

LESSON TITLE: GEOMETRY IN DANCE

Academic subject(s): Math (Geometry)	Art form(s): Dance (Ballet)	Name:		
		City:		
	Grade(s):	Date:	Duration:	

STANDARDS AND OBJECTIVES

Academic Standard(s):

Math Common Core Standards:

(<http://www.corestandards.org/>)

Variations of the lesson plan are provided for differentiation. Additional variations can be created using the same arts integration strategies to address all of the following standards:

Geometry – Identify and Describe Shapes

Kindergarten

- Identify and describe shapes.
- Analyze, compare, create, and compose shapes.

1st-3rd Grade

- Reason with shapes and their attributes.

4th Grade

- Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

5th Grade

- Graph points on the coordinate plane to solve real-world and mathematical problems.
- Classify two-dimensional figures into categories based on their properties.

6th Grade

- Solve real-world and mathematical problems involving area, surface area, and volume.

7th Grade

- Draw, construct and describe geometrical figures and describe the relationships between them.
- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

8th Grade

- Understand congruence and similarity using physical models.

Academic Standard(s):

9th-12th Grade

Congruence

- Experiment with transformations in the plane.
- Make geometric constructions.

Expressing Geometric Properties with Equations

- Use coordinates to prove simple geometric theorems algebraically.

Geometric Measurement and Dimension

- Visualize relationships between two-dimensional and three-dimensional objects.

Modeling with Geometry

- Apply geometric concepts in modeling situations.

Arts Standard(s):

(<http://www.azed.gov/standardspractices/art-standards/>)

Strand 1 (create)

• **Concept 1 – Body**

Identify, demonstrate and analyze the use of the body for dance through an understanding of anatomy, kinesiology and basic movement principles.

• **Concept 2 – Movement Skills**

Identify, demonstrate and analyze basic movement skills in the exploration and performance of dance.

• **Concept 4 – Improvisation/Choreography**

Identify, demonstrate, analyze and apply improvisational structures, choreographic processes, forms and principles.

Performance Objectives:

Upon completion of the lesson, students will be able to:

- Observe and analyze shapes, patterns, and geometry in motion during a dance performance.
- Discuss the relevance of geometry in relation to movement.
- Model the different geometric concepts through their bodies.
- Collaborate to create models that demonstrate their understanding of geometry.
- Explain their process and product demonstrating metacognition and understanding of geometry.

Key Vocabulary:

shape, pattern, lines, angles

*Additional math vocabulary will vary with each grade level to the specific concepts they are working with.

21st Century Skills: Critical thinking, creativity/innovation, problem solving, teamwork/collaboration

ART SUPPORT

Foundational Knowledge Needed for Lesson:

Refer to the dance elements page of the Ballet Arizona Student Matinee Teacher Guide to learn more about the dance elements of space and shape.

ENVIRONMENT / LEARNING ZONE

Materials/Resources:

- CD player and instrumental music
- Loose fitting clothing that accommodates movement

Room Setup:

If there is flexibility in the arrangement of furniture in your classroom, consider how everything can be organized to foster collaboration and movement exploration. Otherwise, every empty nook and cranny can be used, including the aisles between tables or desks.

PROCEDURES

Pre-Performance Inquiry Activity:

1. Facilitate a discussion that asks the students to make general observations about connections they observe between math and dance. Watch the following short video clip:
<http://www.thefutureschannel.com/dockets/realworld/dancing/index.php>
Note: The connection with geometry is fairly intuitive, as dance deals with making shapes visual. However, encourage other connections that are appropriate to their level. For example, primary students might identify shapes while older students might make observations about the golden ratio and/or Pythagorean's theorem.
2. Watch a live dance performance featured by Ballet Arizona. Have students identify at least 5 examples of dance and math as performed on stage.
3. After the live performance, facilitate a discussion about the students' observations regarding the relationship of dance and geometry.

Post-Performance Focused Engagement:

1. Divide the class into small groups of at least 4 students.
2. As a class, identify a minimum of 10 shapes that were observed on stage (shapes the body makes individually, group connected shapes, the shape of the dancers in formations on stage, the shape the arms make in isolation of the body, etc.).
3. Have each group recreate 5 of the shapes (their choice) either as 5 separate stationary visual models or with a structured transition between each shape. Each group will present their “choreography.”
4. A brief discussion follows each performance, allowing observing students to make inferences about the connections to dance and geometry that they saw, as well as for the presenting students to share their creative and decision-making process.

Note: A structured transition could be something as simple as having each student in the group take 8 steps or jumps in one direction to transition from shape 1 to shape 2.

There are many variations to the above process to support a specific geometry standard at grade level.

- A. FOR EXAMPLE:** Identify an “x and y-axis” orientation in the classroom. Have the observing students direct the presenting students on how to move the entire shape in space. Have the directing students use specific terminology (e.g., flip, slide, rotate).
- I. For advanced students with knowledge of stage direction, the directives could involve movement into specific quadrants (e.g., slide this shape into quadrant 3 and then rotate it to quadrant 2, and finally flip it back to quadrant 1).
 - II. This could also be presented as a word problem. If the beginning shape is a line segment in quadrant 4, using all three transformations (flip, slide, rotate) at least once, and moving in all 4 quadrants at least once, transform the shape from quadrant 1 to quadrant 3.
- B. FOR EXAMPLE:** The observation and creative can be further structured to another geometric concept. Perhaps the students observe the angles of the shapes on stage (acute, obtuse, right, 45 degrees). Or students can analyze congruent shapes, asymmetrical shapes, 3-dimensional shapes versus 2-dimensional (sphere versus circle), different types of triangles, and tanagrams.

Skillful Assessment:

The set of shapes each group of students creates is already an artifact of this learning. As an added assessment exercise, have observing students “add-on” to presenting students to either create a new shape or highlight an element of an existing shape. For example, if the presenting group creates a V-shape, how would the observing students make that V into an equilateral triangle. Another possibility would be to have one observing student (using his/her body in space) to identify and highlight the acute angle of the V.

Continuing Inquiry:

Further inquiry could involve asking if the students are able to apply the embodied learning into observations that describe objects in everyday life. For example, desks that are clustered together form what type of shape? Posters that are not hung straight create what kind of line? Or a person sitting at a desk creates what kind of relationship with the desk (parallel, intersecting, and so forth)?

REFLECTIVE PRACTICE

Students:

- How did you model geometry with your bodies?
- How did creating shapes help you understand?
- What is the relationship between geometry and dance?
- What was your group process for creating shapes to model geometry?
- Where in the real world do you see these shapes?
- How many variations of shapes do you think were presented today?
- What were the attributes of the shapes you observed other students perform?

Teachers:

- Are the learners able to apply conceptual understanding of geometry, shapes, and patterns into ways that describe the relationship of real objects with each other?
- In what ways did this lesson help students engage with geometry and understand its relevance?
- In what ways did the students articulate the different concepts present in geometry through their bodies?
- How did creating shapes deepen students’ understanding of geometry?
- How did the students work collaboratively to create the geometric shapes?
- How did students’ discussion after each sharing demonstrate their understanding of geometry?
- Reflecting on their process, to what degree were students expressing metacognition?
- What further inquiry into geometry are the students interested in pursuing?
- How did this lesson work for you? How would you change the lesson to make it more effective?