

Visual Arts and Math Infused Lesson



Lesson Three: *Multiplication in Symmetrical Assemblages*

Author: Meredith Essex      Grade Level: Third

Enduring Understanding

Multiplication can be represented by equal rows of repeated shapes. Symmetry can create order and balance in a composition.

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

Three diverse artworks are analyzed with focus on repetition, multiplication, and symmetry. Students visually represent multiplication problems by drawing rows or arrays of dots. Next, sponge-painted backgrounds for assemblages are created. Glass mosaic beads/buttons (for rows/groups of numbers) are arranged in symmetry and glued to backgrounds to show multiplication. Last, students match equations with each other's assemblages. As an extension, students can explore division within a similar process.

Learning Targets and Assessment Criteria

**Target:** Represents multiplication in composition.

**Criteria:** Organizes correct number of identical groups of mosaic gems/buttons to express a repeated addition problem.

**Target:** Makes composition in formal balance.

**Criteria:** Organizes rows in symmetry.

**Target:** Uses craftsmanship in assemblage.

**Criteria:** Sponges paint to create an evenly textured ground, glues glass mosaic gems/buttons securely.

**Target:** Identifies equations represented in assemblages.

**Criteria:** Compares and writes multiplication equations for own and another's art.

**Extension Criteria:** Compares and writes division equations for own and another's art.

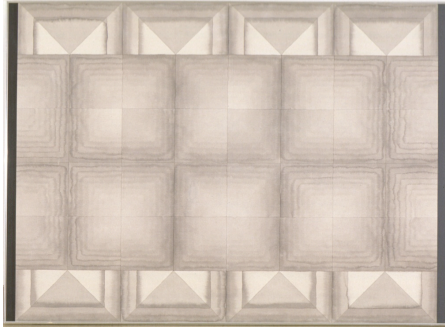
Vocabulary	Materials	Learning Standards
<p><b>Arts Infused:</b> Horizontal Shape Symmetry Vertical</p> <p><b>Math:</b> Array Divide Equation Expression Group Multiply Row</p> <p><b>Arts:</b> Assemblage Balance Composition</p> <p><i>continued</i></p>	<p><b>Museum Artworks or Performance:</b></p> <p><b>Seattle, WA</b> Seattle Art Museum</p> <p><b>Tacoma, WA</b> Tacoma Art Museum</p> <p><b>Materials</b> White cardstock: 8.5x11", copy multiplication cards from lesson and cut into individual cards; Mat board: approx. 5x5"-8x8" rectangles; Metallic acrylic paint: silver, copper, and gold; Paint trays; Sponges; White chalk; Matching buttons or mosaic glass gems: approx. 3/8"-1/2"; Cups/trays/ziplock bags: to store buttons/gems; Scissors; Tacky glue; Arts Impact <a href="#">sketchbooks</a>; Art mats; Class Assessment Checklist</p> <p><i>continued</i></p>	<p><b>WA Arts State Grade Level Expectations</b> <i>For the full description of each WA State Arts Grade Level Expectation, see: <a href="http://www.k12.wa.us/Arts/Standards">http://www.k12.wa.us/Arts/Standards</a></i></p> <p>1.1.2 Elements: Shape 1.1.5 Elements: Space, 1.1.7 Principles of Design: Balance, repetition 1.2.1 Skills and Techniques: Painting, gluing 2.1.1 Creative Process 2.3.1 Responding Process 4.2.1 Connection between Visual Arts and Math</p> <p><b>Early Learning Guidelines (Pre-K – Grade 3)</b> <i>For a full description of Washington State Early Learning and Child Development Guidelines see: <a href="http://www.del.wa.gov/development/guidelines/">http://www.del.wa.gov/development/guidelines/</a></i> (3<sup>rd</sup> grade) 6. Learning about my world: Math: Build skills to multiply and divide up to 10 x 10 accurately. Arts: Explain own artwork to others.</p> <p><i>continued</i></p>

Craftsmanship  
Dot  
Ground  
Repetition  
Space  
Sparkly  
Texture

**Connections**

*Everyday Mathematics*  
Units 4, 7 and 9 - Multiplication and Division

Seattle Art Museum images:  
*Tenebrae Service*, mid 20th century,  
William Hoppe, 72.62



*Hanging*, late 19th-early 20th century,  
Persian, 35.101



*Cabinet*, ca.1881-82, Attributed to Herter Brothers (Christian Herter), 2006.5




**Common Core State Standards (CCSS) in Math**


For a full description of CCSS Standards by grade level see: <http://www.k12.wa.us/CoreStandards/Mathstandards/>  
3.OA.3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.  
3.OA.5. Apply properties of operations as strategies to multiply and divide.

