Math Learning Begins at Home

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Abstract
Children demonstrate gaps in the math knowledge that they possess by the time they begin school, and these gaps have been found to predict long-term outcomes not only in math but also in reading. Consequently, it is important to identify what accounts for these early differences and how they can be addressed to ensure that all children enter school on track for academic success. This article explores the role of parents' math talk in young children's early math learning. The authors highlight the research on variations in the quantity and quality of parents' math input, how these variations relate to children's math knowledge, and how parent math input to young children can be enhanced.

"Look at all the ladybugs on this page! Let's count them."

"You have three more Cheerios to eat."

"You stacked those blocks so high—that's a tall tower!"

"Can you bring me two socks, please?"

"Let's climb up and down the steps: UP: one, two, three. And DOWN: one, two, three."

By the time children enter preschool, there is already wide variation in their math knowledge (Dowker, 2008; Klibanoff, Levine, Huttenlocher, Vasilyeva, & Hedges, 2006; Starkey & Klein, 2008). Of particular concern, these early variations persist throughout the school years (Bailey, Duncan, Odgers, & Yu, 2017; Duncan et al., 2007). There is evidence that this gap is due in part to differences in children's early experiences with math, as measured by both the frequency of engagement in mathematical activities in the home (Niklas & Schneider, 2014; Skwarchuk, Sowinski, & LeFevre, 2014) and the quantity and quality of mathematical talk that parents engage in with their children (Gunderson & Levine, 2011; Levine, Suriyakham, Rowe, Huttenlocher, & Gunderson, 2010; Pruden, Levine, & Huttenlocher, 2011). In other words, children's early experiences with math in the home set the stage for their later achievement in school, pointing to the importance of providing rich opportunities for young children to engage in math from an early age.

Although many educational efforts focus on improving math instruction at school, we review what is known regarding children's early math learning at home and what can be done to improve young children's math-learning opportunities in this more informal learning environment, where children spend much of their time. It is important to focus on math learning in both formal and informal learning environments to close persistent achievement gaps that are associated with socioeconomic status (SES) differences. In the following sections, we examine early math learning in the home environment, including research on parents' use of numerical and spatial language, which relates to the numerical and geometric concepts that are emphasized in both state learning standards for preschool children and the Common Core State Standards (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2017).

Underpinnings of Mathematical Thinking in Preverbal Infants

From infancy, children perceive and conceptualize quantitative and spatial information. Infants as young as 6 months old are able to discriminate between sets that differ in terms of number of objects, using what has been termed their *approximate number sense*, a sense humans share with other species (Ansari, 2008). In fact, there is even evidence that infants may have

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some implicit understanding of simple arithmetic (Wynn, 1992). Although there is active debate about how infants are making these discriminations (Are they relying on numerical differences, or are they using a more generalized approximate magnitude system?; Cantrell & Smith, 2013; Newcombe, Levine, & Mix, 2015), this early sense of quantity predicts their symbolic math knowledge at 3.5 years old (Starr, Libertus, & Brannon, 2013). Similarly, sensitivity to spatial information in infancy also appears to predict later mathematical abilities. That is, the ability of 6- to 13-month-old infants to discriminate mirror images of shapes predicts their numerical math skills at 4 years old (Lauer & Lourenco, 2016).

As we will outline, however, these very early quantitative and spatial skills are far from the whole story in terms of later math achievement. There is strong evidence that mathematical thinking is malleable and that children's exposure to and understanding of number symbols, as well as their attitudes about math, play a critical role in their math achievement.

