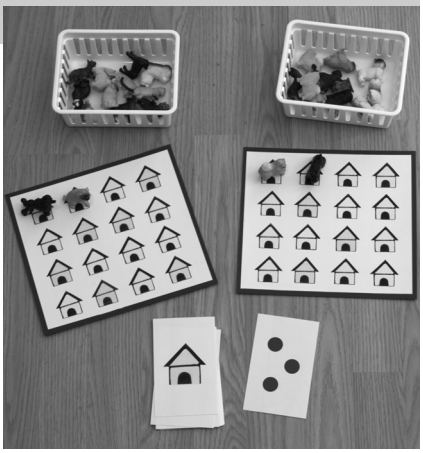
ACTIVITY 2.2

Doghouse Game



Materials

The following materials are needed for this game:

- Game board for each player, made from poster or tag board (8 × 8 inches)
- Sixteen doghouse pictures for each board, attached to the board in 4 rows, with 4 doghouses per row
- Sixteen small toy dogs for each player
- Deck of cards, made from 3 × 5 inch file cards, with one to four 1-inch circle stickers per card

Description

This game appeals to many children because they are interested in dogs or other pets. It accommodates children from a wide range of developmental levels. Young, preschool children who are not yet ready to draw cards and create matching sets may be interested in just placing a dog on each doghouse picture. This reinforces the important concept of one-to-one correspondence. If children place the dogs randomly on the board, the teacher can direct their attention to a one-to-one relationship by asking whether the children can find one dog for each house. Many children will take turns drawing the cards to determine how many dogs to place on their boards. Children at the one-to-one correspondence level of quantification may actually set the dogs on the dots on the cards before moving them to the doghouses. Children who can count will use that strategy to determine how many dogs to take.

Grid games can be played by an individual child, and they make excellent small-group games as well. In preschool classrooms, a grid game can be used as a special activity or placed on a math game table. Kindergarten teachers might decide to divide the class into small groups to play the game. As with other grid games, the doghouse game can be modified for children who are more advanced. They might be asked to put two or more dogs in each doghouse. The quantities of dots used on the cards can be increased as well.

Teachers often have to spend their own money for classroom materials, so cost is an important consideration. The doghouse game was selected because dog and cat counters can be purchased in large quantities for relatively little expense. Doghouse pictures can be downloaded from free clip-art sites.

Math Discussions

Questions similar to those used for math manipulative games are also appropriate for grid games. In addition, teachers can draw attention to the number of spaces covered, the number of empty spaces, or the relationship between the two. Note that all of the sample questions and comments listed next relate directly to the game; therefore, although they are excellent math questions, they fit naturally into the flow of the play. It is this natural seeking of information that makes mathematics creative and exciting, not constant quizzing that is unrelated to anything of interest to the child.

- *How many more dogs do you need to fill up all of your doghouses?*
- *One of my rows is full, one row has two dogs, and this row is empty.*

- *Do you have more occupied doghouses or more empty doghouses in this row?*
- *I got only a 1. Now I'll have to roll again to fill up my last two doghouses.*
- *How many dogs do we have houses for?*

Path Games

Path games are more difficult for young children than grid games; however, they are valuable teaching tools because they simulate a number line. A number line is actually a mental construct that individuals create as they learn to rank numbers in a hierarchy. Mathematics curricular materials that may be used in kindergarten and first grade often create a physical number line, with numerals listed in order, for children to use when answering questions about the magnitude of numbers or when solving arithmetic problems. Difficulties occur when children have not yet constructed a mental number line. They may model use of a physical number line without any understanding of what they are actually doing mathematically. When children play path games and move an object along a series of marked spaces to reach their destination, these games model continuous movement along a number line. With repeated experience, children realize that as they move forward, they take an increasing number of steps along this line, and the spaces which they cover can be quantified.

