

Dance and Math Infused Lesson

Lesson One: *Variables in Motion*

Author: Debbie Gilbert Grade Level: Fifth



Enduring Understanding

A variety of numbers or movements can be substituted for a variable in an expression.

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

In this math and dance lesson, students consider how choreographers use variables to create dances. They explore non-locomotor and locomotor movements. Students explore possible values for the variables "a" and "b" in the following equation: $4(a + b) = 32$. They choose values for the variables and dance locomotor movements for their value of "a" and non-locomotor movements for their value of "b." By performing their dances simultaneously, students observe how all the dancers start and end at the same time, but use different movement choices to represent the different values of the variables that solve the equations.

Learning Targets and Assessment Criteria

Target: Determines a solution for an equation with two variables.

Criteria: Chooses a value of "a" and of "b" that solves the following equation: $4(a + b) = 32$.

Target: Performs movements that correspond to two variables in an equation.

Criteria: Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a + b) = 32$.

| Vocabulary | Materials | Learning Standards |
|---|---|---|
| <p><u>Arts Infused:</u> Counts Value</p> <p><u>Math:</u> Equation Variable</p> <p><u>Arts:</u> Choreographer <u>Locomotor</u> <u>Non-locomotor</u> <u>Shape</u></p> | <p>Museum Artworks or Performance</p> <p>Seattle, WA Pacific Northwest Ballet UW World Series of Dance</p> <p>Tacoma, WA Broadway Center for the Performing Arts</p> <p>Materials <i>Math Dances</i> CD by Debbie Gilbert; CD player; Computer with internet connection and projector; White board, document camera, or chart paper & markers; Drum/percussion instrument; Class Assessment Worksheet</p> | <p>WA Arts State Grade Level Expectations <i>For the full description of each WA State Arts Grade Level Expectation, see: http://www.k12.wa.us/Arts/Standards</i></p> <p>1.1.1 Elements: Space, Place, Shape 1.2.1 Skills and Techniques: Focus and Concentration 1.4.1 Audience Skills <u>2.1.1 Creative Process</u> 2.2.1 Performance Process 2.3.1 Responding Process 4.2.1 Connection between Dance and Math</p> <p>Common Core State Standards (CCSS) in Math <i>For a full description of CCSS Standards by grade level see: http://www.k12.wa.us/CoreStandards/Mathematics/default.aspx</i></p> <p>5.OA. Write and interpret numerical expressions. 5.OA.1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.</p> <p>CCSS Mathematical Practices MP.2. Reason abstractly and quantitatively. MP.3. Construct viable arguments & critique reasoning of others. MP.4. Model with mathematics.</p> |
| | <p align="center"><i>continued</i></p> | |

Pacific Northwest Ballet images:
Eric Hipolito, Jr. in Jerome Robbins'
Glass Pieces



Maria Chapman in Twyla Tharp's *In the Upper Room*



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Video

Opening Ceremony Blog Exclusive - Spike Jonze Presents: Lil Buck and Yo-Yo Ma
<http://www.youtube.com/watch?v=C9jghLeYufQ>

Cylindrical Shadows excerpt
(Video link provided to Arts Impact,
courtesy Pacific Northwest Ballet)
<http://www.youtube.com/watch?v=vkngXCnk0Og>

ICON KEY:

 = Indicates note or reminder for teacher

 = Embedded assessment points in the lesson

Pre-Teach

Practice the Math BrainDance, see lesson step 3. Unpack the math concepts in the BrainDance. Explore using expressions and solving equations with variables.

Lesson Steps Outline

1. Introduce using variables to create choreography. Analyze photographs or video of dancers using locomotor and non-locomotor movements.

2. Prepare students for dancing by creating agreements for appropriate dance behavior. Chart student responses.

3. Lead students in *Math BrainDance* warm-up.

Music: "Math BrainDance (Fifth Grade)" #6, *Math Dances* by Debbie Gilbert

4. Introduce the dance concepts of shape, non-locomotor movement, and locomotor movement. Play percussion instrument(s) for accompaniment.

 Criteria-based process assessment: Freezes in a shape. Moves the body while staying in one spot and traveling.

5. Explore possible values for the variables "a" and "b" in the following equation:
 $4(a + b) = 32$.

 Criteria-based teacher checklist: Chooses a value of "a" and of "b" that solves the following equation: $4(a + b) = 32$.