Environmental Contributions to Early Math Learning

During the preschool years, children gain critical information from their environment that builds on their mathematical understanding of the world. From a young age, children are introduced to words and symbols (e.g., numbers) that advance their mathematical thinking. While a 2-year-old may be able to recognize and distinguish between small sets of two, three, and four objects, they need to learn the number words—the symbols—that are used to label these quantities. This symbol system is critical to representing larger sets exactly and to fully utilizing their understanding of quantity to solve mathematical problems. For instance, imagine a row of three chairs—would you need to count each one to recognize there are three? Most likely, you would be able to just look at them to know that there were three. However, understanding the counting system becomes especially important for representing larger sets of objects exactly—without such a system, it is not possible to represent, for example, "exactly seven." Without a count system, a representation of this set of seven remains approximate, and this is the case for all set sizes that contain more than three to four (Carey, 2004, 2009; Dehaene, 1997). Indeed, studies of cultural groups without a well-developed count system show that quantities such as seven remain approximate even for adults (Pica, Lemer, Izard, & Dehaene, 2004; Spaepen, Coppola, Spelke, Carey, & Goldin-Meadow, 2011).

Moreover, a study on math success in elementary school showed that symbolic number knowledge is more predictive of arithmetic ability than are skills related to approximate, nonsymbolic number knowledge (Lyons, Price, Vaessen, Blomert, & Ansari, 2014). Mapping number words onto set sizes is one of many foundational number concepts emerging in the first few years of life. Notably, this mapping occurs very slowly: Children learn the meanings of the number words one at a time, in sequence over a period of about 2 years before they understand the meaning of all the numbers in their count list (Bloom, 2000; Mix, Sandhofer, & Baroody, 2005; Wynn, 1992). Our work has shown that parents' number talk, introduced to children through social interactions during play and everyday activities, facilitates the development of these foundational numerical concepts.

While numerical thinking is one pillar of math achievement, spatial thinking is another (Cheng & Mix, 2014; Gunderson, Ramirez, Beilock, & Levine, 2012). In addition, spatial thinking predicts success in the STEM disciplines more broadly, even after accounting for individual differences in mathematical and verbal skills (Wai, Lubinski, & Benbow, 2009). Such findings raise the important question of how the environment contributes to building strong spatial skills. There is evidence that spatial play—for example, play with puzzles and blocks—as well as exposure to spatial language, are important in building spatial skills (Casey et al., 2008; Levine, Ratliff, Huttenlocher, & Cannon, 2012; Pruden et al., 2011).

Parents' Math Talk With Young Children

If math language lays a foundation for children's early mathematical thinking, how much "math talk" do parents use with young children, and in what ways do they talk about math? In this section, we discuss research findings regarding the frequency of parents' talk about two components of math talk: talk about number and talk about spatial relationships.

Number Talk

Naturalistic observations of parent–child interactions reveal wide variation in the amount of math talk young children receive in their home environments. We conducted a longitudinal language study that involved observing parent–child interactions in families that differed widely in socioeconomic background. Parents were told to do what

they normally do, and they were videotaped with their children for 90 minutes every 4 months, from when the child was 14 through 30 months old. We transcribed all the parent–child talk that occurred during the first five sessions and coded all of the uses of the numbers from 1 to 10 that parents and children produced. Parents produced, on average, 91 number words over the five sessions (Levine et al., 2010), with the amount of parent talk about number varying widely.

Almost all parents said at least one number word during each session; however, across the five sessions, parents' total number word production ranged from 4 to 257 in 7.5 hours of observed interaction (Levine et al., 2010). This variation in the quantity of number talk is particularly striking when extrapolated to obtain an estimate of how many number words children would hear during their waking hours over a year. Assuming 8 waking hours per day, at the low end, this would amount to a child hearing about 1,500 number words per year and, at the high end, to about 100,000 number words per year, more than a 60-fold difference (Levine & Baillargeon, 2016). Other studies observing parents' talk about numbers with young children yielded similar findings regarding variation in the frequency of parents' number input. Susperreguy and Davis-Kean (2016) observed 4 hours of mothers' and preschoolers' exchanges during mealtimes and found that, on average, mothers produced about 38 instances of number talk, but there was wide variability, ranging from 4 to 195 instances. Thus, it is far from a level playing field in terms of opportunities to learn from exposure to the symbol system that undergirds children's arithmetic skills.

