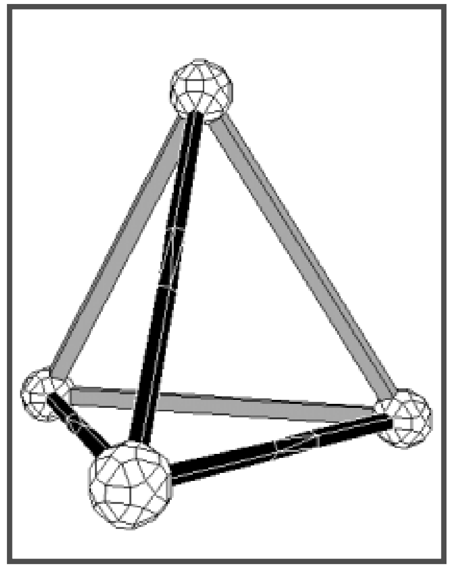
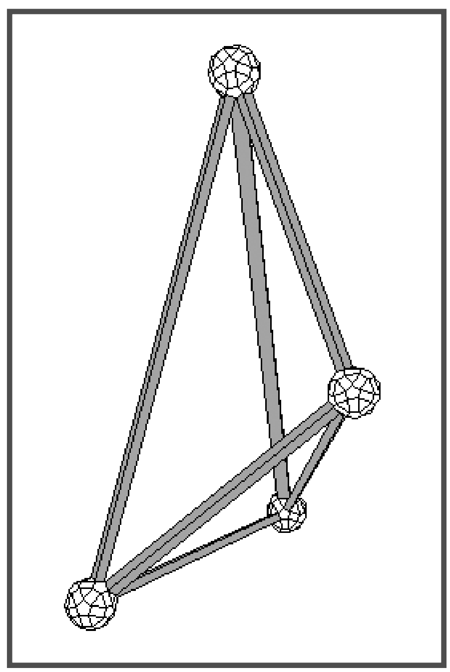
Zome System

Builds Genius!

3-D Triangles

Mathematics
Intermediate Concept





Lesson Objective:
Students will be exposed to the concepts of point, line, plane and dimensions in relationship to the triangle.

Prerequisite Skills:
Familiarity with Zome System and the concept of triangles (“Try the Triangle” and “Similar Triangles”). Ability to relate geometric figures to representative numbers (“Shape and Number”).

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

Materials Needed:
• Two Zome System Creator Kits for class of 25-30 students
• Overhead projector

Procedure:
Divide the class into teams of four students each and distribute Zome System components evenly among the teams. It is important that the teams start with the same number of components.

The team challenge is to build a “3-dimensional triangle.” Students may ask what you mean by a “3-dimensional triangle.” Rather than leading a group discussion at this point, suggest that team members discuss the concept among themselves as they each try to build a model. Allow at least 15 minutes for this exploration, during which time you can offer guidance to teams and students on an individual basis.

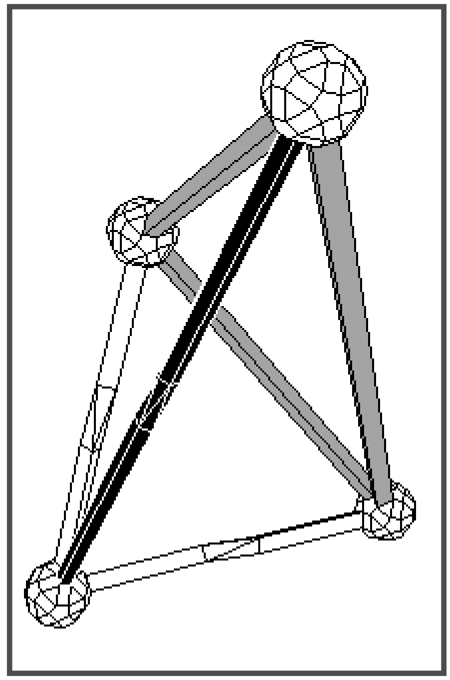
At the end of the exploration, ask a representative of each team to introduce the team’s “3-dimensional triangles” to the class and explain why it answers the challenge. Team representatives can use the overhead projector to show a 2-dimensional shadow of their 3-dimensional triangles.

After each presentation, involve the class in a discussion of the various concepts comprising the idea of a 3-dimensional triangle. *How do you know it is a 3-dimensional triangle? What do we mean by "dimension"? How many dimensions does a normal triangle have? Is a Zome System triangle really 2-dimensional? Why? Is a Zome System 3-dimensional triangle really 3-dimensional? Why? What do Zome System parts really represent? How many parts does it take to make a normal triangle? How many parts does it take to make a 3-dimensional triangle? Are all 2-dimensional triangles the same? In what ways? In what ways are they different? Are all 3-dimensional triangles the same? In what ways? In what ways are they different?*

Discussion of Zome System nodes and struts representing points and lines may also lead to philosophical questions such as: *Do points and lines really exist? Can anything exist in other than 3 dimensions? Is a piece of paper 2-dimensional? A shadow?* Finally you may wish to discuss the idea that the 3 points of any triangle define a plane.

As the students discuss what factors all 2-dimensional triangles have in common, and what factors all 3-dimensional triangles have in common, you may wish to chart the number relationships.

The table will help the students better understand the relationship between shapes and numbers introduced in



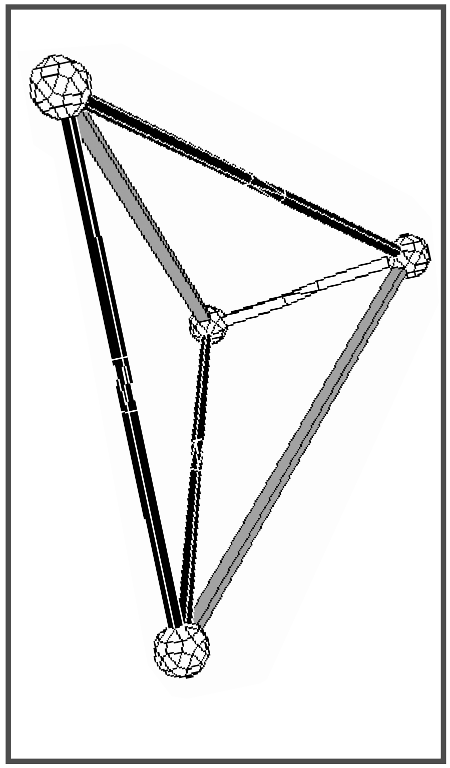
	Number of points	Number of lines	Number of 2-D triangles	Number of 3-D triangles
0-D triangles				
1-D triangles				
2-D triangles				
3-D triangles				
4-D triangles				

the "Shape and Number" lesson plan. Direct students to record their observations (including this chart if applicable) in their math journals.

As an extension you can continue the discussion by asking what a "4-dimensional triangle" looks like? Is there any way to predict what factors are common in all "4-dimensional triangles," based on the number chart on page 130?

Assessment:

Take notes during the discussion, and study students' written work in math logs. To meet the standard students must demonstrate understanding of the concepts of dimensions, points, lines, and planes. To exceed the standard, they must be able to explain the difference between the second, third, and fourth dimensions.



Standards Addressed:

* Mathematics standards addressing mathematics as a means of communications (NCTM Standard 2).

* Mathematics standards addressing the study of the geometry of one, two, and three dimensions in a variety of situations (NCTM Standard 12).

Transfer Possibilities:

This lesson provides a good base for exploration of the use of geometry in architecture and structural engineering ("Tallest Tower in the World," "Bridge Building Unit," and "Space Frame Structures").