

## ARTS IMPACT LESSON PLAN

### Dance and Math Infused Lesson

#### Lesson Three: *Similarity Transformation Dance*

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#### Enduring Understanding

Rotations, reflections, and translations are transformations that make congruent figures. Dilations are transformations that make similar figures. Transformations can be expressed through shape and choreography in dance.

#### Lesson Description (Use for family communication and displaying student art)

*In this dance and math lesson, students create similar figures with a stretchy math tool. Given a card with two polygons, they determine the sequence of dilations, rotations, reflections, and/or translations that begins with the first polygon and ends with the second polygon. They create a dance that demonstrates the sequence.*

### Learning Targets and Assessment Criteria

**Target:** Demonstrates two similar two-dimensional figures with a math tool.

**Criteria:** Makes two polygons that are the same shape, but not the same size with a stretchy.

**Target:** Creates a sequence of transformations with a math tool that demonstrates how a second two-dimensional figure can be obtained from a similar two-dimensional figure.

**Criteria:** Dances a series of dilations, rotations, reflections, and/or translations with a stretchy that begins with the first polygon and ends with the second similar polygon.

#### Vocabulary

##### Arts Infused:

Direction  
Rotation  
Sequence  
Shape  
Size  
Space  
Two-dimensional

##### Math:

Congruent  
Dilation  
Figure  
Polygon  
Reflection  
Similar  
Transformation  
Translation

##### Arts:

Choreograph  
Combination

#### Materials

##### Museum Artworks or Performance

##### Seattle, WA

Pacific Northwest Ballet  
UW World Series of Dance

##### Tacoma, WA

Broadway Center for the Performing Arts

##### Materials

*Middle School Math Dances* CD by Debbie Gilbert; *Music for Creative Dance, Volume IV* by Eric Chappelle; Stretchies; White board, document camera, or chart paper & markers; Transformation cards; Class Assessment Worksheet; Music player

##### Music:

"Middle School BrainDance," *Middle School Math Dances* by Debbie Gilbert  
"Up and At 'Em," *Music for Creative Dance, Volume IV* by Eric Chappelle

Eric Chappelle,  
available on iTunes and  
<http://www.aventurinemusic.com/>

#### Learning Standards

##### WA Arts State Grade Level Expectations

For the full description of each WA State Arts Grade Level Expectation, see:

<http://www.k12.wa.us/Arts/Standards>

- 1.1.1 Elements: Space, Direction, Shape
- 1.1.4 Principles of Choreography: Form
- 1.2.1 Skills and Techniques: Moves with Others in Spatial Formations
- 1.4.1 Audience Skills
- 2.1.1 Creative Process
- 2.2.1 Performance Process
- 2.3.1 Responding Process
- 4.2.1 Connection between Dance and Math

##### Common Core State Standards (CCSS) in

**Math** For a full description of CCSS Standards by grade level see:

<http://www.k12.wa.us/CoreStandards/Mathematics/default.aspx>

8.G. Understand congruence and similarity using physical models, transparencies, or geometry software.

*continued*

8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

**CCSS Mathematical Practices**


MP.1. Make sense of problems and persevere in solving them.

MP.3. Construct viable arguments and critique the reasoning of others.

MP.4. Model with mathematics.

MP.5. Use appropriate tools strategically.

### ICON KEY:

 = Indicates note or reminder for teacher

 = Embedded assessment points in the lesson

### Pre-Teach

Explore two-dimensional figures, rotations, reflections, translations, and dilations. Review congruence and similarity. Practice describing a sequence in which a similar two-dimensional figure can be obtained from another two-dimensional figure by a sequence of dilations, rotations, reflections, and/or translations. Do the Middle School Math BrainDance. Introduce the stretchy math tool.