Parents' number input constitutes a small portion of parents' overall talk. For instance, Gunderson and Levine (2011) observed an average of 13 instances of talk about number per every 1,000 parent utterances. Consistent with the rarity of parent number talk, among preschoolers from a Head Start program, less than a fifth of parents' utterances involved number, even though they were playing with preselected toys containing explicit number content (e.g., board games; Ramani, Rowe, Eason, & Leech, 2015). One exception to the rarity of parent number talk, however, is the frequency of number talk in the context of reading young children number books. Mix, Sandhofer, Moore, and Russell (2012) found that while reading a number book with 3-year-old children, 69% of parents' spontaneous comments about the book involved number, whereas this was only about 3% of parents' spontaneous comments for non-number books.

When parents do talk about number, how are they talking about it? Counting and talking about the cardinal value of a set—the total number of entities in a set (e.g., "You have three cookies!")—are among the most common types of parent number talk (Levine et al., 2010; Ramani et al., 2015; Susperreguy & Davis-Kean, 2016). Levine and colleagues (2010) found that parent talk about cardinal number accounted for half of parents' number input and nearly one third of parents' number input involved counting. Other findings showed that the contexts in which parents are talking about number are related to the types of number talk that occur. For example, in Susperreguy and Davis-Kean's study (2016), in which observations occurred during mealtimes, the second-most

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common type of number talk (behind cardinality) was units of measure (e.g., years, temperature degrees), whereas in the contexts of a number book reading activity, puzzle play, and board games—all of which contained printed numbers—Ramani and colleagues (2015) found that parents' talk about numeral identification (either labeling numerals or prompting children to do so) was most common, exceeding their talk about cardinality. In other words, the quantity and quality of the number input young children receive likely depends on context, with most everyday contexts supporting cardinal number talk and counting. However, other kinds of number talk may predominate depending on when and where parents see opportunities to talk about number with their children and how much time families spend engaging in different activities.

The studies discussed up to this point have looked at parents' number talk with children after they are 1 year old, but a study by Goldstein, Cole, and Cordes (2016) examined parent number talk during number book reading with preverbal infants (5 to 10 months old). They found that parents talked about number in just under a quarter of their spontaneous comments while reading a number book. The amount of number talk was greater for older infants than for younger infants, even though the amount of non-number talk during book reading did not differ. This study showed that parents talk about number with infants, at least within the context of reading a number book; however, it is unclear whether outside the laboratory context parents would select a number book to read to their infants. Thus, researchers currently do not know how much number talk infants are exposed to during the first year of life, how much variation there is in this exposure, or whether there are any consequences of this variation for children's later mathematical achievement.

Spatial Talk

Given that math knowledge extends beyond numeracy, researchers have also examined parents' talk about spatial concepts, such as shapes (e.g., circle, rectangle, triangle), dimensions (e.g., tall, short, wide, narrow), and spatial features

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Children benefited more from number talk when they could see objects that parents were referring to with their number words.

(e.g., straight, curved, corner, side, edge; see box What Is Spatial Talk? for further details). In one study (Pruden et al., 2011), we examined the spatial talk of parents and children participating in the same longitudinal language study described earlier; however, nine sessions from the time children were 14 to 46 months old were included in these analyses. Across 13.5 hours of observation, parents produced about 167 spatial words on average, and, like the findings regarding number talk, there was much variation in parents' spatial talk, ranging from 5 to 525 spatial words. Again, this variation becomes notable when considering the extrapolation to number of waking hours over a year: Assuming 8 hours of waking time per day, some children would hear as few as about 1,100 spatial words per year, while other children would hear close to 114,000 in the same time span, more than a 100-fold difference.

What Is Spatial Talk?

