Piagetian Thoughts on Preschoolers' and Kindergartners' Spatial Development

Preschoolers and kindergartners are in the *preoperational stage*, according to Piaget (1959). They are still bound to their perceptions and usually see things from only one perspective. They like to focus on only one aspect of a thing, so they can be deceived by appearances. Preschoolers and kindergartners have not yet learned to conserve space in the preoperational stage of Piaget (Piaget, 1959; Piaget, Inhelder, & Szeminska, 1960). When six cars are represented in a parking lot spread out on a 10-inch × 10-inch lot, a typical preschooler or kindergartner says that there are more cars than if the cars are shown close together on the same size parking lot. When the child is asked by the teacher, "Is there more cement on the lot with the cars spread out or more with the cars close together?" the child usually answers that there is more cement when the cars are close together. This child cannot conserve number or space. According to Piaget (1959), in the preoperational stage, children are still using intuitive thought rather than logic. This intuitive thought is prevalent in young children's thinking about spatial development. The good news is that, with teacher guidance, the child can progress to a higher degree than was once thought. The following activities will support children in their enhancement of spatial skills:

Geometry Focal Point for Preschool: Identifying Shapes and Describing Spatial Relationships

Children develop spatial reasoning by working from two perspectives on space as they examine the shapes of objects and inspect their relative positions. They find shapes in their environments, and describe them in their own words. They build pictures and designs by combining two- and three-dimensional shapes, and they solve such problems as deciding which piece will fit into a space in a puzzle. They discuss the relative positions of objects with vocabulary such as *above, below,* and *next to.* (NCTM, 2006, p. 23)

1. Children can work with cubes or rectangular prisms. They identify these shapes and can create an actual design on grid paper, such as a fence for a pet, or they can design a pen for a zoo animal. Children can also put the cubes on paper, and then discuss what they have created. Then they can see them from different perspectives.
2. Children can investigate shapes with playdough. The teacher can help the children touch the outline of the shapes and describe them by the type of line, number of lines, the number of points, and what they look like when transformed.
3. Children can find many shapes in the environment, and describe them in their own words. Children can look for shapes on the floor, the wall, the door, the ceiling, their clothing, walls, fences, or cars. Children should go further than naming a triangle, a rectangle, and a square.

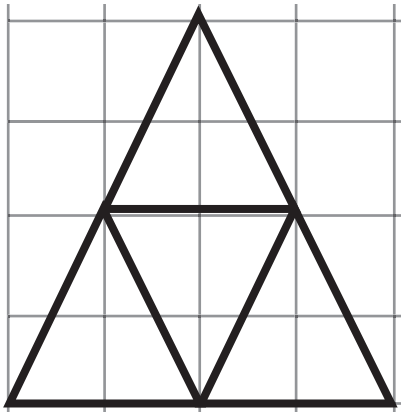

Figure 3.8. Find three triangles in one triangle.

They should see that not all triangles are equilateral and discuss in depth the attributes of the shapes so that language development is taking place and explanations are precise. The teacher needs to describe, for example, the roundness of the bird's nest, the round peas, and the round cherry. The teacher describes the triangle mountain tip, the triangle shark's fin, and the triangular ear of the cat. The teacher asks the children what they can build with two triangles. The teacher then asks the students to name three shapes they can build with three triangles. The students decide what shape fits into a space.

4. The teacher asks the children to fold a square in half. The teacher then asks the children what shape they have created. The teacher asks the students what kind of origami animal could be made with three triangular folds. This beginning origami is very difficult for children in preschool. Folding from one point to another is rather difficult for most preschoolers in the United States because they have not had much experience in paper folding. Children from Asian countries have many origami projects that they learn at home and school. I observed young children in Japan performing this activity with ease. The children can easily fold the square into a rectangle. It might be helpful to demonstrate how a square can be turned into two triangles.
5. The teacher can have students play a game called Guess What the Shape Is at circle time and bring the shapes out of an apron. Play this with three-dimensional shapes and with flat shapes.
6. The teacher can ask the students to find three triangles in one triangle (see Figure 3.8).
7. The teacher can ask the students to build different things with two triangles.
8. Students can be asked to find smaller circles in larger circles. Make a 10-inch circle on paper, and let children use paint with cans and place circles within the large circle. Repeat this with other two dimensional shapes.

9. The children can discuss the relative size of the objects using simple adjectives, such as large, big, small, and little. Using buttons that are large and round and small and round, and large and square and small and square, they can complete an activity helping a teddy bear find its buttons. The teacher can ask the following question: "Can you help the teddy bear find one large button and one small button?" Even though sorting by color is the first way most preschoolers learn, sorting by color sometimes takes away from the spatial sense of words because children focus on the color.
10. Using a grid, such as the one in Appendix B in the back of the book, the children can visualize what is happening with cubes, rectangles, triangles, and prisms as they place them on the grid. The grid helps the children structure their learning and later can lead into learning about coordinates.
11. Students can sort three-dimensional figures by size, number of sides or vertices, and weight, and precisely describe the characteristics. Weight and graphs should be related to extensive language in math whereby size, shape, and quantity can be described (connection to data analysis).
12. Students can determine how many sides a shape has (connection to number and operations).
13. Students can develop simple sequential patterns, such as triangle, triangle, and square (AAB) or triangle, square, and square (ABB) (connection to algebra).
14. Students can play with puzzles of all types, starting with small puzzles of two or three pieces and moving into complex puzzles. The teacher's role is to give some guidance if needed but not to show exactly how to perform the activity. After using picture puzzles, the children can work on shape puzzles using various shapes to make a picture.
15. Many books, such as *All About Where* and *Over, Under and Through and Other Spatial Concepts* by Hoban (1973) can be used to discuss position words and phrases, such as *under, above, below,* and *next to*. There are other books on position words in Appendix F.

Kindergarten Focal Points in Geometry: Describing Shapes and Space

Children interpret the physical world with geometric ideas (e.g., shape, orientation, spatial relations) and describe it with corresponding vocabulary. They identify, name, and describe a variety of shapes, such as squares, triangles, circles, rectangles, (regular) hexagons, and (isosceles) trapezoids presented in a variety of ways (e.g., with different sizes or orientations), as well as such three-dimensional shapes as spheres, cubes, and cylinders. They use basic shapes and spatial reasoning to model objects in their environment and to construct more complex shapes. (NCTM, 2006, p. 24)