### Lesson Steps Outline

1. Introduce dancing similarity and transformations.
2. Review expectations for movement.
3. Lead students in the *Middle School BrainDance* warm-up.  
Music: "Middle School BrainDance," *Middle School Math Dances* by Debbie Gilbert
4. Introduce the math tool: stretchies. Discuss how to move safely and appropriately with them. Distribute stretchies.  
 Criteria-based process assessment: Moves safely with the math tool.
5. Explore using the stretchies to create two-dimensional figures, rotations, reflections, translations, and dilations.  
 Criteria-based process assessment: Makes polygons with the math tool. Demonstrates rotations, reflections, translations, and dilations.
6. Demonstrate creating a Similarity Transformation Dance.  
Music: "Up and At 'Em," *Music for Creative Dance, Volume IV* by Eric Chappelle
7. Facilitate small groups creating Similarity Transformation Dances. Distribute a transformation card to each group.  
Music: "Up and At 'Em," *Music for Creative Dance, Volume IV* by Eric Chappelle  
 Criteria-based teacher checklist, self-assessment: Makes two polygons that are the same shape, but not the same size with a stretchy. Dances a series of dilations, rotations, reflections, and/or translations with a stretchy that begins with the first polygon and ends with the second similar polygon.

**8.** Guide performance and response.

Criteria-based teacher checklist, peer assessment: Makes two polygons that are the same shape, but not the same size with a stretchy. Dances a series of dilations, rotations, reflections, and/or translations with a stretchy that begins with the first polygon and ends with the second similar polygon.

**9.** Lead reflection.

Criteria-based reflection: Makes a connection between math and dance.

## LESSON STEPS

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### 1. Introduce dancing similarity and transformations.

- *Dancing Mathematicians, today we are going to be creating similar polygons and showing a series of transformations to get from the first figure to the second figure.*
  - *Instead of doing them with paper and a pencil, we'll be creating them on a large scale with movement and stretchy math tools.*
  - *Remind me, what is a transformation?*
  - *What is a rotation? Show me with your hands.*
  - *What is a reflection? Show me with your hands.*
  - *What is a translation? Show me with your hands.*
  - *What is a dilation? Show me with your hands.*
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### 2. Review expectations for movement.

- *Before we move, think about our expectations for dancing.*
  - *I am looking for focus and respect.*
  - *Keep empty space around yourself at all times and keep your eyes open and your body under control.*
  - *Have fun and learn simultaneously.*
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### 3. Lead students in the **Middle School BrainDance warm-up.** (BrainDance originally developed by Anne Green Gilbert, [www.creativedance.org](http://www.creativedance.org), reference: *Brain-Compatible Dance Education*, video: *BrainDance, Variations for Infants through Seniors.*)

Music: "Middle School BrainDance," *Middle School Math Dances* by Debbie Gilbert

☐ In the BrainDance music, you will hear the title of each pattern spoken. The prompts below are suggestions if you would like to give the students more detail. You can also adapt the prompts to meet the needs of your students and the lesson. If you prefer to have the prompts spoken for you, you can use the "Middle School BrainDance with narration."

☐ You could choose to include movements that rotate, reflect, translate, and/or dilate.

- *Before we start moving, we are going to do a BrainDance to warm-up our brains and bodies in preparation for learning the dance.*
- *The BrainDance will take us through a series of patterns that help to wire the central nervous system. The movement will increase oxygen and blood flow to your brain and body, and help with balance, alignment, and coordination.*

### Breath

- *Dancing Mathematicians, breathe quietly.*

## **Tactile**

- *Energize the surface of your body, tapping from your head to your toes.*

## **Core-Distal**

- *Expand from your core into a large shape, reaching to the limits of your distal edges.*
- *Shrink into a small shape pulling everything back towards your core.*

## **Head-Tail**

- *Curl your spine forwards and backwards and forwards and backwards.*
- *Curve from side to side.*

## **Upper Half**

- *Freeze the lower half of your body. Move the upper half.*

## **Lower Half**

- *Freeze the upper half of your body. Move the lower half.*

## **Body-Half Right**

- *Dance with your whole right side while the left side is frozen.*

## **Body-Half Left**

- *Dance with your whole left side while the right side is frozen.*

## **Cross-Lateral**

- *Reach across your body with your arms on different levels.*

## **Vestibular**

- *Turn. Freeze in a shape. Turn. Freeze in a shape. Turn. Freeze in a shape. Turn. Freeze in a shape.*

## **Breath**

- *Breathe quietly, Dancing Mathematicians.*

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## **4. Introduce the math tool: stretchies. Discuss how to move safely and appropriately with them. Distribute stretchies.**

▣ The stretchies are strips of 4-way stretch fabric about 3 inches wide and 4-6 feet long tied tightly together to make a loop.

