Pennsylvania Governor's Institute for Mathematics Educators 2004

Names of Group Members: Anne Fields, Vange Ronstadt, Tom Sperow

Topic/Theme: Tessellation/Geometry

Level: Grade 5

Time Element: 3 – 5 days

NCTM Standards Addressed:

Understand patterns, relations, and functions.

Analyze characteristics and properties of two-and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Apply transformations and use symmetry to analyze mathematical situations.

PA Math Standards Addressed:

2.5.5 A – Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense and explain how the problem was solved.

2.5.5 B – Use appropriate mathematical terms, vocabulary, language symbols and graphs to explain clearly and logically solutions to problems.

2.8.5 A - Recognize, reproduce, extend, create and describe patterns, sequences and relationships verbally, numerically, symbolically and graphically, using a variety of materials.

2.9.5 A - Give formal definitions of geometric figures.

2.9.5 B – Classify and compare triangles and quadrilaterals according to sides or angles.

2.9.5 D – Describe in words how geometric shapes are constructed.

2.9.5 E – Construct two-and three-dimensional shapes and figures using manipulatives, geoboards and computer software.

2.9.5 F – Find familiar solids in the environment and describe them.

2.9.5 G – Create an original tessellation.

2.9.5 K – Analyze simple transformations of geometric figures and rotations of line segments.

2.9.5.L – Identify properties of geometric figures (e.g., parallel, perpendicular, similar, congruent, symmetrical).

2.10.5. A – Identify and compare parts of right triangles, including right angles, acute angles, hypotenuses and legs.

Math Assessment Anchors Addressed:

M5. C.1.1 - Define and/or use basic properties of quadrilaterals (parallelograms, squares, rectangles, trapezoids, rhombi), triangles, circles, pyramids, cubes, and/or prisms.

M5. D.1.1 - Create or extend patterns.

M5.2.1 Analyze transformations and/or use symmetry to analyze mathematical situations.

Reading Assessment Anchors Addressed:

R5.A.2.1 – Identify the meaning of vocabulary from various subject areas.

R5.A.2.3 – Make inferences and draw conclusions based on text.

R5.A.2.4 – Identify the main idea, relevant details and generalizations.

R5.A.2.5 – Retell or summarize the major ideas or procedures of the text.

Objectives: The students will demonstrate their knowledge of pattern and attributes of geometric shape by creating an original tessellation project.

Instructional Strategies and Plan (include strategies used to help different types of learners, i.e. auditory, visual, etc.):

1) Introduce M.C. Escher and the art of tessellation by reading aloud from Creating Escher-type Drawings p. 191 – 194.
    a. Show pictures from pages 142, 129 and 113.
2) After reading aloud, the following questions will be part of a discussion
    a. Who was M.C. Escher?
    b. Why are we learning about M.C. Escher today?
    c. What intrigues you about what you've just learned?
    d. What do you know about shapes that might be important? (Create a list as the children discuss this)
    e. The definition of a tessellation – to completely fill a plane without any gaps or overlaps
3) Hand out worksheet #1 and have kids find out which shapes tessellate.
    a. The children will work cooperatively with a partner but will each create their own project.
4) After completing worksheet #1 – have children choose one shape that tessellates and using an 8" x 11" piece of unlined paper, create an original tessellation including a color pattern.

5) Using worksheet #2 (directions) and worksheet #3 (rubric) create a project on 12" x 18" piece of paper that includes information which shows what the students know.

Materials/Resources:

The students will need: pencil, paper, markers, colored pencils, crayons, erasers, rulers and worksheets.

The World of M.C. Escher. Henry N. Abrams, Inc. Publishers, New York. Distributed by New American Library, 1971.

Bezuszka, Stanley, Kenney, Margaret and Silvey, Linda. Tessellations: The Geometry of Patterns. Creative Publications, 1977

Britton, Jill, Britton, Walter. Teaching Tessellating Art. Dale Seymour, 1992.

Ranucci, E.R., Teeters, J.L. Creating Escher-Type Drawings. Creative Publications, 1977.

Seymour, Dale, Britton, Jill. Introductions to Tessellations. Dale Seymour Publications, 1989.

Fifth Grade Addenda Book. Curriculum and Evaluation Standards, NCTM, 1993.

Interdisciplinary Connections:

- **Reading/Writing**
  - Reading aloud to children about M.C. Escher
  - Brainstorming ideas
  - Writing to Learn

- **Technology (these are websites for extended learning opportunities)**
  - **http://www.boxermath.com/plp/modules/online/workshop/toolbox/mosaictool.html?offer_id=PMTHF**
  - **http://www.matti.usu.edu/nlvm/nav/frames_asid_163_g_2_t_3.html?open=activities**

- **Art**
  - The patterns that children create should be regular and beautiful.

Assessment Strategies:

- **Formative Evaluation (checking student understanding during the lesson):** class discussion and teacher observation

- **Summative Evaluation (how will it be determined that the objectives were achieved**?): The finished project and a teacher graded rubric (See worksheet #3).

Correctives/Remediation:

- Students will use the letter "L" if having limited success.
- Students will use pattern blocks as tracers if having more difficulty.
- Students with significant difficulty will be given a template and asked to color that in.

Extensions/Enrichment:

- See Interdisciplinary Connections – Technology
- Classroom library – students will read about Escher's life, look at his art work, will report about what he/she has read to class.
- Student will create from a hexagon an original tessellation.
- Student will create his/her own two shaped tessellation.

Special Accommodations (special needs students)

- **Description of the Special Needs Student Selected:** The child receives Emotional Support (ES) Services in a part time Learning and Emotional Support classroom. His IEP includes annual goals to develop reading skills to build reading fluency and comprehension, to develop math skills in the four basic processes (he is two grade levels behind in the district math curriculum), and to improve social skills by acquiring conversational skills, recognizing and expressing feelings, and solving problems in conflict situation. Through an informal Functional Behavior Assessment (FBA) the Team has ascertained that Thomas engages in noncompliant behaviors such as arguing, talking out, and destruction of learning materials as a means to escape completing his assigned school work, especially in his regular (inclusion) classes. Incidence of these challenging behaviors occur at least three times a week in his regular math class, although his teacher reports that it appears he is motivated to be in the class.

- **Accommodations to Use with this Student:**
  - The child will use pattern blocks to create and trace his shape.
  - The child will use crayons to create his pattern.
  - If necessary, the child will work independently.
  - The requirements of the assignment will be modified and the child will be required to use three vocabulary words.