Path games are more difficult for young children than grid and counter games because they are more abstract. Children do not have a tangible object to represent each quantity; instead, they must quantify steps taken toward a goal. As in Hansel and Gretel's journey through the forest, however, the steps they have taken seem to vanish as they move forward. Assume that a child has moved three spaces on his first turn, and then moves two more spaces on his second turn. His place on the path does not look like two; instead, it looks like five—or just "a lot." At first, some children move their marker back to the starting point for each turn so that their placement on the path matches the number on their current turn. Quantifying spaces involves a new entity for children to count, so path games support development of the abstraction counting principle.

A common error that children make when playing path games is to re-count the space which their mover is on when they begin a new turn. They often make the same mistake when they perform addition on a number line (see Chapter 3). Gross motor path games, in which children are themselves the movers, help the children understand that the space they occupy at the end of a turn is not part of their next turn. They realize that it has already been counted because they are standing on it. Many children stop making this re-counting error on board games after they have had experience with gross motor path games.

Games with short, straight paths help children make the transition from concrete manipulative and grid games to more abstract path games. For these initial path games, children should have their own paths to move along so that they are not confused by the markers of other players. Ten spaces is a good length for initial paths. This relatively short length seems to help children envision their movement along the path. If they have moved five spaces, they can see that they have five more to go. Once children have constructed the concept of moving along a path on consecutive turns, they can tackle games with longer paths that have curves or angles, additional directions, and bonus or trap spaces. Children can now share the same path, which allows them to account for the position of their mover in relationship to those of the other players. They can also use dice with larger amounts, and eventually begin to add the numbers on two dice. This transition into addition will be the focus of Chapter 3. The following examples illustrate both short- and long-path games.

ACTIVITY 5.1

The Magnificent

The child may reply that she created a house, and the teacher can agree while adding that in geometry that shape is called a "pentagon." Teachers should also look for symmetrical relationships that children may create. Some children may begin with a

central shape and then branch out, in a symmetrical fashion, from that starting point. Other topics of conversation might be items that are the same shape, but a different size; how shapes look when they are turned (rotated), or flipped; and the types of lines that form the edges of the shapes.

ACTIVITY 6.5

Container "Brainer"

Materials

The following materials are needed for this activity:

- Sensory table, or several plastic dishpans
- Assorted clear containers, in various sizes and shapes
- Several small scoops
- Several funnels
- Recording chart (optional)

Description

This activity is designed to help children visualize the various parameters that affect volume. Preschool and kindergarten children typically believe that tall containers automatically hold more than shorter, wider containers. Therefore, for this activity, teachers should select containers that confound that notion. Some taller containers should be included that have less capacity than shorter containers. At first, children will need time to randomly experiment with the materials, particularly in preschool. The teacher can then introduce the challenge of finding the containers that hold the most water. The idea of using the funnels and scoops to measure how much water goes into each container can be modeled, perhaps during group time. For recording purposes, a chart with a list of the children's names and a digital photo of each container can be placed near the activity. Children can add comments, such as "a lot," or measurement numbers, such as "5 scoops," to the chart. To facilitate later discussion, the bottles can be labeled with letters; however, numbered labeling should be avoided because children may confuse the numbers with a volume hierarchy or think that the numbers refer to the measurements.

This activity should be repeated, perhaps during the following week, using a dry material, such as sand or rice. Some children believe that the filler material affects the capacity of the containers, and this variation allows them to check that hypothesis.

Math Discussions

Conversation is an important component of this activity. Before the activity begins, teachers can ask the children to estimate the number of scoops that each container will hold. This can be done informally, just before children engage in the activity, or as a formal **estimation** activity at group time, with the estimates listed on chart paper.

Scaffolding during the activity will be critical for many children. In preschool, teachers can help children keep count of the number of scoops that they poor into various containers. Kindergarten children can be grouped in pairs or small groups so that they can help each other keep track of the counts. Teachers may also suggest that children pour the contents of particular containers into other containers to check their predictions. For example, the teacher may suggest that the sand in a tall container be poured into a shorter container to see whether it overflows.

