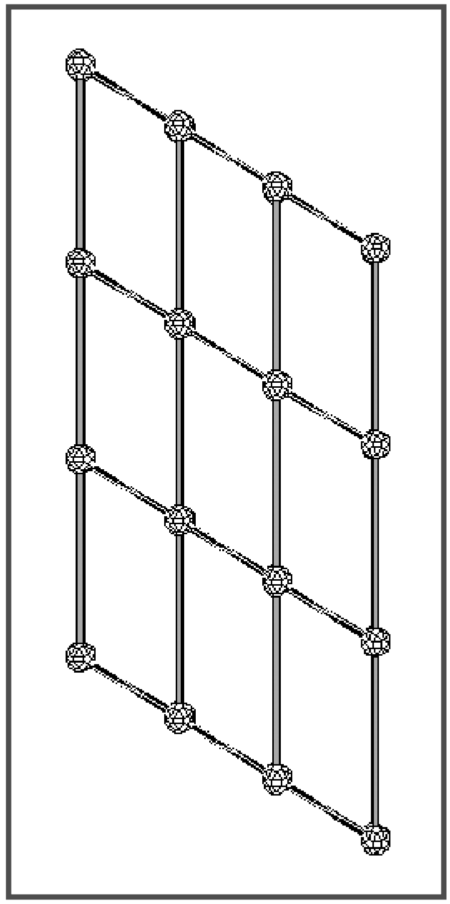
Zome System

Builds Genius!

Translational Symmetry in Tilings

Mathematics Basic Concept



Lesson Objective:
Students will understand how periodic tilings always have translational symmetry.

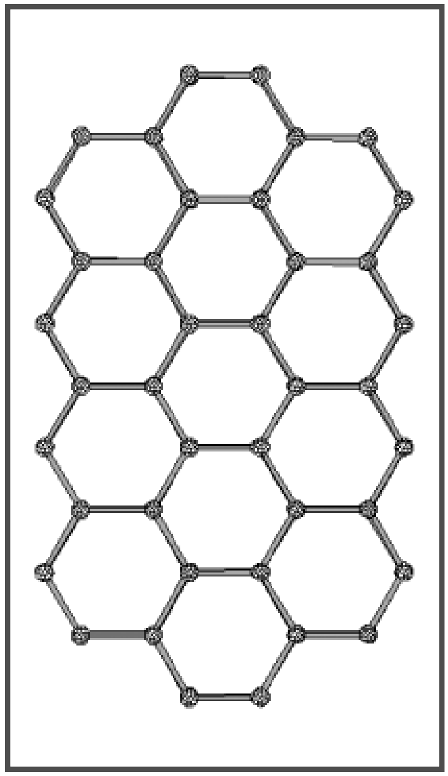
Prerequisite Skills:
Knowledge of various types of symmetry ("What is Reflection Symmetry," "Multiple Reflection Symmetry," and "Rotational Symmetry").

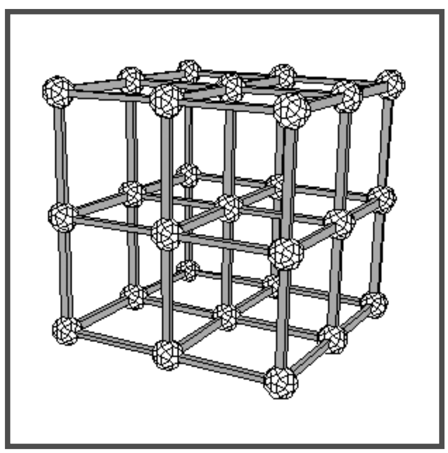
Time Needed:
One or two class periods of 45-60 minutes.

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

Procedure:
Explain to the students that they will continue to discuss further concepts of symmetry. Review reflection and rotational symmetry. *What are other ways that a shape or pattern can repeat itself?* List the students' descriptions and ideas on the board. If they have not listed or described translational symmetry, let them know that there is another form in which a basic unit can be repeated in an orderly way, but that it is their task to determine what it is.

Divide the class into teams of four to five students and distribute the Zome System elements evenly. Ask each team to build either a parallelogram or hexagon to work with. Allow the teams to build a flat tiling with copies of their shape. *What kinds of symmetry can you find? Does it have rotational symmetry? Where? Reflection symmetry? How? Where? What else is happening?* (The tile moves in a fixed direction over a fixed distance an infinite number of times.) After they have defined this symmetry, tell them it is called translational symmetry. *Where in the "real* *world" do we find translational symmetry* (examples include floor tilings, brick walls, carpet patterns, honeycombs, etc.)*?* Each student should write down his or her own definition of translational symmetry in their math journals. If there is time, the teams can start experimenting with more advanced translational symmetries. *Can a translational symmetry take place in 3 dimensions? Which types of shapes can be used in a 3-dimensional tiling without leaving gaps between the cells? Can the shapes fit together in more than one way?* Allow the teams to explore how a 3-dimensional lattice can be constructed. As they finish they can be allowed to present their models to the class and show how they show translational symmetry. *Do we know any examples of 3-dimensional translational symmetry in nature or the man-made world?* Examples that are useful for discussion include the formation of crystals when atoms are arranged in this type of symmetrical pattern. Translational patterns are also found in plant cells, honeycombs, and architectural space frames.





Assessment:
Discuss the definitions offered by the students individually and with the class, and review their math journals. To meet the standard students must build a model with translational symmetry, and be able to show how their pattern repeats itself. To exceed the standard they must verbalize a correct definition of translational symmetry.

Standards Addressed:
* Mathematics standards addressing geometry and spatial sense (NCTM Standard 9).

Transfer Possibilities:
Additional work on symmetry ("Tilings with Multiple Symmetries" and "Spiral Symmetries"). It is also a good introduction to discussions on the use of tilings in fine art and design.