EISENHOWER PROFESSIONAL DEVELOPMENT PROGRAM

Mathematics Within: Shape, Space & Measurement

Lesson Plan: Part 2 of a 5-part lesson

Part 1, 3, 4, 5 Laurel Kohner Berker, Lori Haaland, Ania Wrase, and Lynn Bartol

Participant Name: Judy Klatt **Broad Topic:** Geometry

Subtopic: Tessellation/Triangulation

Aim: *Extend Part 1 of the lesson by using triangles to predict which polygons will tessellate.*

Specific Objective(s):

- Demonstrate triangulation—combining the angles of a quadrilateral
- Determine degrees of combined angles
- Explore predictions of polygons that tessellate
- Extend your shapes to create tessellations

Materials/Supplies:

- Patterns of triangles
- Large chart or poster board
- Polygon Chart—*Everyday Math* Lesson Plan 5th grade 3.9

Lesson:

- Based on the results of the exploration done prior to break, ask the students, "Why do some polygons tessellate while others do not tessellate?"

  Gather their ideas, but do not discuss in detail. Explain to the students we will be able to answer this question by the end of our session.

- Teacher Demonstration: Triangulation

  "What did we discover about the angles of our quadrilaterals when they were combined?"

  "If we do the same thing with a triangle, what do you predict will happen? How many degrees do you think the combined angles will equal?"

  Teacher proceeds to tear off the angles of the triangle and affix them to a backing. Discuss result. Points may include:

  straight angle
  straight line
  half of a circle
  180°

  In the discussion, combine another pre-assembled, torn-triangle figure with the first assembled figure to show a whole circle, of which one triangle forms half.

  Students must understand the angles of a triangle equal 180°, half of a circle measurement of 360°.

- Exploration: "Polygon Chart" (Reference Everyday Math Master 31, 5th Grade, Lesson 3.9) ***Calculator Use

  Students work individually for this exploration.

  "Triangles playa huge part in helping us to predict which polygons will tessellate. With this chart we will explore how it is that by using what we have learned about triangles, we can predict which polygons will tessellate."

Demonstrate how to draw diagonals on the large quadrilateral and pentagon. "Can you draw a diagonal on the triangle? Why not?"

Review the information on the triangle already on the chart.

Together complete the information for the quadrilateral, demonstrating the use of the calculator.

Students complete the information for the pentagon. As a large group, check to make sure all are doing the calculations accurately.

Students complete the chart.

Discuss the chart, looking for patterns in the data. Patterns to notice:

Polygons of more than 3 sides: If the sum of the angles is a multiple of 360°, the polygon will tessellate. Spend time showing how to use the calculator to determine multiples.

Polygon of 3 sides: The triangle becomes a special case as it is the base on which all else is determined. The sum of its angles is 180°, which is exactly half of 360°, so it also tessellates.

Revisit the question asked at the beginning of the session, "Why do some polygons tessellate while others do not tessellate?" Students should be able to answer in terms of the sum of the angles needing to be a factor/multiple of 360°.

- Extension, if time, or homework:

  - "Do you think it is possible to create a tessellation with either the pentagon or the octagon if you add another polygon? In other words, you use the two polygons together somehow?"

    Introduce the envelope of shapes to the students (see page 3). Explain to them the addition of the rhombus as another polygon may be of use to them in creating their tessellations.

    Challenge: "Can you figure out the degrees in the angle of the rhombus that fits together with the pentagons to create the tessellation?"

    Share tessellations when completed.

    Possible combinations: 3 pentagons (108° x 3) + 1 rhombus (36°) = 360°

    2 octagons (135° x 2) + 1 square (90°) = 360°

  - Students may create other tessellations using an irregular triangle or an irregular hexagon that they design.

    Share tessellations when completed.

Text or Website references:

- Everyday Math—5th grade edition, Lesson 3.9