It is important to remember that for some children, particularly preschoolers, this will be a general, introductory activity. It takes many experiences over time for children to develop measurement concepts related to volume. For younger children, the teacher's role may simply

be to draw children's attention to close observation. For example, the teacher might say, "Tom poured the water from the tall bottle into this shorter bottle. Did it fill the short bottle all the way up?"

For older children, the charted measurements can be discussed as a group. There will undoubtedly be discrepancies, and children can speculate about why this would happen. The teacher may want to demonstrate some of the suggestions, such as what happens if the scoop is not filled to the top or if children keep counting after a container is filled. During the conversation, teachers can draw children's attention to a comparison of pairs of containers. They may notice that container C always holds more than container D. If this conversation is held after the experiments with water, the teacher might ask children to predict whether or not the same pattern will emerge when they use sand or rice.

ACTIVITY 6.6

Snake Adventure

Materials

The following materials are needed for this activity:

- Small container of play dough for each child
- Measurement tools, such as string, linking cubes, or standard measures (e.g., ruler, yard stick)
- Recording sheet (optional)

Discussion

Children who do not yet conserve mass, which includes most children in preschool and many in kindergarten, typically believe that the mass of an object changes when it is spread out or compressed. Therefore, they think that a lump of play dough that has been spread out now has more mass. In this activity, children experiment with stretching out play dough and then returning it to its original container.

Children frequently experiment with coiling by rolling play dough or clay back and forth across a flat surface with their hands. As they do this, the dough becomes longer and thinner. Children often announce that they have made a snake. This activity extends this natural focus of children by encouraging them to measure their snakes, speculate as to whether the play dough will still fit into its original container, and then see for themselves. There are various ways that children can measure their snakes. They can cut a piece of string that is as long as the snake, use interlocking cubes or other manipulative materials, or compare the snake to a standard measure. The activity thus involves both linear measurement and comparison of mass.

Children who are close to conserving, or understanding that no mass has been lost or gained by manipulating it, may be highly intrigued (or bothered) by their experiments. They may repeat the process over and over to see whether the results remain the same. Within a few

days, they may have convinced themselves that the mass does not change. However, younger children who are not developmentally ready to conserve may not be bothered at all by the process, because they remain convinced that the amount of play dough actually changes as they manipulate it. Nevertheless, the activity gives them experience in manipulating a continuous quantity, some beginning experiences with measurement, and the opportunity to make focused observations accompanied by conversation.

Math Discussions

Once again, conversations should focus on predictions, observations, and discussions about the results of the experiments. Teachers may wish to begin by modeling the coiling technique, although play dough can also be stretched without coiling. Children can begin with estimates of how long they think they can make their snake (or stretch their play dough). They can then conduct and record their measurements. Finally, they can speculate as to whether the play dough will go back into its container, and then find out. Teachers' comments and questions guide this process. For example, the teacher might use tape to mark the child's measurement prediction on the table or floor. Teachers will certainly want to draw attention to how the width of the snake changes as it gets longer; in fact, this can be measured as well. Teachers can also interject ideas for other experiments; for instance, if half of the play dough in the container is used, will the snake be as long?

The research cited earlier in this chapter indicates that the dialogues among children are a critical component in increasing the understanding of nonconservers. For this reason, kindergarten teachers may want to group together children with various levels of understanding about measurement concepts. More advanced children can explain and demonstrate their reasoning, which adds to their own mathematical thinking while also encouraging their peers to think about possibilities that are new to them.

Measuring Speed and Time

Children typically do not understand the relationship between speed and time until about age 10 or 11 (Piaget & Inhelder, 1969b; Wadsworth, 1989). The formal relationship is expressed as velocity = speed/time. Younger children fail to consider whether or not two objects whose speed they are comparing started at the same time and followed the same paths. Nevertheless, young children are very interested in racing objects. The activity that follows focuses on physics. Children can initially rely on their visual perception to judge speed. Later, they can compare how speed relates to distance traveled and even can conduct general measures of elapsed time.

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