6. Guide students as they dance the equation using different values for the variables.

Music: "Variables in Motion" #13, *Math Dances* by Debbie Gilbert

 Criteria-based teacher checklist, self-assessment: Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a + b) = 32$.

7. Conduct a performance of Variables in Motion and response. Discuss performer and audience behavior.

Criteria-based teacher checklist, peer assessment: Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a+b) = 32$.

8. Lead reflection.

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

LESSON STEPS

☐ Prepare the classroom for dance.



Moving Desks/Set-up

1. Introduce using variables to create choreography. Analyze photographs or video of dancers using locomotor and non-locomotor movements.

- *We are going to do a lesson that is a dance lesson and a math lesson at the same time. We'll be Dancing Mathematicians.*
- *Dancing Mathematicians use movement to analyze and discover why something is true in math.*
- *Choreographers are the inventors or creators of dances. They use math when they invent their dances.*
- *Here is a simple equation that a choreographer could use to create a dance: $2(a + b) = 16$. What are some of the possible solutions for this equation?*
- *The choreographer would have many choices. If the dance is sixteen counts long, she/he could do her first movement (a) for two counts and the second movement (b) for six counts. Then she'd repeat the "a" for two counts and the "b" for six counts again. Or she/he could do the first movement for five counts, the second movement for three counts, and repeat them. Or any of the other solutions for the equation that you discovered.*
- *Let's dance one of those solutions using an eyebrow dance for "a" and shoulder dance for "b."*
- *The movements that we are going to put in our dances today will be locomotor (movements that travel) and non-locomotor (movements that stay in one place).*

☐ You can use these photos of PNB dancers to illustrate locomotor and non-locomotor movements. You could also choose to find your own photos or videos that represent a variety of styles and cultures. Look for dancers that appear to be traveling and dancers that seem to be moving in one spot.



- *Here are photos of dancers from Pacific Northwest Ballet doing locomotor and non-locomotor movements. What do you see?*

■ If you choose to use video, show one or more of the following video clips of professional dancers. Ask students to identify when the dancers are moving with locomotor movements or non-locomotor movements. If time is limited, you could do this part of the strategy on another day.

Opening Ceremony Blog Exclusive - Spike Jonze Presents: Lil Buck and Yo-Yo Ma
<http://www.youtube.com/watch?v=C9jghLeYufQ>

Cylindrical Shadows excerpt
(Video link provided to Arts Impact, courtesy Pacific Northwest Ballet)
<http://www.youtube.com/watch?v=vkngXCnk0Og>

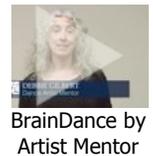
2. Prepare students for dancing by creating agreements for appropriate dance behavior. Chart student responses.

- *Before we begin moving, I have a question for you. How can you be creative and safe at the same time?*



3. Lead students in *Math BrainDance* warm-up. (BrainDance originally developed by Anne Green Gilbert, www.creativedance.org, reference: *Brain-Compatible Dance Education*, video: *BrainDance, Variations for Infants through Seniors*.) Music: "Math BrainDance (Fifth Grade)" #6, *Math Dances* by Debbie Gilbert

- *The BrainDance will warm up your body and make your brain work better at the same time. Notice when we use math in the BrainDance.*



Breath

- *Dancing Mathematicians, breathe silently.*

Tactile

- *Tap the top of your head twelve times. Tap your arms six times. Tap your stomachs three times. Tap your legs 1.5 times. What's my rule?*



Core-Distal

- *Grow into a large symmetrical quadrilateral shape. Shrink into a small shape that is not symmetrical.*

Head-Tail

- *What is 1/3 of 24? Curl your backbone forwards and backwards and from side to side eight times.*

Upper Half

- *Freeze the lower half of your body. Draw parallel lines with the top half of your body.*

Lower Half

- *Freeze the upper half of your body. Draw perpendicular lines with the lower half of your body.*

Body-Half Right

- *Dance with your whole right side while the left side is frozen. Dance with 2/3 of your right side. Dance with 1/3 of your right side.*

Body-Half Left

- *Dance with your whole left side while the right side is frozen. Dance with 2/3 of your left side. Dance with 1/3 of your left side.*

