SYMMETRY SIMPLIFIED

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Islamic, Isfahan, Persia. Friday Mosque, c 1500, Detail: Ornamental Ceramic Wall Tile.
Below: *Detail: Ceramic Tile Wall.*

Art teachers are often looking for opportunities to integrate the curriculum and I have found some "kid pleasing" ideas for teaching math and art. Students always look forward to working with clay, so I developed several different ways to teach the math concept of translation, rotation, and reflection through the study of Iznik ceramics. Iznik, Turkey, an important artistic and cultural center during the Roman, Byzantine, Seljuk, and Ottoman periods, was known all over the world for its quartz tiles. The different techniques presented in these lessons allow the teacher to adapt the lesson for different ages and student abilities.

I begin by using a questioning strategy to get the students to tell me how people a long time ago learned how to create different types of art. The students discuss how learning concepts are passed from person to person and from one generation to another. Students are shown examples of early Chinese and Iznik ceramics, and while looking at a world map, speculate on how the artistic techniques made their way to the Middle East.

Examination of the types of decorative designs used in the Iznik ceramics leads into a discussion of different kinds of symmetry: translation, rotation, and reflection. Ceramic tile designs from the Middle East are good examples for this lesson, since the tilings are found as a decorative feature in mosques and other public buildings. Students should be aware that human and animal images are not used in Middle Eastern designs and all designs are calligraphic, floral, or geometric.

Objectives
Students will:

1. identify in artwork that color, texture, form, line, space, and value are basic elements and that principles such as emphasis, pattern, rhythm, balance, proportion, and unity serve as organizers.
2. compare relationships between design and everyday life.
3. create original artwork using a variety of art materials appropriately.
4. compare and contrast the artwork of several cultural settings.

Radial Tile Design Materials

- clay slabs rolled with slab roller or rolling pins
- 6–8" (15–20 cm) cardboard tile templates (or a ceramic tile cutter)
- rulers
- plastic cups, lids, condiment cups (anything circular)
- clay tools: paper clips, clothespins, marker tops, and other found objects to imprint into the moist clay tiles

Radial Design Process

Clay slabs can be pre-rolled to expedite the construction process. I use a table-top slab roller and layer the clay slabs between sheets of plastic inside a garbage bag to keep the slabs moist until needed. Students lay the cardboard template on top of the clay slab and cut around the cardboard and then use a ruler to measure and mark the clay tile into fourths. (Warn the students not to press too hard because the tile may crack and separate during the drying process.)

The intersecting line impression in the surface of the clay serves as a guideline for the radial designs. Students next press jar lids or small plastic condiment cups into the clay. The same circular impressions must be imprinted in all four segments of the tile to achieve symmetry.

There are numerous creative directions from which this activity can progress. One technique is to continue to have the student imprint other objects into the clay to embellish the radial design in a symmetrical fashion. When the clay is leather-hard, underglazes can be applied to the design, or the tiles can be bisque fired, decorated with Majolica glazes and fired again.

Creating a More Complex Design

Another variation of this activity requires the student to have an understanding of the math concept of tilings, using translation, rotation, and reflection. After discussing the visual and historical background of tessellations and the different types of symmetry, students draw designs on at least two 3" (8 cm) squares of paper and choose their favorite design.

Examination of the decorative designs used in Iznik ceramics leads into a discussion of different kinds of symmetry.

Students place a piece of graphite paper under the 3" square with their favorite design on it, then trace over the design so the design is on the back and front of the 3" square. They next fold the three 6" (15 cm) squares into fourths, and place the graphite paper on one fourth of the 6" square, and trace the design onto the top left fourth of the 6" paper tile.

Students decide on whether the design will be translated, rotated, or reflected. The graphite paper can be slid into each of the remaining fourths of the 6" white sulphite paper tile. The 3" paper tile design can then be slid and traced for translation, flipped and traced for reflection, or turned ninety degrees and traced for rotation. Having the design on the back and front of the 3" square enables the original design to be slid, flipped, or turned. The 6") paper designs will serve as a reference guide for completing the tile. Students may use markers to color their paper tiles.

Transferring Designs to Tile

Students transfer the design by placing the 6" paper tile design onto the damp clay tile and piercing the lines of the design with a pushpin. They remove the paper and imprint designs into the areas marked with the pushpin outline. Another alternative is to use the additive process of clay construction to embellish the clay design around the pierced design. When the clay is leather-hard, underglazes can be applied to the design, or the tiles can be bisque fired, decorated with Majolica glazes, and fired again.

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NATIONAL STANDARD

Students make connections between visual arts and other disciplines.

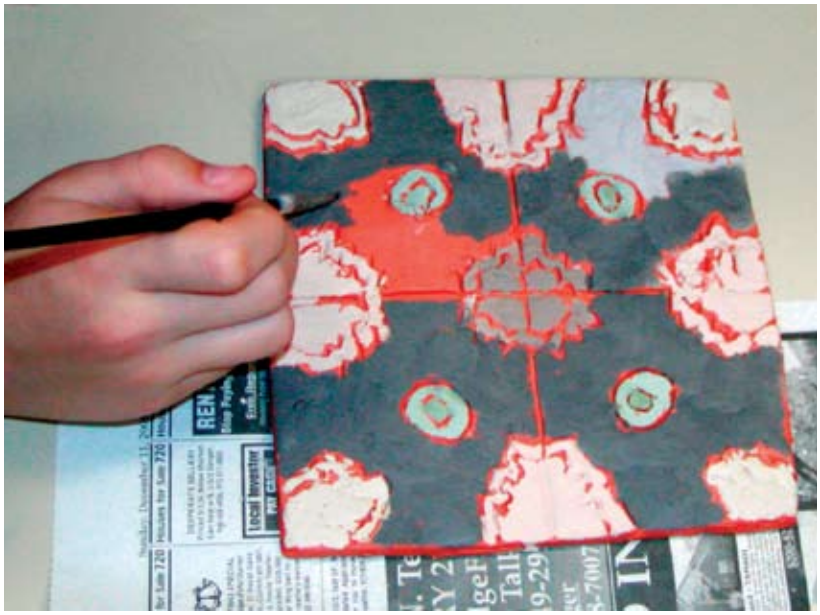
WEB LINKS

www.iznik.com

mathforum.org/sum95/suzanne/tess.intro.html

Rotation Tile Design Materials

- clay slabs rolled with slab roller or rolling pins
- 6" (15 cm) cardboard tile templates (or use a ceramic tile cutter)
- three 6" (15 cm) squares of white sulphite paper per student
- several 3" (8 cm) squares of white sulphite paper per student
- one 3" (8 cm) square of graphite paper



When the clay is leather-hard, underglazes can be applied to the design, or the tiles can be bisque fired, decorated with Majolica glazes, and fired again. Each tile is glazed so that each quadrant is consistent in appearance.