- *We'll use the stretchies to make transformations of two-dimensional figures. They are math tools and not toys.*
- *How can we dance safely with the stretchies?*
- *When you start moving, remember to keep empty space around you. Put a space bubble around yourself and your stretchy. Do not wrap the stretchy around your neck. What should you do with your math tool when you are listening to directions so it doesn't distract you?*

Criteria-based process assessment: Moves safely with the math tool.

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## 5. Explore using the stretchies to create two-dimensional figures, rotations, reflections, translations, and dilations.

- Explore different ways of using your math tool to make polygons.
- Show me a triangle, a trapezoid, and a rectangle.
- Make a polygon. Rotate the polygon. Rotate again. Rotate again. How do you know you did a rotation? Is your polygon congruent to the first polygon? Why?
- Make a different polygon. Show me a reflection of the polygon. Do another reflection. How do you know you did a reflection? Is your polygon congruent to the polygon before you began reflecting? Why?
- Make a different polygon. Show me a translation of the polygon. Do another translation. How do you know you did a translation? Is your polygon congruent to the polygon before you began doing translations? Why?
- Make a different polygon. Show me a dilation. How did your polygon change? How do you know you did a dilation? Is your polygon similar to the polygon before the dilation? Why?
- How can you change your polygon so it is not a dilation?
- Let's explore a series of changes with your polygons. Make a polygon. Do a dilation. Change without doing a dilation. Do a dilation. Change without doing a dilation.
- What did you discover?

Criteria-based process assessment: Makes polygons with the math tool. Demonstrates rotations, reflections, translations, and dilations.

## 6. Demonstrate creating a Similarity Transformation Dance.

Music: "Up and At 'Em," *Music for Creative Dance, Volume IV* by Eric Chappelle

▮ The prompts use the first card included in this lesson that begins with a triangle and ends with a similar, larger triangle. You can choose to create your own.

▮ You may choose to project the image or draw it on the board.

- I am going to choreograph, or invent, a Similarity Transformation Dance.
- I have a card with two similar, not congruent, two-dimensional figures. I'll demonstrate making those two polygons with my math tool.
- My task is to start with the first polygon and create a series of rotations, reflections, translations, and/or dilations to get to the second polygon.
- Since my figures are similar, but not congruent, which transformation will I need to include in my series?



- *What transformations do I need to do to get from the first two-dimensional figure to the second? (For example, reflection, dilation)*
- *I'll demonstrate beginning the dance combination in a triangle and then reflecting it. Then I'll do a dilation to change the size, ending in the second triangle on the card. I'll use music to make the dance more interesting.*

## **7. Facilitate small groups creating Similarity Transformation Dances. Distribute a transformation card to each group.**

Music: "Up and At 'Em," *Music for Creative Dance, Volume IV* by Eric Chappelle

☐ You can choose the groups in advance to keep the momentum of the class going. You can also list their names in the order of their groups on the assessment checklist to make assessing during the performance easier. Groups of three to five work well.

- *In your group, look at your card with the two figures. What is a sequence of rotations, reflections, translations, and/or dilations that will get you from the first figure to the second?*
- *You may need to do two, three, or four transformations in your sequence.*
- *Practice using the math tool to make the shapes and transformations.*
- *Choreograph, or invent, your dance combination together to demonstrate the shapes and transformations in a sequence with the music.*

☑ Criteria-based teacher checklist, self-assessment: Makes two polygons that are the same shape, but not the same size with a stretchy. Dances a series of dilations, rotations, reflections, and/or translations with a stretchy that begins with the first polygon and ends with the second similar polygon.

## **8. Guide performance and response.**

- *Now is your opportunity to show your Similarity Transformation Dances.*
- *Before we begin, performers, what do you want from your audience?*
- *Audience, what do you want from your performers?*
- *Performers, when you are done, show us your card.*

☐ Or you could project the card if a document camera and projector are available.