Many parents and practitioners might think that spatial talk consists only of teaching children the names of geometric shapes, but children's spatial understanding develops from hearing many other kinds of spatial talk. For shapes, it is helpful not only to label the shape but also to talk about the defining features of shapes—for example, talk about the fact that all triangles have three sides and three angles. There are also other types of spatial language that support children's spatial thinking. Pruden and colleagues (2011) identified three categories of spatial terms that play this role:

- **Shape terms:** standard mathematical names for two- and three-dimensional objects, such as *circle, triangle, rectangle, cone,* and *pyramid*
- **Dimensional adjectives:** words that describe size of objects, people, and spaces, such as *big, little, long, short, tall, tiny,* and *huge*
- **Spatial features terms:** words that describe the features and properties of two- and three-dimensional objects, spaces, and people, such as *curvy, edge, side, line, corner, straight,* and *flat*

In addition, Cannon, Levine, and Huttenlocher (2007) provided a coding scheme for the following category, which, in the Pruden et al. (2011) study, was highly correlated with overall amount of parent talk:

- **Spatial location and directions:** words that describe the relative position of objects, people, and points in space, such as *between, into, forward, over, behind, near,* and *far*

How Parents' Math Talk Contributes to Children's Understanding of Number and Space

The math talk young children hear in their home environments—talk about number and spatial relationships—appears to play an important role in building their mathematical knowledge. Below, we review this evidence for these two components of math talk: number talk and spatial talk.

Parents' Number Talk and Children's Number Understanding

The frequency of number words children hear over the first few years of life predicts children's early understanding of the cardinal meanings of number words—the idea that the last number in a count represents the number of elements in a set. Parents' cumulative number talk during interactions with their children between 14 and 30 months old predicted children's cardinal number knowledge at 46 months old (Levine et al., 2010). Several points are worth noting. First, parents' general talk (all words excluding number words) did not predict children's cardinal number knowledge. Thus, it is specifically talk about numbers that contributes to children's number knowledge. Second, while parents' and children's number talk were highly correlated, parents' number talk predicted children's number knowledge even after accounting for children's own number talk. Thus, parents' talk about numbers does provide opportunities for children not only to talk about numbers but also to learn about what the number words mean.

When examining the relation between parent number talk and children's understanding of cardinality, it became evident that the quality of parents' talk about numbers matters. One salient finding was that parents' number talk referring to present objects or objects represented as pictures predicted children's cardinal knowledge at 46 months old, whereas reciting the count list in the absence of objects did not (Gunderson & Levine, 2011); in other words, children benefited more from number talk when they could see objects (or pictures of objects) that parents were referring to with their number words (see box A Closer Look at Parent–Child Talk About Numbers, p. 39).

In our longitudinal study, we also found that children's cardinal number knowledge was related to parent use of larger number words (4 to 10) as opposed to smaller number words (1 to 3). However, in a subsequent experimental study, we found that this relation depends on the child's current level of number knowledge (Gibson, Gunderson, & Levine, 2015). In the experimental study, we assessed children's understanding of the cardinal meanings of the number words before and after

A Closer Look at Parent–Child Talk About Number

What do actual parent and child exchanges about numbers look like? In some instances, parents engage in rote counting, where number words are used in ways that make it difficult for children to learn what the number words mean:

Parent: One, two, three, whee! *(tosses child into air)*

In other instances, parents talk about numbers at times when they can refer to visible objects and help make connections about the meanings of the number words:

Child: Ah wow! Candles. *(pointing to a photograph in album)*

Parent: That's Kevin's party. The candles? How about you help me count the candles, okay? Ready? Go ahead. One. *(points to candle in photo)* And then—what's after one?

Child: One!

Parent: And then... One, two.... What's after two?

(Talk about people in photo for a while.)