Eye-Tracking

- *Focus on your right thumb. Watch it as you draw a cube in the air. Watch your left thumb as you draw a cube in the air.*

Cross-Lateral

- *What is one fourth of 80? Reach across your body up high, up high, down low, down low for a total of 20 reaches.*

Vestibular

- *Turn, then freeze in a parallelogram shape. Turn, then freeze in a rectangle shape. Turn, then freeze in a rhombus shape. Turn, then freeze in a square shape.*

Breath

- *Breathe silently, Dancing Mathematicians.*

4. Introduce the dance concepts of **shape**, **non-locomotor** movement, and **locomotor** movement. Play percussion instrument(s) for accompaniment.



Prompting for Creativity

- *Our first dance concept is shape. When you make a shape, you freeze your whole body, like a statue. It's OK to breathe and blink.*
- *Make a shape. Freeze with your whole body. Make a different shape. It could be wider or narrower or bent or expanded. Freeze. Have a seat right where you are.*
- *Our next dance concept is non-locomotor movement. When you move in one spot, your movements are called non-locomotor movements. Dancers also call that dancing in self-space.*
- *When you hear me play my percussion instrument, do a non-locomotor movement with your whole body. When the sound stops, freeze in a shape.*

☐ Cue students to use specific non-locomotor movements, like stretching, twisting, floating, and shaking. Then ask them to choose their own non-locomotor movements.

- *Our next dance concept is locomotor movement. When you travel through the empty space in the room, your movements are called locomotor movements. Dancers call that moving in general space.*
- *When you hear me play my drum, do a locomotor movement with your whole body. When the sound stops, freeze in a shape. While you are moving it is important to keep empty space around you, so that you do not touch anyone or anything in the room.*

☐ Cue students to use specific locomotor movements, like stomping, leaping, jumping, and creeping. Then ask them to choose their own locomotor movements.

☑ **Criteria-based process assessment:** Freezes in a shape. Moves the body while staying in one spot and traveling.

5. Explore possible values for the variables "a" and "b" in the following equation:

$$4(a + b) = 32.$$

▮ Display the equation and chart all the possible values.

▮ When assessing the criteria in this lesson, any students who are not meeting criteria will be very clear to you, so you may want to use a reverse checklist, putting a "0" where students have not met criteria, rather than trying to notate every single one who has met criteria. You can go back later and give those who have met criteria a "1." This information will let you know who needs more practice, so you can repeat the exploration in the future.

- *This is the equation that we, as choreographers, will use to create our dance.*
- *Let's discover all the possible values for the variables "a" and "b."*
- *Turn and talk with a partner. How should we find the values? What could they be?*
- *I'll chart your solutions.*

Criteria-based teacher checklist: Chooses a value of "a" and of "b" that solves the following equation: $4(a + b) = 32$.

6. Guide students as they dance the equation using different values for the variables.

Music: "Variables in Motion" #13, *Math Dances* by Debbie Gilbert



Variables in Motion
Equation Dance

- *Let's dance one of the solutions we discovered: $4(2 + 6) = 32$. The "a" will stand for the locomotor movement and the "b" will stand for the non-locomotor movement. So a dancer would analyze that by saying that it is an eight-count movement phrase with two counts of the locomotor movement and six counts of the non-locomotor movement. The phrase is repeated four times for a dance that is a total of 32 counts long.*
- *The composer created a piece of music that is 32 counts long. Let's listen to the music and count the beats out loud using the values we chose for the variables: "(1, 2 / 1, 2, 3, 4, 5, 6) (1, 2 / 1, 2, 3, 4, 5, 6) (1, 2 / 1, 2, 3, 4, 5, 6) (1, 2 / 1, 2, 3, 4, 5, 6)."*
- *Now, let's dance it! I'll play the music and you can dance the movement phrase of two locomotor movements and six non-locomotor movements using your whole body. You'll start frozen in a shape and repeat that movement phrase four times and then freeze.*
- *Let's dance another solution: $4(3 + 5) = 32$.*

▮ It will help students to hear the musical phrase if you loudly call out, "one" at the beginning of each eight-count phrase.

