COMMON MISCONCEPTIONS

• Students may have trouble differentiating between visually similar shapes.

Some students have challenges differentiating between visually similar shapes. For example, when classifying a shape as a triangle of a non-triangle, students may think that a three-sided open shape is a triangle. This is because they recall the three straight sides portion of the definition, but they do not recall that a triangle must be a closed shape. Students may also mislabel a closed shape with two straight sides and one curved side as a triangle. To remedy this, ask probing questions that focus students on the definition of the shape. For example, “A triangle needs to have _______. Does this shape have ________? Is the shape a triangle?” If students are not able to answer these questions, or their answers are not logical, review the defining attributes using manipulatives. Clear rulers or index cards can help students check if a line is straight. You can also have students make an attribute checklist.

• Students may become overwhelmed and shut down.

Some students may find the number of shapes and their definitions overwhelming. It can be particularly overwhelming if most of the student’s definitions are written, and their literacy is not yet developed enough to be comfortable reading the definitions. If the student is overwhelmed, reduce the number of shapes they are working with. Also build a visual definition or attribute checklist with them for each shape. Use a large sheet of paper with enough room for all the shapes they learn at this level. As they become more comfortable with the first shapes, add another shape to their activities and definition or checklist sheet. This provides a progressive development of the concepts they are working with, while maintaining a visual cue to prompt recall.

• Students may have difficulty with shapes that belong to multiple categories.

Students are not required to learn how to sort shapes into a hierarchy until grade 4, but this concept is present any time students are sorting shapes. The most common example of overlapping shape definitions is a square and a rectangle. The definition of a rectangle is a closed shape with two sets of parallel sides and four right angles. The definition of a square is the same, except that it adds the requirement that all sides have the same length. Because a square has all the defining attributes of a rectangle, plus an additional attribute, all squares are rectangles, but not all rectangles are squares. If students are sorting shapes into categories where a rectangle and a square are in separate categories, this can be confusing. You can address this directly with your class, and account for it in the design of your activities. Have students first sort squares and rectangles together, and then sort out the squares into another smaller section within the group of rectangles. Similar issues arise when we use the category “polygon” for all the left-over closed shapes with straight sides. Some students conclude that a square, rectangle, triangle, etc. are not polygons, which is not true. In fact, they are all polygons.
BACKGROUND ON 2D AND 3D SHAPES

In Kindergarten, students learned how to differentiate between flat (2D) and solid (3D) shapes. They used informal language to discuss attributes of these shapes, and focused on learning to describe and discuss attributes. In Grade 1, students learn how to use defining attributes to identify and draw shapes. A defining attribute is a feature that a shape must have to meet the formal definition of that shape. For example, having all straight sides and being a closed shape are the defining attributes of a polygon. It is important to note that many shapes meet multiple definitions, with some definitions having more defining attributes than others. For example, a triangle is a closed shape with all straight sides, which makes it a polygon. It also has exactly three sides, which makes it a triangle. This is important because if students learn in grade one that a shape can only fit into one category, they will need to unlearn this in future grades. In grade 4, students will learn how to sort 2D shapes into a hierarchy based on their attributes.

DEFINING ATTRIBUTES OF 3D SHAPES

In Kindergarten, students learned about the 3D shapes cube, rectangular prism, cylinder, cone, and sphere. A cube has six congruent (equal) square faces. Just as a square is also a rectangle, a cube is also a rectangular prism. A prism is a shape with two parallel congruent faces that are polygons, and the remaining faces are rectangles. A cylinder is a shape with two congruent circles separated by a round surface. A cone has one circular base with a curved surface that forms an apex (point). A sphere is a shape with one continuous round surface where every point on the surface is equidistant from the center of the sphere. When defining a sphere in kindergarten, students learned it as “shaped like a ball.” This definition is helpful to give some connection to the shape, but it is limited, since the true definition is more specific and there are many examples of balls that are not spheres. Some students may erroneously believe that eggs, footballs, or rugby balls are spheres. It is helpful to explore this with students while refining the definition of a sphere.

TEACHER TIPS

When teaching students to classify and draw objects based on their defining attributes, use the correct formal language when you speak. Students use both formal and informal language to discuss shapes, so keep in mind the ambiguity of the informal language. Have a vocabulary wall with visual definitions so that students are less limited by their reading comprehension.