Blue Ribbon Applied Geometry Workshop Lesson Plan
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Lesson Objectives – Students will:

- Identify which common shapes will tessellate the plane and explain why they do so.
- Recognize the constancy or variance of area and perimeter under transformations.
- Create a tessellation using translations by hands-on manipulation of a base shape.
- Use Geometer's Sketchpad to create a tessellating figure and use it to tile the plane.

WV Content Standards - Students will:

- analyze characteristics and properties of two- and three-dimensional geometric shapes
- apply transformations and use symmetry to analyze mathematical situations

WV Content Objectives – Students will:

G.3.13 given a polygon, find angle measures of interior and exterior angles

G.3.14 develop properties of tessellating figures and use those properties to tessellate the plane.

G.3.15 develop and apply formulas for area, perimeter, surface area, and volume and apply them in the modeling of practical problems.

G.3.18 using transformational geometry, create a reflection, translation, rotation, glide reflection and dilation of a figure; and apply transformations and use symmetry to analyze mathematical situations.

Materials: Index cards, scissors, tape, patty paper (or burger wrappers), Geometer's Sketchpad

Procedures:

- Introduce students to tessellations by showing examples. Include common objects such as a chess board, honeycomb or floor tilings, as well as Escher drawings, and previous student works.
- Use templates of regular polygons placed on an overhead projector to help students identify which shapes will tessellate the plane and which will not. Discuss the interior and exterior angles in these figures as they relate to tessellating the plane.
- Lead students in creating a tessellating figure by cutting simple regions from one side of an index card and translating them to the opposite side (attaching them with tape). Make sure that students understand why the regions must be attached in the same orientation and position on the opposite sides.
- Discuss the area and perimeter of the new figure in comparison to the old. Help students to recognize why the area will remain constant while the perimeter increases.
- Allow students to demonstrate that their tessellating figure will indeed tile the plane by tracing their figure multiple times - interlocking on every side.
- Have students create a tessellating figure by drawing an alteration to one side of a parallelogram or hexagon, tracing it using patty paper, and translating it to the opposite side. This process must be done in pencil to allow the alterations of the original shape.

- Demonstrate to students (preferably using an LCD projector) how to create a tessellating figure using Geometer's Sketchpad to create the base shape, alter the sides of the figure, and translate the alterations. Then show how to use copy and paste to tile the plane with this figure.
- Have students create a tessellating figure and tile the plane with it using Geometer's Sketchpad and detailed written instructions.
- Encourage students to create "artistic tessellations" by manipulating their tessellating figure into recognizable form.

Assessment

- Students will be observed as they work on their tessellations to assess level of understanding.
- Student's final work will be evaluated on accuracy, creativity, and whether design is readily recognizable to others.
- Students will be quizzed on the geometry content relating to tessellations.
- Students will demonstrate their ability to form a simple tessellation using patty paper transformations.

Performance Descriptors

Novice - The student is unable to create a tessellating figure without continual guidance. Persistent errors are present in student's attempts to perform translations. Little or no creativity is evidenced in the student's final work.

Partial Mastery - The student creates a tessellating figure using the written directions and frequent input from the teacher. Several errors are present. Minimal creativity is evidenced in the student's final work.

Mastery - The student creates a tessellating figure using the written directions and moderate input from the teacher. Only occasional errors are present. The student's final work demonstrates some thoughtfulness and creativity.

Above Mastery - The student creates a tessellating figure using the written directions with only minor errors requiring guidance from the teacher. The student is then able to assist other students who are having difficulty. The student's final work demonstrates above average thoughtfulness and creativity.

Distinguished – The student creates a tessellating figure using the written directions with minimal guidance from the teacher. The student is readily able to assist other students who are having difficulty. The student's final work demonstrates significant thoughtfulness and creativity.

Accommodations:

- Students will learn the rules and steps of creating a tessellation using hands-on manipulation.
- Students will have a step-by-step guide for building a tessellation using the Geometer'sSketchpad.
- Assistance is made available from a student who has demonstrated proficiency in the formation of tessellations.

Web Links:

http://library.thinkquest.org/16661/index2.html

http://www.tessellations.org/

http://forum.swarthmore.edu/sum95/suzanne/tess.intro.html