**CCSS Mathematical Practices**

- MP 1. Make sense of problems and persevere in solving them.
- MP 4. Model with mathematics.
- MP 6. Attend to precision.
- MP 7. Look for and make use of structure.
- MP 8. Look for and express regularity in repeated reasoning.

### ICON KEY:

 = Indicates note or reminder for teacher

 = Embedded assessment points in the lesson

### Pre-Teach

Sketchbook Activity: Using small dots or circles, practice organizing number groups of 3 to 10 in rows and rectangular arrays (rows and columns). Look for and draw rows and arrays seen all around us.

### Lesson Steps Outline


#### Day One

**1.** Warm-Up: Guide students to practice making groups of dots representing multiplication problems. Demonstrate organizing groups of dots in arrays and rows.

**2.** Introduce and guide art and math analysis of *Tenebrae Service* by William Hoppe from the Seattle Art Museum collection. Focus on groups of shapes, arrays, and multiplication.


**3.** Introduce *Hanging, Persian, and Cabinet* attributed to Herter Brothers (Christian Herter) from the Seattle Art Museum collection and compare with focus on groups of shapes, multiplication, and balance in composition.

**4.** Distribute cards with multiplication problems on them. Review how groups of dots representing numbers can be represented in rows or arrays. Demonstrate creating a plan for a multiplication composition arranged in symmetry.

 Criteria-based peer assessment: Organizes correct number of identical groups to show a multiplication (repeated addition) expression.

**5.** Share example of bead multiplication assemblage on sponge-painted mat board.

**6.** Demonstrate and guide selecting mat board color and sponge-painting ground.

 Criteria-based teacher checklist: Sponges paint to create an evenly textured ground.

## Day Two

**1.** Demonstrate and guide selecting, counting, mapping out, and arranging glass mosaic gems/buttons.

Criteria-based teacher checklist: Organizes correct number of identical groups of glass mosaic gems/buttons to express a repeated addition problem and organizes rows in symmetry.

**2.** Demonstrate gluing glass mosaic gems/button rows using craftsmanship.

Criteria-based teacher checklist: Glues mosaic gems/buttons securely.

**3.** Guide completing multiplication problem/equation representing own and a partner's assemblage.

Criteria-based teacher checklist: Compares and writes multiplication equations for own and another's art.

**4.** Guide criteria-based group reflection.

Group criteria-based reflection: Identifies and shares equations seen in assemblages. Analyzes how compositions are balanced.

**5.** Extension: Challenge students to interpret their assemblage (and another's) as a division problem and record equations.

Criteria-based self-assessment: Compares and writes division equations for own and another's art.