- *Audience, what transformations did the dancers do to get from the first polygon to the similar polygon at the end?*

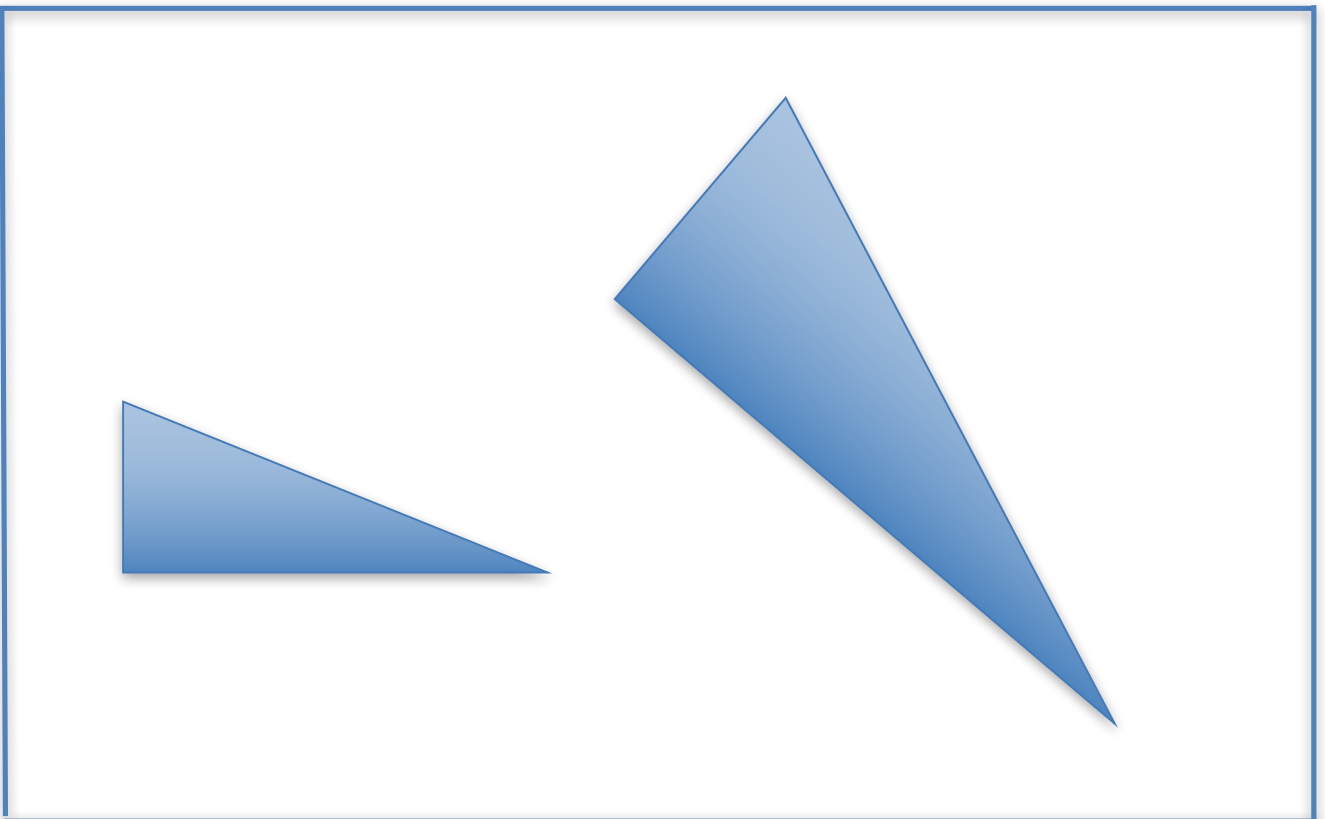
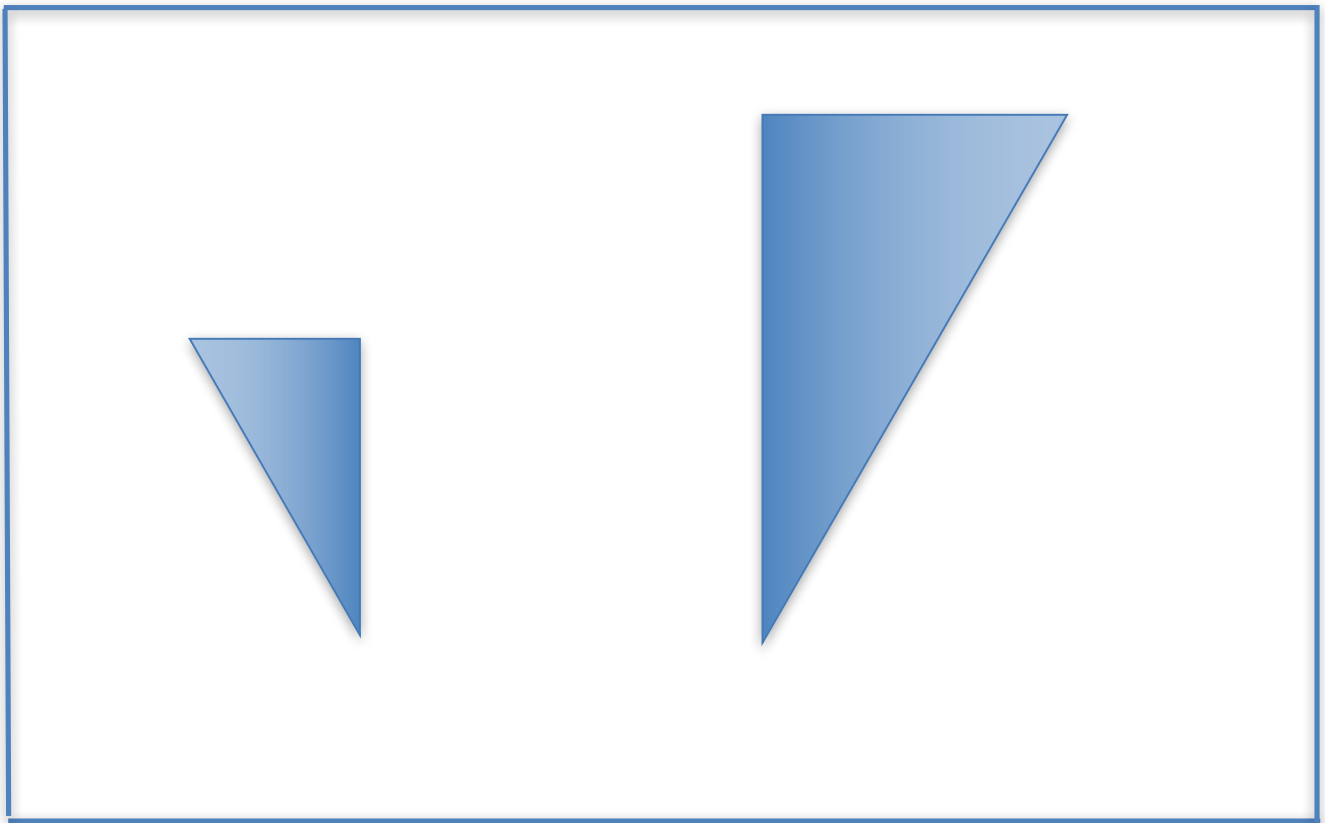
☑ Criteria-based teacher checklist, peer assessment: Makes two polygons that are the same shape, but not the same size with a stretchy. Dances a series of dilations, rotations, reflections, and/or translations that begins with the first polygon and ends with the second similar polygon.

