FEATURE | *by Cheryl Y. Mixon*

One, two, three: Math as far as the eye can see

In Ms. Smith's pre-kindergarten classroom, the children chatter and play busily in the centers. In the construction center José and Faith are discussing how to make their rocket ship large enough for the block family to fit inside. In the art center Mary and Bobby are painting monsters with sponges cut into circles, squares, and triangles. "This can be the monster's teeth," says Mary, holding up the triangle sponge. In the library center Eric and Monique are searching for books to see the different colors and bodies of bears so they can make a bear book in the writing center.

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What are all these children doing? They are blending their mathematical knowledge into their play throughout the classroom. Incorporating mathematical concepts in play results in a deeper level of children's mathematical thinking. The children discuss math as they observe, ask questions, and explore materials (Klibanoff, Levine, Huttenlocher, Vasilyeva, and Hedges 2006). By providing opportunities for math activity in centers, teachers can help children explore math as they engage in play.

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The joint position statement of the National Association for the Education of Young Children (NAEYC) and the National Council of Teachers of Mathematics (NCTM) suggests young children construct math knowledge through experiences in the learning environment. Teachers should encourage children to "develop, construct, test, and reflect" on their math thinking (NAEYC and NCTM 2009).

In a discussion of mathematics in the preschool classroom, Clements (2001) observes that mathematics is a natural component of children's play. The playful interactions promote development of math knowledge. But children need an adult to recognize opportunities to provoke mathematical ideas and assign mathematical meaning to their play (Van Oers 2010).

Incorporating math concepts into the centers is the first step to move children's mathematical thinking forward. The other imperative component is the teacher interacting and discussing the play with the children. These interactions assist the teacher in targeting the children's zone of proximal development of mathematical knowledge (Vygotsky 1962).

Learning centers

The following ideas incorporate math and questioning ideas to assist the teacher in creating enriching centers that engage children mathematically in their daily play.

Art center

The art center ranks among the favorite centers in many classrooms because it provides opportunities for children to create. Math can be a natural compo-

nent of this creativity, and adding common items can contribute to the creation of unique artwork.

- Buttons can prompt sorting and data analysis discussions. Children can sort the buttons by attributes, such as buttons with four holes or buttons shaped like ovals. When they create collages or other art work, the teacher can challenge the children to determine the common attribute or sorting rule for each button.
- Cotton balls can promote counting discussions. Children can glue cotton balls to cardboard cutouts for each person in their family. The teacher can talk to the children about how many cotton balls they used and who used the most cotton balls, prompting them to count and compare.

Construction center

Children enjoy building structures with Lego® bricks, unit blocks, and any other manipulative that is available. Incorporating additional materials and engaging children in math discussions can enhance the math experience.

- Paper cups of different sizes open the door for math discussions. Children can create sandcastles with the cups, promoting spatial awareness. The teacher can talk to the children about what might happen if different cup sizes were used for various parts of the castle. A number cube could also guide children in creating the castle with specific numbers for each size cup.
- Blocks made by simply stuffing paper inside paper lunch or shopping bags add variety to the construction experience. The children can create structures with these blocks and predict the height of the structure before it crashes to the floor. The teacher can talk to the children about the block sizes and whether more paper inside would impact the their stability.

Dramatic play center

The dramatic play center allows children to take on roles and engage in discussions that promote numerous skills. The center serves as a place children can re-enact the everyday tasks observed in their homes and cultures. Math, an integral part of daily life, can be a natural extension in this center.

- Birthday party paper hats, cups, and plates can extend into graphing. The children can survey their peers about their favorite flavors of ice cream or cake for the party. The teacher can facilitate the surveying by asking how they can decide which items to buy and how many items will be needed for everyone attending the party.

MATHEMATICS IS A NATURAL COMPONENT OF CHILDREN'S PLAY.

- Common props for playing house can be a springboard for numeracy skills. The teacher can ask children which role they will take on, such as mother, father, brother, sister, or baby. Further, the children can explain who is older or younger in the family, prompting number comparisons.

Library center

The library center, typically a cozy place for children to enjoy literature, can include books that contain number operations and patterns. Include books published by commercial companies as well as class-made books and audiobooks. The children can begin to create math stories that prompt early addition and subtraction concepts. Many stories have a pattern to the story such as a repeated line after each character is introduced. Any story can lend itself to developing math concepts in children's play.

