

SMART Program 2010
Lesson: Transformations and Sculpture
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Summary:

Demos and activities in this lesson are intended to illustrate the basic concepts of transformation geometry - translations, dilations, rotations, reflections and tessellations. The "lecture" portion of the lesson includes many demonstrations to keep students engaged, yet has high expectations for the students to perform transformations independently as required. The completion of the sculpture and quiz are used to reinforce and assess these basic mathematical concepts.

Engineering Connection

Engineers want to know the properties of materials in advance of using them in a project so they can design the structure to be strong enough to stay safe (not fail) under its anticipated forces and stresses. Thus, strength of materials is a significant area in engineering design because engineers want to be able to make informed decisions about construction materials. Many engineering companies have a team dedicated to researching and selecting the optimal materials for their products and projects to make sure their designs work dependably and last a long time. The basic concepts of materials research and material processing are fundamental engineering concepts utilized in materials science and design are also utilized in this lesson.

Grade Level: 6-8
Time Required: 120 minutes (3 periods)

Related Curriculum

subject areas

Materials Science

Sculpture

Geometry

Art Design

Educational Standards:

- National Council of Teachers of Mathematics Math
- National Science Education Standards Science
- National Standards of Art

Prerequisite Knowledge

- Arithmetic : Students must be able to identify basic 2D shapes
Students must have knowledge about the Cartesian coordinate system
- Science: Students should have basic knowledge of the properties of several materials.
- Art: Students should have a basic knowledge of design elements.
Students should have been to multiple art museums

Learning Objectives

- Students will perform transformations of 2D objects on the coordinate plane
- Students will create several unique art pieces: painting and sculpture
- Solve related math problems and science problems upon completion of the sculpture

Introduction/Motivation

The students will have been introduced to transformational geometry and how to perform them on the coordinate plane. The purpose of this lesson is to practice performing the transformations and introduce the students to the basic concepts of materials science and to use that knowledge to create an original sculpture. To begin thoughts on materials science, consider the following questions:

- What do you think about when you hear the term "material?"
- What do students think about when they hear the term "Artwork?"
- Where/how do you use materials in your lives? Name a few things that we do that use materials. Can use examples from game.
- What happens when we don't have access to materials?
- Is it possible to run out of materials?

Engineers and scientists have worked hard to learn how to "manipulate" materials to make machines that provide the community with numerous needs. Artists use materials as well to create their masterpieces. There are similarities between the two methods that will give us a greater understanding of both.

Lesson Background & Concepts for Teachers

Students should have been given a lesson on transformational geometry. They should know how to define and perform translations, dilations, reflections, and rotations. There are many resources online that will provide help with that portion of the lesson. It would be helpful if you first demonstrate the techniques using Geometer Sketch pad on the Smart board. Several sites such as,

1. www.mathwarehouse.com
2. www.teachers.net
3. www.emint.org
4. www.mathisfun.com

After the students understand the basic concepts of transformational geometry, it is time for the creativity to begin. Students will begin this part of the lesson by making a template. That template can be of any thing that they want. Make sure the students are aware of the end project. You don't want them to create a template that will complicate their process. Using their template, they will do several things.

- They will first perform all four transformations on it
- Next, they will create a sketch for either a mosaic or a tessellation using two of the transformations
- Finally, they will create a sculpture using their template as inspiration

For the sculpture creation, the students will need support and guidance. It is important for each student to write a detailed plan to hopefully avoid many mishaps. There are multiple online sites that will help the teacher and student get through this project:

- www.nashersculpturecenter.org
- www.dickblick.com/lesson-plans/ez-grout-mosaics
- www.princetonol.com/.../lessons/high/kevan-wiresculpture.htm

Vocabulary/Definitions

- Translation:* the composite of two reflections over parallel lines; aka **slide**
- Rotation:* the composite of two reflections over intersecting lines
- Reflection:* the set of all of the reflection images of points in the figure
- Dilation:* Let A be a point and k be a positive real number. For any point B, let T(B) = B' be the point on \overrightarrow{AB} with $OP' = K*OP$. Then S is the size change with **center** A and **magnitude** k.
- Assembling:* Creating a composition made of various materials
- Carving:* Material is removed from an original piece to reveal the final form
- Modeling:* Material is being built up to create a final form, material must be pliable
- Casting:* Making art from a hollow mold by pouring molten metal, liquid plaster, or other material into the mold to let it harden
- Materials:* Products used to create art such as objects, paper, wood and/or textiles

Lesson Closure

- Give back their transformation sheets with feedback
- Discuss design for art piece
- Ask about material choice

Assessments

- Translation Worksheet
- Dilation Worksheet
- Reflection Worksheet
- Rotation Worksheet
- Essay
- Sculpture
- Quiz

Assessment

Post introduction assessment: The worksheet of each transformation of their template. The students need to provide a brief explanation attached to each transformation, that describes method and procedure used.

Lesson summary assessment: A quiz will be given on the different methods to manipulate the materials. The essay will explain their inspiration and the reason for their materials choice for the sculpture. The sculpture will assess their understanding of their chosen materials.