Parent: I think that was his fourth birthday because there's four candles, see? One, two, three, four. *(points to each candle in photo while counting)*

In this second example, the parent both counts the candles and labels the set of four candles, which may make it easier for the child to make the link between counting and cardinality.

parents read number books to their children over a period of a month. Parent–child dyads were randomly placed in one of three groups: a small number book group (books dealing with numbers one to three), a large number book group (books dealing with numbers up to six), and a control adjective book group (no numbers included in the books). Overall, children showed more improvement in cardinal number knowledge when they were in either of the number book conditions than when they were in the non-numerical book condition. This finding showed that reading children number books is an effective way of promoting their number knowledge. It was interesting that the effectiveness of the small and large number books depended on children's prior knowledge. Children whose ability at pretest was limited to understanding only the number "one" or the numbers "one" and "two" showed significant improvement in their cardinal knowledge when parents read a book focused on the numbers one through three but not when their parents read the book focusing on numbers up to six. In contrast, children who already knew the meanings of "three" or "three" and "four" learned from both the small and large number books. Thus, this experimental study highlighted the importance of parents' focusing on the children's zone of proximal development (Vygotsky, 1934/1986)—focusing on number words just beyond a child's current level of understanding, particularly when children are just beginning to gain an understanding of the first number words.

Another factor that appears to be related to children's learning of cardinal knowledge from number input is how the information is packaged when it is presented to them. In an experimental study by Mix et al. (2012), 3.5-year-olds received different kinds of number instruction: counting, labeling set sizes, labeling set sizes and then counting the same sets, and alternating between counting and labeling set sizes on separate sets of objects. Only children who were instructed using both labeling and counting of objects in the same set showed improvement in their cardinal knowledge. It was also interesting that Mix et al. (2012) and Levine (personal communication, based on naturalistic longitudinal data) found that it was rare for parents to provide both cardinal labels and counting when talking about a set of objects. Rather, they typically either count or label the set size, which likely makes it more difficult for children to understand the link between counting and cardinality.

Finally, there is also some evidence that parents' number input is most effective in contributing to children's understanding of number when the talk is accompanied by gesture. For instance, if children observe parents pointing to objects while counting, parents' gestures provide important information beyond the sequence of number words, such as the role of one-to-one correspondence in obtaining a correct count (Alibali & DiRusso, 1999; Goldin-Meadow, Levine, & Jacobs, 2014). Gestures can also be used to indicate or reinforce the cardinal value of a set. Suriyakham (2007) found that parents who more often used cardinal gestures with their talk about set size (e.g., saying "There are three cars" while holding up three fingers) had children who performed better on a test of cardinal knowledge, even after accounting for the quantity of number words parents produced. These findings suggest that the gestures that accompany number talk play an important role in promoting children's number understanding.

Parents' Spatial Talk and Children's Spatial Knowledge

Similar to the relation between parents' number talk and children's number knowledge, parents' talk about concepts related to shape, spatial features, and dimensions positively predicts children's later spatial skills (e.g., their ability to visualize what shape two pieces would make when moved together, their ability to recognize analogous spatial relations such as matching a picture of a dot *above* a circle with a picture of a bird *above* a tree; Pruden et al., 2011). Parents' talk about space led to children talking more about space, and children's own talk about space predicted their better performance on spatial reasoning tasks. As for number, this relation was upheld when controlling for parents' overall talk, indicating that parent talk about spatial concepts contributes to children's spatial thinking.

Why might parents' spatial talk support children's spatial thinking? There are several possible reasons. One possible benefit is that a rich spatial vocabulary reduces children's

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Parents' number talk, introduced to children through social interactions during play and everyday activities, facilitates the development of foundational numerical concepts.

cognitive load when performing spatial tasks and thus increases their performance. For example, when visualizing spatial transformations that will bring pieces together to form an object, children who have a rich spatial vocabulary may be able to use these words to describe the objects, which could reduce the difficulty of the task. Another possible benefit of having a rich spatial vocabulary is that having these words at the ready may more generally increase children's attention to spatial relationships in the world. This habitual increased attention, in turn, may enhance children's spatial thinking.

