COMMON MISCONCEPTIONS

• Students think the size or orientation of a shape changes the shape.

Some students may think that if one shape is larger than another shape, the shapes must have different names. However, the size of the shape does not change the attributes we use to define the shape. It is helpful to use examples and manipulatives that have a variety of sizes and colors. This will help the students learn what attributes to use to define the shape. You could point out that size and color are not what define a shape; the sides and corners are. Some teachers use color to help students learn what shapes are alike, such as by having all the rectangular prisms green and all the cones yellow. This is not ideal because some students may believe that the color is what defines the shape. In that case, if you switch the prisms to yellow and the cones to green, those students will still call the green shapes prisms.

The same is true for shapes in different orientations. Some students believe rotating a shape makes it a different shape. Being able to recognize the congruence of rotated shapes is a cognitive skill that takes time to develop. Try using cut outs of shapes, having students identify the shape, then rotating it on the table and asking them to identify it again.

• Students refer to both edges and faces as sides.

Students are being introduced to these concepts using informal language. Many students will refer to the sides of 2D shapes, edges of 3D shapes, and surfaces of 3D shapes all as sides. You can introduce the academic language of edges and faces but should not require students to use it exclusively. Instead, engage students in conversation about the attribute they are calling a side. This act of describing the side will help develop their language skills and their ability to recognize and describe the attributes of shapes. In future grades, the language used to describe these attributes will become more formal.

• Students confuse 2D and 3D shapes.

Many students will confuse 2D and 3D shapes. This is partly because many 3D shapes have 2D shapes as their faces. A 2D shape is two-dimensional, which means that it is flat. 3D shapes are three-dimensional, which means that they are solid and you can hold them. One way to explain the difference between 2D and 3D shapes is to draw a 2D shape like a square on a piece of paper and then ask the student to pick up the square from the paper. The student won’t be able to do this because the shape only has two dimensions. Then, give the student a cube and ask them to pick it up and hold it. The student will be able to hold the cube. This can provide a good way of understanding the difference between 2D and 3D shapes. The student can then look at the cube and notice that the faces themselves are 2D shapes, so 3D shapes contain some 2D shapes. When using this explanation, be sure to use paper that is obviously larger than the shape you want the student to try to pick up from the page. If you use smaller paper or a cut out shape, the student will likely become confused. Paper has thickness, so a 2D shape cut out of paper is technically a 3D shape with the height being the thickness of the paper. That nuance could cause some confusion for your students.
Shapes like cylinders, spheres, and cones have curved surfaces on them. Students are learning to assess and describe attributes of these shapes. The outside of these shapes could be called curved faces, or surfaces. Some students may describe a cylinder as having three faces, two flat and one curved. Other students may describe a cylinder as having only two faces, and one curved surface. Either description is acceptable at this point, because the goal is to encourage students to notice and describe these attributes. Encourage further discussion and explanation of the attributes the student is describing. Students may describe a sphere as having no faces and a curved surface, or as having one curved face. A cone may be described as having one flat and one curved face, or as having one face and a curved surface.

Students are only required to use informal language at this point, but it is helpful for teachers to also introduce academic language that will be used in future grades. In kindergarten, students describe shapes using terms like sides and corners. The academic language for these attributes includes terms like faces, vertices, surfaces, sides, and edges. In geometry, a face is a flat surface on a solid object. In informal language, face has another meaning. You can address this directly by explaining that some words have multiple meanings. Surfaces are the exterior boundaries of an object and can be flat or curved. In later grades, students will learn about area, which is the measurement of 2D space, and about surface area, which measures the 2D space around the surfaces of an object. A vertex is a point where the ends of two or more lines meet. The plural of vertex is vertices. A vertex looks like a corner. The lines forming a vertex do not always meet at a 90° angle like in the corners on a rectangle or square; they can also meet at other angles, like in the corners on a triangle. A side is a straight line that bounds the area of a 2D shape, while an edge is a straight line that bounds a 3D shape. Sides and edges are both lines that connect two vertices.

Students will learn best when what they are learning seems relevant to them. You can relate the learning of 3D shapes to many common objects in the classroom and at home. Scavenger hunts are a great way to engage students in learning about shapes. Have them move around the classroom to select and sort the 3D shapes in the classroom. You can also do some messy activities, like painting pictures using 3D shapes as stamps. This kind of activity will help students learn about the 2D shapes that are also in 3D shapes. For example, a cube will make a square stamp, and a rectangular prism will make rectangular stamps. This is also a good priming exercise for the concepts of surface area and nets, which students will encounter in future grades.

Use lots of examples and manipulatives. Encourage students to describe the attributes of these shapes to you and their peers. Have them explain their reasoning to you. This process will be informal, so look for simple explanations like, “It is flat, so I know it is 2D.”