- *This time decide on your own values for the variables. I'll play the music and we'll all start at the same time in a shape, we'll dance our own choices for the movement phrase, then we should all end at the same time frozen in a shape after 32 counts. As you dance your own movement phrase, be aware that some dancers may be doing locomotor movements while you are doing non-locomotor movements and vice versa since you are dancing different values for the variables. Keep your eyes open so you don't bump anyone.*

- *Ask yourself, what were the values of "a" and "b" that you danced? If you used them in our equation, is the equation true?*

Criteria-based teacher checklist, self-assessment: Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a + b) = 32$.

7. Conduct a performance of Variables in Motion and response. Discuss performer and audience behavior.

Depending on the space you have available, you could choose to have half the class perform at a time, as described below, or you could have smaller groups perform.



Audience and Performer Expectations

- *Half of you will demonstrate the dance, and the other half will be the audience. Then, you'll switch.*
- *Before we begin, what is the job of the audience? What is the job of the performers?*
- *Audience, as they are dancing, notice what you see. After the performance, I'll ask you some questions. What non-locomotor movements did you see? What locomotor movements did you see? Did they dancers start and end at the same time? What different values for the variables did you see?*

Criteria-based teacher checklist, peer assessment: Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a + b) = 32$.

8. Lead reflection.

- *Dancing Mathematicians, how did you know that the values for the variables the dancers chose solved the equation?*
- *By observing dancers dance different values for variables, what did you learn that will help you when you use variables in math?*

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

ARTS IMPACT LESSON PLAN Dance and Math Infusion

Fifth Grade Lesson One: *Variables in Motion*

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

STUDENT SELF-ASSESSMENT WORKSHEET

| Disciplines | MATH | | DANCE/MATH | | Total |
|--------------|--|---|--|------------------------|-------|
| Concept | Variables | | Locomotor and Non-Locomotor Movement Variables | | 4 |
| Criteria | Finds a value of "a" and of "b" that solves the following equation: $4(a + b) = 32$. | | Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a + b) = 32$. | | |
| | a | b | a | b | |
| Student Name | | | locomotor movement | non-locomotor movement | |
| | | | | | |

ARTS IMPACT LESSON PLAN Dance and Math Infusion

Fifth Grade Lesson One: *Variables in Motion*

CLASS ASSESSMENT WORKSHEET

| Disciplines | MATH | | DANCE/MATH | | Total 4 |
|--------------|---|---|---|-----------------------------|------------|
| Concept | Variables | | Locomotor and Non-Locomotor Movement Variables | | |
| Criteria | Finds a value of "a" and of "b" that solves the following equation: $4(a + b) = 32.$ | | Dances a locomotor movement to represent a value of "a" and dances a non-locomotor movement to represent a value of "b" in the following equation: $4(a + b) = 32.$ | | |
| Student Name | a | b | a locomotor movement | b non-locomotor movement | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
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| 16. | | | | | |
| 17. | | | | | |
| 18. | | | | | |
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| 20. | | | | | |
| 21. | | | | | |
| 22. | | | | | |
| 23. | | | | | |
| 24. | | | | | |
| 25. | | | | | |
| 26. | | | | | |
| 27. | | | | | |
| 28. | | | | | |
| 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: *Variables in Motion*

Dear Family:

Today your child participated in an **Arts and Math** lesson. We talked about how both mathematicians and dancers can use variables.

- We thought about how choreographers, the inventors of dances use mathematical variables to create dances.
- We did the Math BrainDance to warm up our brains and bodies.
- We explored non-locomotor movements that stay in one spot and locomotor movements that travel.
- We searched for values for the variables "a" and "b" in the following equation: $4(a + b) = 32$.
- We each chose values for the variables and danced locomotor movements for our value of "a" and non-locomotor movements for our value of "b." Our dances had 32 movements total and four sets of the locomotor plus non-locomotor movements, for example, three leaps plus five stretches repeated four times.
- We performed our dances simultaneously, and observed how all the dancers started and ended at the same time, but made different movement choices to represent the different values of the variables that solved the equations.
- We reflected and thought about what we learned by observing dancers dance different values for variables that will help us in math.

At home, you could ask your child to help you write an equation with a variable. Then, you could both solve the equation and compare your answers. Ask you child to show you how to dance a variable.

Enduring Understanding

A variety of numbers or movements can be substituted for a variable in an expression.