Although home influences on children's math development is a rapidly growing area, the research is still limited in scope. Research has generally focused on mothers without fully considering the role that fathers play or considering socialization within a family system. Much of the research is based on parents' self-reports and does not include observation of actual interactions. At least some of the locus of income-related differences in children's math skills may be due to differences in the quality of interactions children have with their parents.

The research reported in this chapter focused primarily on children from low-income backgrounds in the United States. Although race/ethnicity is often conflated with income (Reardon & Galindo, 2009), it would be beneficial to take an intersectionality approach when feasible. That said, Sonnenschein, Metzger, and Thompson (2016) found few differences in beliefs or practices related to math socialization between a small sample of Black and Latino low-income parents of preschoolers. Furthermore, more research should compare socialization practices of children from different countries.

Despite issues for future research to explore, the available research does suggest areas that are ripe for intervention. Low-income children in the United States arrive at school with more limited math skills, at least in part, due to limitations in the amount and quality of the math experiences they have had at home. As parents think math is important and are willing to play a role in fostering such skills, interventions for parents' math involvement is one avenue to promote equity in math prior to school entry.

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