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- *Where's My Teddy?* by Jez Alborough (1994) can be acted out to include addition or subtraction. After reading the book, the teacher can add plastic teddy bears and a picture of a forest and start creating a story such as this: "Three bears lose their way in the forest. Eddie finds two bears and takes them home. How many bears are left?" The children can create their versions of the story by drawing pictures or recording their voices as they tell the story.
- *The Very Hungry Caterpillar* by Eric Carle (1969) can be an opportunity to discuss growing patterns. Giving children pre-cut circles allows them to represent the fruits the caterpillar eats and to watch its growth. Additional shapes can allow children to create their own growing patterns.

Sand and water center

Any center that allows children to get dirty or wet is typically a big hit among young children. Aside from the soothing and calming effects of sand and water, children can strengthen their math knowledge. Adding measuring cups, spoons, and various sizes of containers can evoke math discussions on capacity, size, and weight.

- Cups of various sizes can stimulate conversations about capacity. The teacher can ask children which cup will fill a container faster. The children can discover the answer by counting the number of scoops required to fill each cup. The teacher can also provide containers of different shapes but containing the same amount, such as recycled half-gallon containers from different brands of ice cream.
- A balance scale can build concepts of weight. Children can fill containers of different sizes and place them on the scale to determine which is heaviest. The children can place a number of spoons on one side of the scale and find the cup that would equal them in weight.

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Music and movement center

The melodies and rhythms of music are created around math concepts, such as patterns, counting, and sequencing. Adding simple elements like number cards and action movement cards can extend children's math thinking.

- Add a collection of number cards to the music and movement center. Children can create new rhythmns with drum and rhythm sticks by selecting a number card and tapping that number of times with the instrument. Glue a picture of the instrument and the number card onto paper and build a collection of child-developed musical compositions.
- Moving to music involves some level of patterning. Children can choreograph a dance by selecting movement cards and creating an order for each movement. When the music is played, the children can move to the music following the movement cards selected, creating a pattern of movement.

Science center

In the early childhood classroom—and in the adult world—math and science often overlap. Children often compare themselves by height and objects by quantity. Providing non-standard tools for measuring or unique objects to classify can stimulate math concepts in their play.

- Planting seeds or beans opens the door for several math concepts. Children can begin by sorting the different types of seeds based on color, size, and shape. Once the seeds are planted, the children can monitor plant growth by measuring the height with Unifix® cubes. They can also compare the different length and width of leaves.
- Taking the children on a nature walk with a bag to collect items can provide materials such as rocks and leaves to explore. The children can then sort and graph the materials and answer questions such as the following: How many leaves were found that had pointed tips? How many bumpy rocks

were found? Which material was collected the most in the class? The explorations with the objects can be limitless in stimulating math concepts.

Writing center

A writing center may be added to traditional centers in classrooms of 4- and 5-year-olds. Teachers can provide different types of writing utensils and paper and encourage children to write about various topics, all of which can include math concepts.

- Adding-machine tape offers an opportunity to explore concepts such as *long* and *short.* One of the first words children write is their name. They can write their names on adding-machine tape and then compare the length of names—or letters in names—with their peers. Their tapes can be glued to a chart to reveal the longest and shortest names. Questions will arise about the size of children's writing and how the size can affect the length of names.
- Self-made books, created by stapling papers together, can provide experience in one-to-one correspondence. As the children illustrate their pages, they can write the page number on each page. They can also write books about numbers, such as one house and two trees, for example, or different versions of finger-play songs such as *Five Little Monkeys Jumping on the Bed*.

Learning centers can provide engaging activities that promote children's learning in every aspect. The centers are a great opportunity to incorporate math concepts that provide real experiences to encourage children's math thinking. By facilitating the play occurring in the centers, the teacher can be aware of children's math understandings and engage them in a deeper level of math knowledge.

References

Alborough, Jez. 1994. *Where's My Teddy?* Somerville, Mass.: Candlewick.

Carle, Eric. 1969. *The Very Hungry Caterpillar*. New York: Penguin Putnam.

Clements, D. 2001. Mathematics in the preschool. *Teaching Children Mathematics*, 7, 270-275.

Klibanoff, R., S. Levine, J. Huttenlocher, M. Vasilyeva, and L. Hedges. 2006. Preschool children's mathematical knowledge: The effect of teacher "math talk." *Developmental Psychology*, 42 (1), 59-69.

National Association for the Education of Young Children and National Council of Teachers of Mathematics. 2009. *Where We Stand on Early Childhood Mathematics.* Washington, D.C.: NAEYC.

Van Oers, B. 2010. Emergent mathematical thinking in the context of play. *Educational Studies in Mathematics*, 74, 23-37.

Vygotsky, Lev. 1962. *Thought and Language.* Cambridge, Mass.: Massachusetts Institute of Technology Press.

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