## LESSON STEPS

### Day One

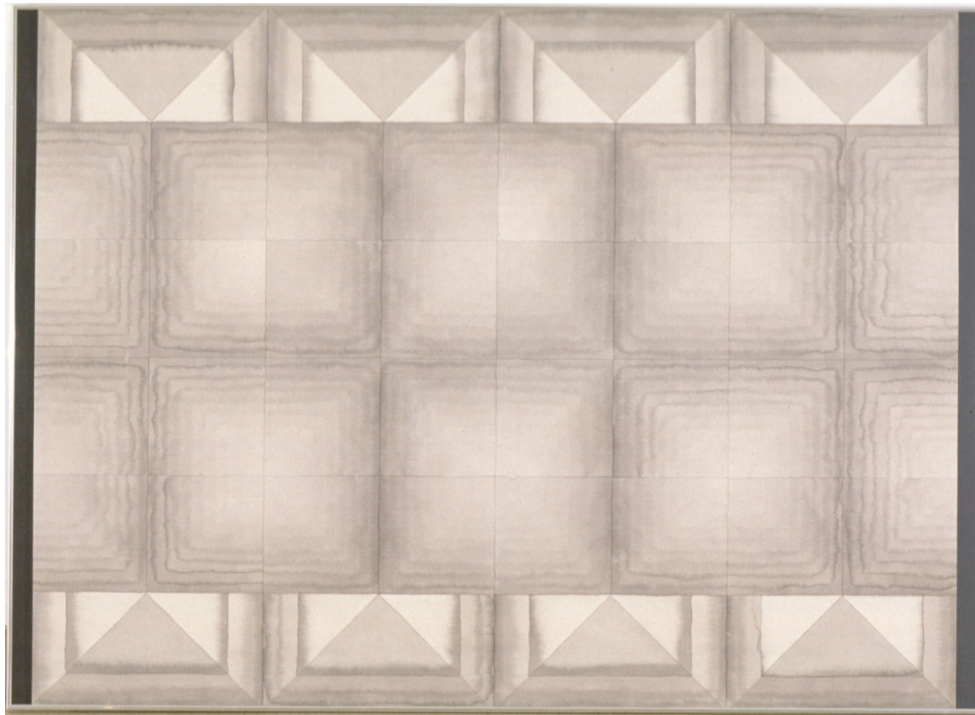
**1. Warm-Up: Guide students to practice making groups of dots representing multiplication problems. Demonstrate organizing groups of dots in arrays and rows.**

- *In your sketchbook, show the multiplication expression:  $3 \times 3$  by clearly drawing three groups of 3 in a single array.*
- *Now, let's show  $5 \times 4$ : Organize and show five groups of 4 as individual rows or arrays.*
- *Now, let's show  $3 \times 6$ . Now for the next more artistic question: How can we organize the groups showing multiplication in a way that is balanced and interesting to look at?*

**2. Introduce and guide art and math analysis of *Tenebrae Service* by William Hoppe from the Seattle Art Museum collection. Focus on groups of shapes, arrays, and multiplication.**



Responding to Art in the Classroom



■ The Seattle Art Museum's collection is available on-line at:

<http://www.seattleartmuseum.org/emuseum/code/collection.asp>. To find the images in this lesson, enter the accession number for the work of art in the search box on the collections page of SAM's website. Accession numbers for these works of art are listed in the materials box at the beginning of the lesson.

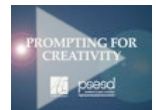
- *Where do we see anything that resembles a row, shape, or array in this art?*
- *Where do we see repetition of groups of shapes in this art?*
- *Where can you find multiplication in this art? If we were to write a multiplication problem for all or part of this artwork, what might it be?*
- *What other math do you see in this art? Fractions, geometric shapes?*

**3. Introduce *Hanging*, *Persian*, and *Cabinet* attributed to Herter Brothers (Christian Herter) from the Seattle Art Museum collection and compare with focus on groups of shapes, multiplication, and balance in composition.**



- *In these three very different works of art, where do you see groups of shapes or evidence of multiplication?*
- *What do these artworks have in common (symmetry)?*
- *Where do we see rows, shapes, or arrays in balance?*

**4. Distribute cards with multiplication problems on them. Review how groups of dots representing numbers can be represented in rows or arrays. Demonstrate creating a plan for a multiplication composition arranged in symmetry.**



Prompting for Creativity

▣ In distributing multiplication cards, you may choose to differentiate by matching equations with students based on their ability.

- *With  $5 \times 5$ , how can I arrange five rows of 5 in symmetry? They could be horizontal rows forming one large array in the center, or they could be two vertical rows on each side with a horizontal row in the center.*
- *Sketch some rows of dots in symmetry that show your multiplication problem.*

Criteria-based peer assessment: Organizes correct number of identical groups to show a multiplication (repeated addition) expression.