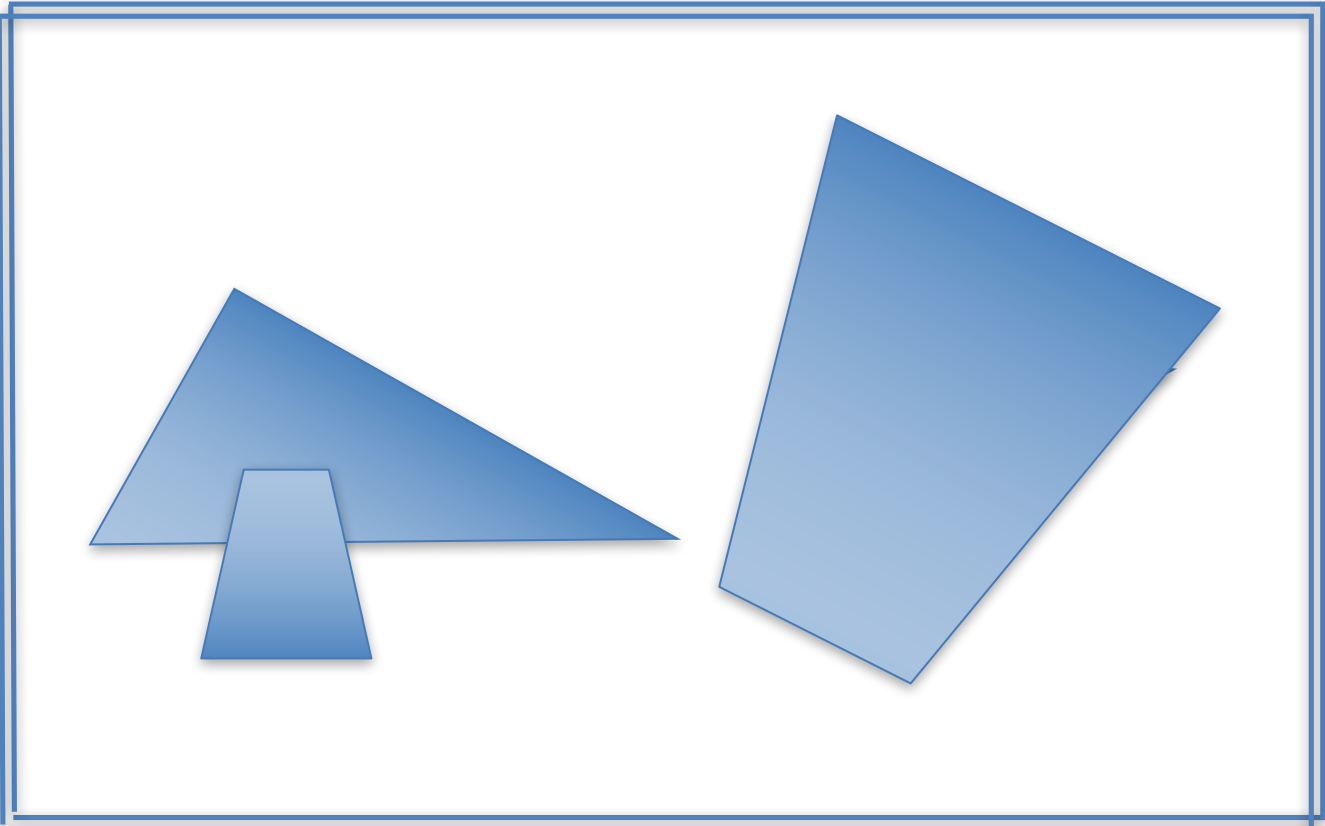
## **9. Lead reflection.**

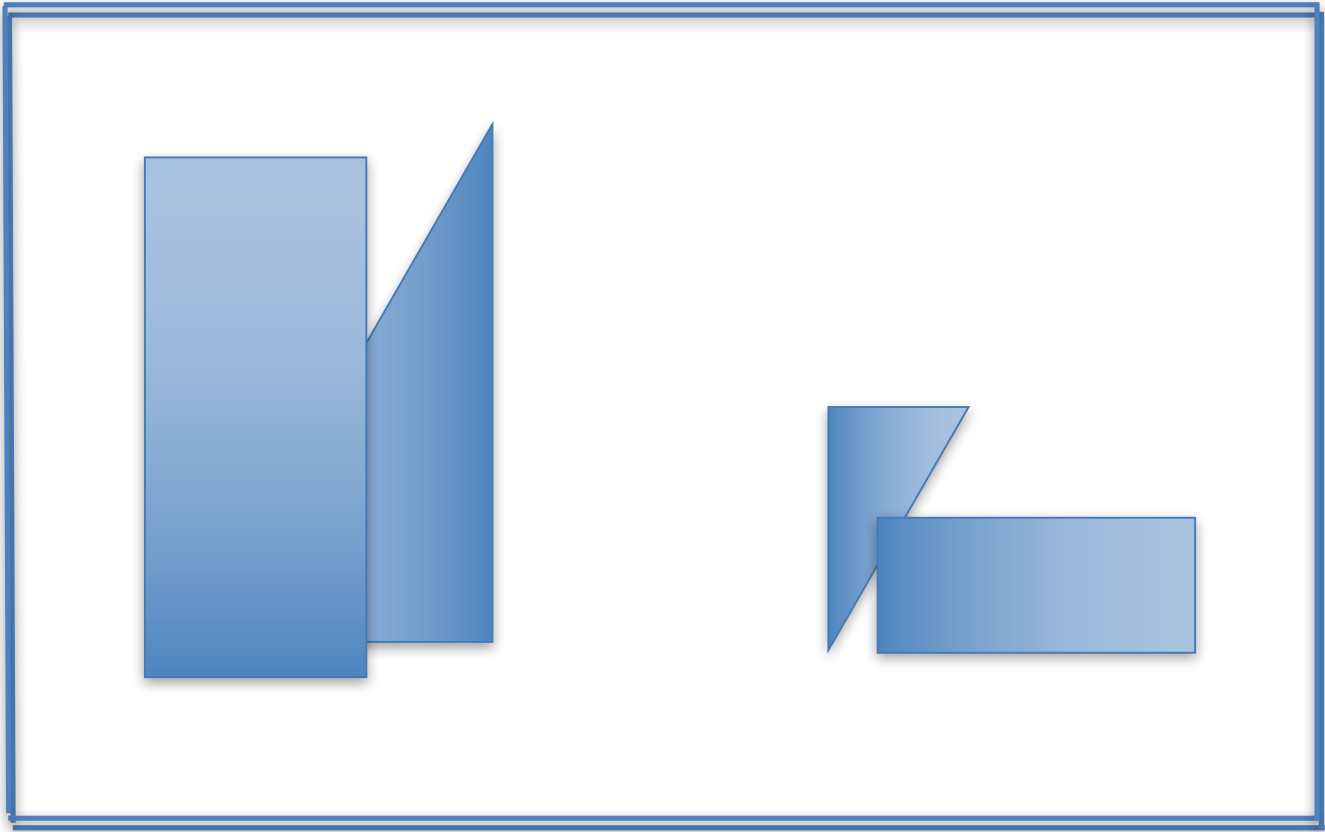
- *Dancing Mathematicians, what did you discover about transformations and similarity by dancing?*