Why Does Parents' Math Talk Vary?

What factors are correlates and contributors to differences in how much parents talk about math with their children?

SES

One factor that is correlated with parent math talk is family SES, a composite of parents' education and family income (Gunderson & Levine, 2011; Levine et al., 2010). A study of parents' number talk during storybook reading and play found that parents from low-SES households used less number talk than families from high-SES homes (Vandermaas-Peeler, Nelson, Bumpass, & Sassine, 2009). However, these SES-related differences are not present for all kinds of number talk. In particular, although Vandermaas-Peeler et al. found SES-related differences in the amount of number talk involving mathematical concepts (e.g., counting, comparing quantities), they did not find these differences for sociocultural numeracy exchanges (e.g., talking about the cost of an item while playing store). Similarly Saxe, Guberman, and Gearhart (1987) found stronger SES differences for talk and activities involving more complex number concepts. Further, even among lower SES families, there is substantial variation in parents' number talk. For example, in a study of Head Start families, Ramani and colleagues (2015) found that parents' talk about numbers accounted for 4%–34% of their overall talk during play with their preschoolers while engaged in a counting book, puzzle, and number board game.

These findings raise a host of questions about why parents' number talk varies both within and across SES groups. Some parents may not engage in math talk and activities with their young children because they do not realize that early math learning is important, or they lack knowledge about how to support children's math learning, or both. Further, parents' past experiences around math learning in school may impact their math engagement with their children—parents who had positive experiences may engage their children in math talk more and more effectively than those who had negative experiences. Relatedly, parents who have negative attitudes about math—notably high levels of math anxiety (fear or apprehension about doing math)—may produce less and lower quality of math talk than those who are more confident in their math abilities. These math anxious parents may also have lower expectations for their children's success in math and may not value achievement in this domain for their children, which can lead to lower levels of parent-child math engagement. To the extent that these factors affect parents from low-SES households more than parents from high-SES households, researchers may observe SES-related differences in math talk to children.

Parent Math Anxiety and Other Math Attitudes

Parents' attitudes about math, particularly about their own math abilities, may also affect how often and how well parents engage in math talk and in activities that have substantial opportunity for math talk. LeFevre, Polyzoi, Skwarchuk, Fast, and Sowinski (2010) found that parents who reported positive attitudes toward math also reported engaging in more direct practices to help their kindergarteners learn math. Niklas and Schneider (2014) found that families in which someone in the household had a math disability also reported engaging in fewer math games with their kindergarten-age children. What is not yet clear is whether parents' attitudes about math—including their math anxiety and stereotypes—relate to the quantity and quality of the math talk they provide to their young children. One study did show that, by first grade, parent math anxiety is negatively related to children's math learning (Maloney, Ramirez, Gunderson, Levine, & Beilock, 2015). However, providing families with a math app that engages parents and children in solving word problems together raised math learning in children of math-anxious parents (Berkowitz et al., 2015). These findings suggest that math-anxious parents can more effectively support their children's math learning when they are provided with engaging and productive ways to engage with their children in mathematical thinking.

Expectations and Value of Math for Their Children

Variations in parents' expectations for their child's achievement in math and their beliefs regarding the importance of math for their child may contribute to differences in the supports they

provide to children around math learning. That is, if parents have lower expectations for how their child will perform in math, or do not recognize math as being important for their child, they may be less likely to devote time to talking about math. There is some evidence that this is the case from studies showing that parents who rate early math learning as less important engage in fewer math activities with their young children (Missall, Hojnoski, Caskie, & Repasky, 2015; Skwarchuk et al., 2014). While less is known about how parent beliefs about their children's math potential relates to their early math talk, there is some indication that lower expectations and beliefs about math translate to lower amount of math talk. That is, in one study, we observed parents engaging in pretend play with toy dishes and food with their 2- to 4-year-olds and found that parents' beliefs about the importance of math for their child related to the amount of number talk they used during the play session (Eason, Nelson, Leonard, Dearing, & Levine, 2017).

