Math 6 - Act. 14: Pyramids & Prisms: Euler's Formula

Summary

Students will relate their understandings of two-dimensional shapes to three-dimensional shapes and construct a variety of polyhedra, in particular, the five Platonic solids.

Materials

- Scissors
- Glue or stapler
- Pencil
- Colored pencils
- Sample large prisms, pyramids, cylinders, and cones
- Recording sheet

Additional Resource

:

The Amazing Circle by AIMS Education Foundation.

Background for Teachers

Using the three-dimensional constructions, students will analyze the models to observe relationships among the number of vertices, the number of edges, and the number of faces. Students will develop a formula relating the number of vertices, edges, and faces of a polyhedron and test the formula by analyzing other polyhedra.

Intended Learning Outcomes

3. Reason mathematically.
6. Represent mathematical situations.

Instructional Procedures

Invitation to Learn

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Introduce this task by recalling the tetrahedron students created during the Shape Shifter Activity. Have a display of jumbo size pyramids, prisms, cones, and cylinders to use as demonstration.

Instructional Procedures:

- Ask students what they can recall about the set of shapes on display (e.g., names of the parts--faces, edges, vertices, bases, apex, what the shapes remind them of in real life--ice cream cone, pyramids, etc.).
- Hold up two shapes up (e.g., the cone and the pyramid) and ask how the shapes are the same and how they are different. Do the same with another pair.
- Hold up three shapes for the students to observe (e.g., the cone, the square pyramid, and a cube). Ask which shape does not belong in the group and why. Encourage multiple responses, for instance, "The cube does not belong because it does not come to a point (apex)" or "The cone does not belong because it has a round base."
- Demonstrate how to construct one or more of the shapes using nets printed on cardstock or straws.
- Provide patterns for participants to construct their own 3-D shapes.
- Using the models that the students construct, have the students analyze the solids to find out the number of faces, vertices, and edges of each of the solids. They will keep track of the information on a handout.

Have students share patterns. This will lead to uncovering the Euler's Formula.
Lead a closing discussion.

Curriculum Integration

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Math/Real World/Art -- A fun connection with shapes and the real world is to have the students envision and then sketch what certain shapes would look like from a variety of perspectives. For example, ask what a shape might look like from a "bird's-eye" view, from a street level view, and from a "foot print" view. This is very much like envisioning what the shapes look like in 2-D from a variety of perspectives. Another possibility is to have students sketch shapes and relate to shading and casting shadows. Geometric shapes are nicely related to the study of how certain crystals and minerals grow.

Extensions

Students could construct a variety of shapes and decorate them for holiday ornaments. Because shapes can be constructed in a variety of ways, it is valuable to have students use multiple construction techniques. If students use toothpicks for edges and little round balls of clay for vertices, the shapes can then be dipped in a tub of soap bubbles and students can make conjectures about how well the soap bubbles will cling.

Homework & Family Connections:

Begin a rock collection of crystals that reflect a variety of geometric structures. Have students build additional geometric structures at home out of toothpicks and clay and have fun dipping them in dish soap. Have families take a neighborhood walk to look for geometry in architecture and other sights. The student could take a camera and the family could take pictures of sights in the neighborhood, which reflect any of the geometry concepts that have been studied.

Assessment Plan

Observe and listen as students explore and provide reasons to support their conjectures. Assess performance on students' handout. Playing a game of "Win, Lose, or Draw" with these and other geometry terms can be a fun and insightful way to check for understanding. Students can also create a variety of "Geometry Poems" using some of the following poetry types: Cinquain, Diamante, Acrostic, or Haiku.

Authors

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