## 5. Share example of bead multiplication assemblage on sponge-painted mat board.

- *We are going to be showing our multiplication problem/equation in an assemblage: art that is made out of found materials that are 3-dimensional.*
- *We are going to be using glass mosaic gems/buttons for our rows and/or arrays.*
- *We will be counting and arranging them using our ideas for creating a composition in part two of this lesson.*
- *Right now, we are going to create a sparkling textural metallic color ground—an interesting surface that our beads/buttons will be glued to.*

## 6. Demonstrate and guide selecting mat board color and sponge-painting ground.

▣ Place 3-4 small trays at each table group with a small amount of acrylic metallic colored paint and one sponge per student. Place paper under mat board to protect table.

- *Choose a color of mat board that jumps out at you. Write your name on the back of it (the white side).*
- *Choose a color of metallic paint at your table that you feel will look good on your color background.*
- *Creating a textured, sparkly "ground" means sponge painting a light consistent sponge texture but not completely covering up your background/color. The idea is to add some sparkle or sheen. Sponging is an up and down motion used to create the textural color effect all over your mat board.*

Criteria-based teacher checklist: Sponges paint to create an evenly textured ground.



Sponge Painting Grounds for Assemblage Arrays



## Day Two

### 1. Demonstrate and guide selecting, counting, mapping out, and arranging glass mosaic gems/buttons.

- Choose glass mosaic gems/buttons with the color of your ground in mind. If you have large numbers, choose small beads or buttons. If you have small numbers, choose large beads or buttons to fill the space. Think about combinations that stand out; you might want to use complementary or warm and cool colors together in your assemblage.
- If a multiplication problem is  $6 \times 5$ , how many groups of 5 beads/buttons are needed? Count carefully.
- Now that the correct number of groups has been counted, it is time to arrange them. Look at composition ideas you have already sketched. (Optional: you can draw dots in chalk on your ground for each row.)
- Arrange your glass mosaic gems/buttons in symmetry, making sure each row can be clearly seen.
- Talk with a partner about your composition: check each other's math and symmetry.



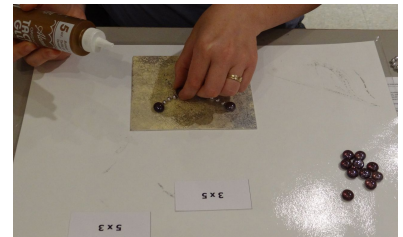
Criteria-based teacher checklist: Organizes correct number of identical groups of glass mosaic gems/buttons to express a repeated addition problem and organizes rows in symmetry.

### 2. Demonstrate gluing glass mosaic gems/button rows using craftsmanship.

- Now that every row is arranged and your math and symmetry (formal balance) has been checked, it is time to glue. Both mathematicians and artists use precision in their work. Craftsmanship means care to keep our symmetry and glue securely so that the beads will not fall off.
- Move one mosaic gem/button at a time, just to the side, and squeeze a thick dab exactly matching the places where your mosaic gem or bead was. You can also carefully put a dab of glue on the mosaic gem or bead and place it securely on the background. Make sure there is enough glue under each glass mosaic gem/button.
- Repeat until all rows are glued down. It important to use enough glue!
- Leave your assemblage on your table without touching or disturbing it until the glue sets.



Assemblage: Gluing with Tacky Glue



Criteria-based teacher checklist: Glues mosaic gems/buttons securely.

### 3. Guide completing multiplication problem/equation representing own and a partner's assemblage.

- *Write the multiplication expression for your assemblage.*
- *Now calculate how many mosaic gems/buttons total you have in all the rows. Add the total to make an equation.*
- *Talk with a partner about his or her composition. Figure out the multiplication equation for their composition and share with the group.*

Criteria-based teacher checklist: Compares and writes multiplication equations for own and another's art.

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### 4. Guide criteria-based group reflection.

▣ Once glue has set, it is helpful to line all assemblages up on a flat table in an array/grid configuration for students to analyze. Art can also be ordered from smallest to greatest in grid. Once glue dries, this is a great way to display them as one work of art on a bulletin board.



Guiding Reflecting on Student Art

- *Let's order our assemblages from smallest to largest.*
- *Look at all of our work as a group. Find and share the specific multiplication equations you discovered in other's assemblages.*
- *Notice the ways that artists organized their compositions. How are they balanced?*

Group criteria-based reflection: Identifies and shares equations seen in assemblages. Analyzes how compositions are balanced.