Conclusion

The past few decades have yielded research findings showcasing the importance of early math input in the home as well as the substantial differences in the quantity and quality of math input parents provide to young children. Encouraging parents to engage in more math talk and to start early (see box How Can Parents Increase Their Math Talk?) holds promise for reducing SES-related achievement gaps in children's math knowledge at school entry.

Learn More

For more ideas on how parents can engage in early math talk:

- Let's Talk About Math: Early Math Video Series from ZERO TO THREE: https://www.zerotothree.org/resources/series/let-s-talk-about-math-early-math-video-series
- "Professional Help: 5 Ways to Turn Your Preschooler Into a Math Wiz": https://www.theatlantic.com/health/archive/2012/04/professional-help-5-ways-to-turn-your-preschooler-into-a-math-wiz/254967/

For more information about our research:

- Susan Levine's Cognitive Development Lab: https://cogdevlab.uchicago.edu
- Development and Research in Early Math Education (DREME): https://dreme.stanford.edu

How Can Parents Increase Their Math Talk?

Bringing more math into the home doesn't have to take up any extra time: Parents can talk about math with their children while reading books, eating meals, playing with toys, and even just going about their regular routines. Here, we provide some pointers for how parents can talk more about math.

- **Read picture books that include numbers and shapes.** Picture books that involve counting or shapes can be a great starting point for parents who might not be sure how to talk about math with young children. Start with what is provided in the text, and then extend the text to relate the math contexts to the child's experiences. For example, when reading *The Three Little Pigs*, children could be prompted to show their three fingers or to find three other books they want to read. These books might also help parents think about how they can talk about the same ideas during other activities.
- **Incorporate math talk into play.** Playing with blocks, for example, offers many opportunities to talk about math: Parents and toddlers can count how many blocks are stacked together, compare shapes and sizes of blocks, and make patterns by alternating colors of blocks. At the playground, parents can count the steps on the slide and talk about space as their children move around the equipment: "Here we go *up* the ladder, here we go *down* the slide. Let's go *in* and *out* of the tunnel."
- **Talk about the math in everyday activities.** Children are often with their parents while they are going about their regular routines, so it is helpful for parents to talk about math as they use it. "I'm measuring three scoops of oatmeal for our breakfast—one, two, three. One banana for you and one banana for me." Parents can also count the buttons on their child's shirt as they help them button them, or count toys as they clean up and put them in the container where they go.
- **Be positive.** If parents model a positive attitude toward math, this sends the message to kids that math is important and can be fun. It is important to spark children's interest about math. This is much more important than learning a particular math concept at a particular age. Remember that math is a process and they will get there.
- **Praise children's effort.** Parents' praise of toddlers' effort has been found to later predict how the children approached learning and achievement in elementary school (Gunderson et al., 2013). So when engaging in math talk with toddlers and preschoolers, it is helpful for parents to provide process praise, focusing on what their children are doing ("I like how you counted each piece!" or "You gave me exactly three spoons. Good job!"), rather than providing person praise, or praising their children's inherent abilities ("You are so smart!" or "You are so good at math!"). Eventually, all children face hard problems—including hard math problems. If they hear a lot of person praise, they may decide that their inability to do the hard problem reflects a lack of ability. In contrast, if they hear a lot of process praise, they are likely to decide that, with effort, they can solve the problem (Kamins & Dweck, 1999; Mueller & Dweck, 1998).
- **Start early.** Even if children are too young to be counting on their own, or even if they are not talking yet, they are still listening to and learning from parents' talk. While no one knows at exactly what age babies start to benefit from parents' talk about number and space, if parents start talking about math with their infants, they can think of it as getting themselves into the habit of supporting their children's math development. When children are ready to learn from their parents' math talk, their parents will already be doing it.

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