Zome System

Builds Genius!

What Is Reflection Symmetry?

Mathematics
Basic Concept

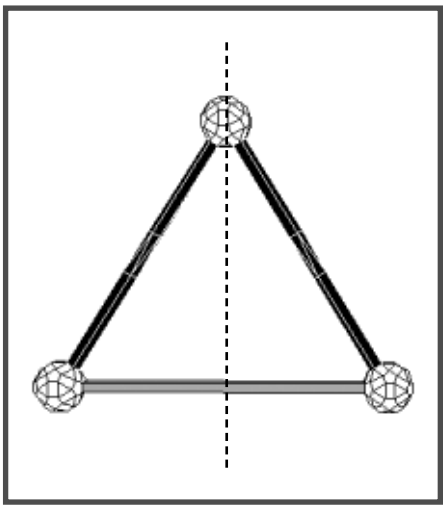
Lesson Objective:
Students explore the concept of bilateral reflection symmetry, and discover its relevance in geometry and nature.

Prerequisite Skills:
Students need to have worked with Zome System before.

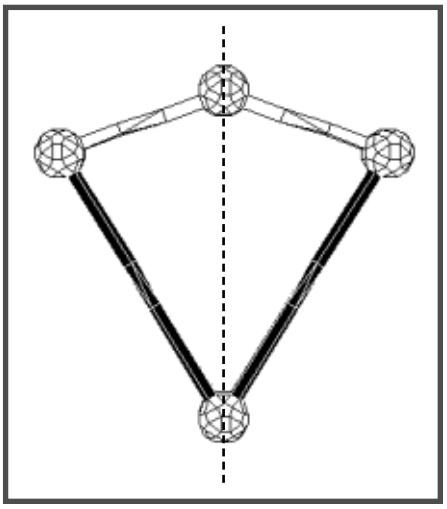
Time Needed:
One class period of 45 to 60 minutes.

Materials Needed:
- One Zome System Creator Kits for 25-30 students
- A hand-held mirror

Procedure:
Ask the students what they know about symmetry, and symmetrical. Discuss the suggested definitions, and see if the class can agree on one or several options. *How can we tell if an object in the classroom has symmetry?*



Use a volunteer as a visual example for a discussion on symmetries in the human body. *What is a line of symmetry?* If we divide a symmetrical object, the line down which we divide or cut that object is called the line of symmetry. *If we could divide the student down the middle, would the two halves be symmetrical? Which way could we divide him/her so that the two halves would be the same?* Lead a discussion of how our bodies are not perfectly symmetrical due to uneven facial features, asymmetrical haircuts, and placement of internal organs.



Ask the students how to place a mirror on a student's face to demonstrate the reflection symmetry of the face and body. *What does the reflection show?* Half of the face plus its reflection gives a whole face. *Is this the same as the whole face?* Ask the students to write their own definitions for reflection symmetry. *Is it possible to divide the human*

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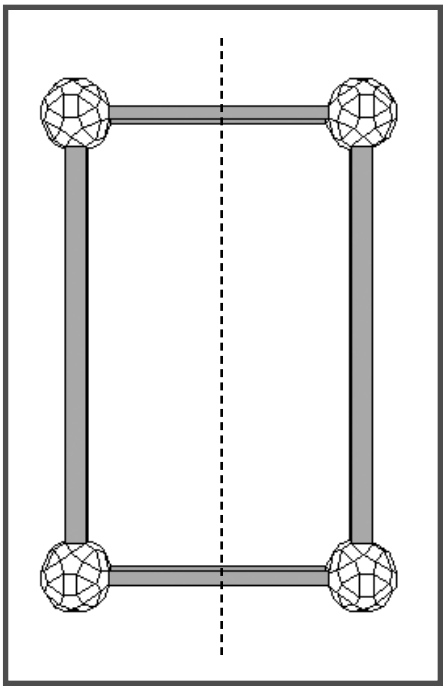

body into symmetrical halves, in more places than down the center? They will find that we only have one axis of symmetry. This is known as bilateral symmetry.

Distribute Zome System pieces to the class and ask them to build structures with reflection symmetry. They can build either 2-D polygons, or more complex 3-D structures. Have them work in teams of four to create one example to present to the class. They should record anything they discover along the way in their math journals. Depending on their age and spatial ability, some students will realize that shapes often have more than one axis of symmetry (they are not bilateral). List on chart paper or blackboard the properties of bilateral symmetry. *Do animals have bilateral symmetry? Would an animal be able to move efficiently if they were not symmetrical?* Make two columns on the board, labeled "bilateral symmetry" and "no bilateral symmetry." *Can anyone name animals with bilateral symmetry? With no bilateral symmetry? With multiple symmetry?* Lead a discussion about how all of these animals move.

Do any man-made structures, such as buildings, have bilateral symmetry? Why are many buildings symmetrical? What kind of symmetry is it? What is the purpose of symmetry? Use the students' structures as examples whenever possible.

Assessment:

Observe and listen to students as they build their structures. Older students should write about their findings in their math journals.

To meet the standard students must build a symmetrical model and show an axis of symmetry. To exceed the standard they must verbalize a few qualities/advantages of symmetry in an animal or natural object.

Standards Addressed:

* Mathematics standards addressing mathematical connections (NCTM Standard 4).
* Mathematics standards addressing geometry and spatial sense (NCTM Standard 9).

Transfer Possibilities:

More advanced work on different symmetry concepts (Multiple Reflection Symmetry," "Rotation Symmetry," "Translational Symmetries in Tilings," and "Spiral Symmetries"). Human and animal anatomy ("Animal Forms"), structure and balance in botany, aesthetics in man-made structures, as well as many concepts in fine art.