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### 5. Extension: Challenge students to interpret their assemblage (and another's) as a division problem and record equations.

- *If you divide that total number of beads by the number of rows you have, what is the answer? (The number is equal to the number of beads in each row.)*
- *Record the equation that represents your assemblage as a division problem. Also record a partner's division equation.*

Criteria-based self-assessment: Compares and writes division equations for own and another's art.

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<b>3 x 3</b>	<b>4 x 4</b>
<b>3 x 5</b>	<b>4 x 6</b>
<b>3 x 7</b>	<b>4 x 8</b>
<b>5 x 3</b>	<b>6 x 3</b>
<b>5 x 5</b>	<b>6 x 5</b>
<b>5 x 7</b>	<b>6 x 7</b>

$4 \times 8$

$7 \times 3$

$4 \times 9$

$7 \times 5$

$4 \times 10$

$7 \times 7$

$8 \times 3$

$9 \times 3$

$8 \times 4$

$9 \times 5$

$8 \times 5$

$9 \times 4$

<b>8 x 6</b>	<b>8 x 8</b>
<b>6 x 6</b>	<b>8 x 7</b>
<b>5 x 4</b>	<b>5 x 6</b>

**ARTS IMPACT LESSON PLAN Visual Arts and Math Infusion**

Third Grade Lesson Three: *Multiplication in Symmetrical Assemblages*

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

**STUDENT SELF-ASSESSMENT WORKSHEET**

Disciplines	MATH		VISUAL ARTS		MATH			Total 6 (or 7)
Concept	Multiplication	Balance	Craftsmanship		Multiplication/Division			
Criteria	Organizes correct number of identical groups mosaic gems/buttons to express a repeated addition problem	Organizes rows in symmetry	Sponges paint to create an evenly textured ground	Glues glass mosaic gems/buttons securely	Writes multiplication equation for own art	Writes multiplication equation for another's art	<b>Extension</b> Writes division equations for own and another's art	
Student Name								

**ARTS IMPACT LESSON PLAN Visual Arts and Math Infusion**

Third Grade Lesson Three: *Multiplication in Symmetrical Assemblages*

**CLASS ASSESSMENT WORKSHEET**

Disciplines	MATH		VISUAL ARTS			MATH			Total 6 (or 7)
Concept	Multiplication	Balance	Craftsmanship		Multiplication/Division				
Criteria	Organizes correct number of identical groups mosaic gems/buttons to express a repeated addition problem	Organizes rows in symmetry	Sponges paint to create an evenly textured ground	Glues glass mosaic gems/buttons securely	Writes multiplication equation for own art	Writes multiplication equation for another's art	<b>Extension</b> Writes division equations for own and another's art		
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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 visual arts and math?*

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

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

VISUAL ARTS AND MATH LESSON: *Multiplication in Symmetrical Assemblages*

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Dear Family:

Today your child participated in a two-part **Arts and Math** lesson. We looked at three very different artworks: a painting, a hanging, and an example of antique furniture. We found examples of repetition of shapes in rows or arrays and symmetry in all of these artworks. We also found examples of multiplication in this art. We made assemblages that show our understanding of multiplication.

- We practiced figuring out multiplication problems by drawing rows or arrays of dots to represent numbers.
- We made art in response to a multiplication problem by organizing rows of dots that represent numbers into a plan for a symmetrical composition.
- We prepared a textured sponge painted ground (surface to adhere things to) for an assemblage (artwork that is made of real 3-dimensional objects).
- We used glass mosaic gems or buttons for our assemblages and mapped out where we would place them.
- We showed multiplication by using groups of beads or buttons to represent numbers.
- We selected, counted, arranged, and glued our glass mosaic gems or buttons.
- We looked at our work together and recorded multiplication equations matching our own and other's assemblages.
- Some of us identified and recorded division equations matching our assemblages.

At home, you could encourage your child to group and count objects as a way to practice multiplication. Together, you could look for examples of rows or arrays in the world around us, and use multiplication to determine total numbers. You could also experiment with making symmetrical mathematical collages out of dot stickers or small objects found in nature.

### **Enduring Understanding**

Multiplication can be represented by equal rows of repeated shapes.  
Symmetry can create order and balance in a composition.