

EISENHOWER PROFESSIONAL DEVELOPMENT PROGRAM

Mathematics Within: Shape, Space & Measurement

Lesson Plan: Part 1 of a 5-part lesson plan

Part 2, 3, 4, 5 Judy Klatt, Lori Haaland, Ania Wrase, and Lynn Bartol

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Broad Topic: Geometry

Subtopic: Tessellations-Part 1

Aim:

To develop student's understanding of tessellation concepts.

Specific Objective(s):

- o Define tessellation rules
- o Categorize patterns that do and do not tessellate
- o Explore quadrilateral tessellation
- o Apply tessellation angles
- o Explore regular polygons

Materials/Supplies:

- o Large chart paper
- o Patterns of tessellated shapes
- o Patterns of shapes that do not tessellate
- o Regular Polygons handout--*Everyday Math* Master 31, 5th grade lesson 3.8

Lesson:

- o TESSELLATIONS: Part 1
*Students work in pairs for explorations unless otherwise noted. The pairings remain the same for both lessons.

1. "Does anyone know what a tessellation is? Can anyone describe a tessellation? What can you tell me about tessellations?"

Assess prior knowledge of students, recording their responses on chart paper.

Show students a large-size tessellation of a irregular quadrilateral around one point. From this pattern, help students to identify any missing conditions, or "rules," necessary for a tessellation that may be missing from their original list. Add these to the chart.

Tessellation rules: vertices meet in a common point.
no gaps between or overlapping of polygons
sides of equal length meet

2. The large group will categorize different patterns. Place the following labels on the board:

Tessellates Does Not Tessellate (reference pages 4-9)

Displaying the patterns one at a time, place each pattern where the students indicate. Students need to explain their placement. If a pattern has been incorrectly placed, do not correct. Rather, after all patterns have been placed, guide students to carefully examine

the groupings by having them reference the "rules" chart. Misplaced patterns should be corrected by the students during this examination.

The "rules" for tessellation must be clear to students before proceeding.

"We have identified all these descriptors, or "rules" of a tessellation. But, when I look at a tessellation, I also see movement. Animal tracks on the ground show movement and when I look at a tessellation, I see the polygon tracks across the page!"

Demonstrate translations and rotations with a regular quadrilateral - trace on the board/overhead. Use the terms. Reinforce all the tessellation "rules". Return to the patterns hanging on the board and analyze for movement

3. Exploration: Quadrilateral Tessellation

"Will any quadrilateral tessellate? What if the quadrilateral is not a regular quadrilateral?"

Student pairs will select one quadrilateral to tessellate on their paper. Caution students that the only polygon movements allowed are rotations and translations (no reflections/flips). Also encourage them to begin in the middle of their paper and work out toward the edges.

As tessellations are completed, display them where all can see (will be needed for the following discussion).

Discuss with the class the results of the exploration. Guide the class to answering the question of whether or not any quadrilateral, regular or irregular, will tessellate.

4. Exploration: "Why do quadrilaterals tessellate?"

Ask students the above question, not commenting on their responses. Explain that they will now do an exploration that will help them in answering this question.

Using the quadrilateral from the creation of their tessellation, student pairs tear off all four corners.

Students may not tear off a piece large enough to be able to successfully do the exploration, so the teacher should demonstrate. Be sure to use a large figure so students can easily see the piece being removed. Also, if students tear the corner (and not cut the corner) they should not become confused as to which vertex in the torn shape was the vertex in the original polygon.

Before going on, ask students to predict what it will look like when all the torn corners are arranged with the vertices together.

Student pairs assemble the torn corners on a backing (post-it works well) so that the vertices of the quadrilateral come together in a common point.

As the student pairs are working, the teacher should also assemble the pieces torn from the demonstration quadrilateral in a common point - will use next as a model.

Using the teacher's model, demonstrate to the students that a circle can be drawn around the assembled vertices. Direct them to do the same to their assembled vertices (make it of a size that can be seen!) Discuss what is seen inside the circle. Attach the assembled vertices to their tessellation.

It is important students understand the vertices completely fill the area (no gaps or overlaps). Guide the discussion so students understand the vertices fill the space of the circle, 360° . Emphasize that all 4 angles are needed to fill the space equaling 360° . Discuss the vertices form angles and will now be referred to as "angles".

As a large group, ask students again, "Why do quadrilaterals tessellate?"

The fact that all 4 angles (vertices) of a quadrilateral combine to equal 360° should be reflected in their response.

5. Exploration: Apply the discovery that all 4 angles combine to equal 360° to their tessellation. *Student pairs need a second copy of their original quadrilateral.

Before student pairs claim their tessellations from being displayed, explain/discuss (see below) they are to choose three places where the angles (vertices) meet on their tessellation. The challenge is to find out if all 4 angles (vertices) of the polygon they used are in each of these places.

"How can you keep track of the different angles?" Guide students to numbering the different angles that can then be compared to their tessellation.

When completed, within the large group ask, "Do you have 360° in each circle? Can you explain to me, once again, why any quadrilateral (regular or irregular) will tessellate?"

6. Exploration: "Regular Polygons": Students work individually for this exploration.

Tessellates	Does Not Tessellate
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 ("Regular Polygons" is from Everyday Math Master 31, 5th Grade, Lesson 3.8)

Challenge the students to discover what other shapes tessellate.

Fold the ditto into four sections. Cut out each polygon (you will get four per cut). Combine like polygons in the center of the table from all the people at the table.

Each student chooses one type of polygon and takes all those pieces from the center of the table. On a small sheet of paper, student tapes/glues chosen polygons in attempt to create a tessellation. Given the size of the paper, students may not use all their pieces.

Students cooperate to assemble any remaining polygon shapes in the same manner as above.

When groups are completed, the teacher directs each table to bring one polygon to the board, placing it under the proper category. "Does everyone agree with the placements?" The discussion of this will take place after break.

Text or Website references:

- o *Everyday Math* Text --,5th grade lesson 3.8, Master 31