- *The next time you work with transformations and similarity in math, remember how you used them with movement and it will help you go deeper in math.*

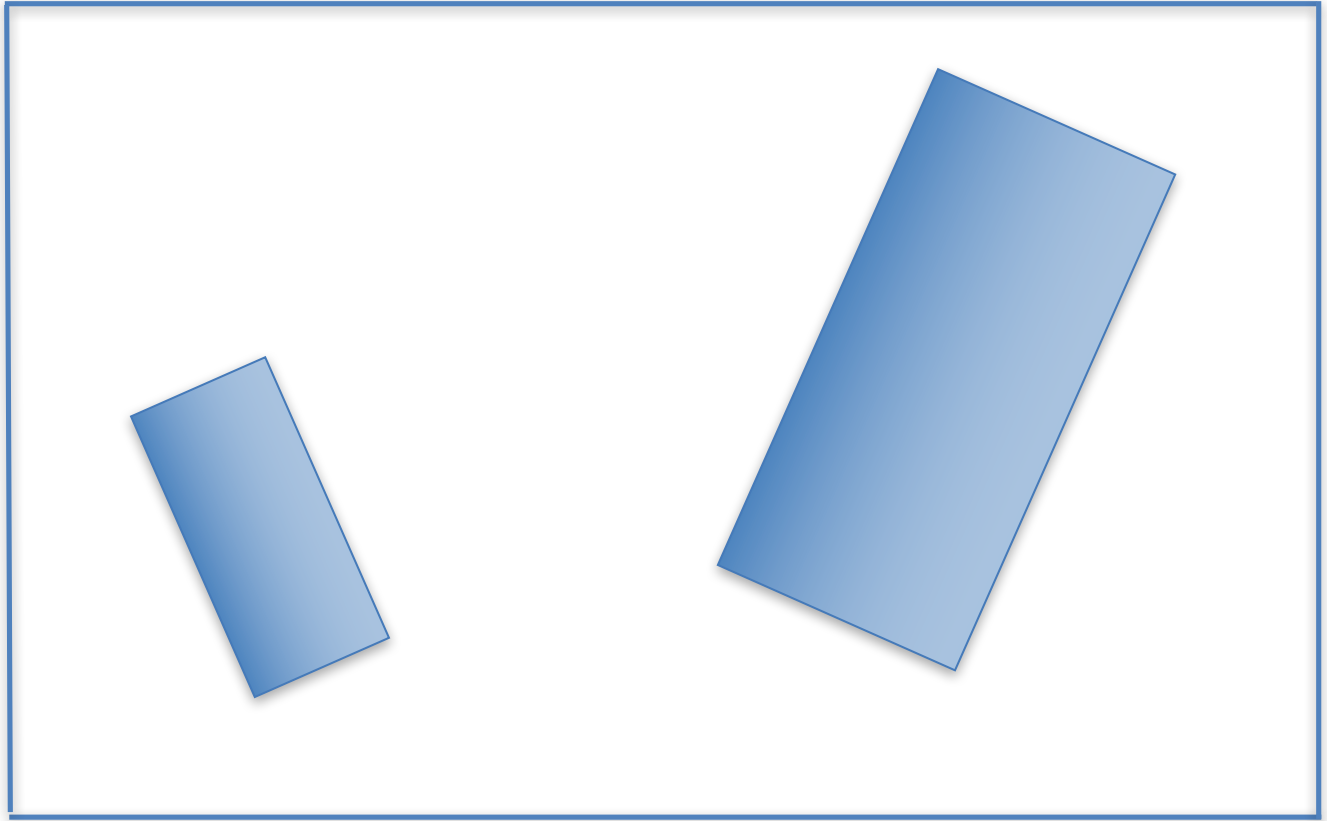
Criteria-based reflection: Makes a connection between math and dance.

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**ARTS IMPACT LESSON PLAN Dance and Math Infusion**

*Eighth Grade Lesson Three: Similarity Transformation Dance*

Teachers may choose to use or adapt the following self-assessment tool.

**STUDENT SELF-ASSESSMENT WORKSHEET**

Disciplines	<b>DANCE/MATH</b>	<b>DANCE/MATH</b>	Total
Concept	<b>Similarity</b>	<b>Similarity, Transformations</b>	2
Criteria	Makes two polygons that are the same shape, but not the same size with a stretchy.	Dances a series of dilations, rotations, reflections, and/or translations with a stretchy that begins with the first polygon and ends with the second similar polygon.	
Student Name			

**ARTS IMPACT LESSON PLAN Dance and Math Infusion**

Eighth Grade Lesson Three: *Similarity Transformation Dance*

**CLASS ASSESSMENT WORKSHEET**

Disciplines	DANCE/MATH		Total 2
Concept	Similarity	Similarity, Transformations	
Criteria	Makes two polygons that are the same shape, but not the same size with a stretchy.	Dances a series of dilations, rotations, reflections, and/or translations with a stretchy that begins with the first polygon and ends with the second similar polygon.	
Student Name			
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29.			
30.			
Total			
Percentage			

*What was effective in the lesson? Why?*

*What do I want to consider for the next time I teach this lesson?*

*What were the strongest connections between dance and math?*

Teacher: \_\_\_\_\_ Date: \_\_\_\_\_

DANCE AND MATH LESSON – *Similarity Transformation Dance*

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Dear Family:

Today your child participated in an **Arts and Math** lesson. We talked about similarity and transformations.

- We discovered that similar figures are the same shape, but not the same size.
- We used a stretchy math tool to create two similar shapes from a card we were given.
- We danced a sequence of transformations (dilations, rotations, reflections, and/or translations) that showed how you could get from the first polygon to the second polygon.

At home, you could look for objects that are the same shape, but different sizes. Ask your child to tell you what dilations, rotations, reflections, and translations are in math. Then ask him or her to demonstrate a transformation in movement. Look at your doors, are they rectangles that rotate, reflect, or translate?

**Enduring Understanding**

Rotations, reflections, and translations are transformations that make congruent figures.  
Dilations are transformations that make similar figures.  
Transformations can be expressed through shape and choreography in dance.