

ARTS IMPACT LESSON PLAN

Visual Arts and Math Infused Lesson

Lesson One: Math Action Figures: Human Body Proportion

Author: Meredith Essex Grade Level: Seventh



Enduring Understanding

Ratio and proportional relationships can guide accurate portrayal of human figures of any size.

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

Students apply understandings of fractions, scale, and ratio to create a human figure in proportion. Head and total height of a human figure is drawn on grid paper based on a 1:8 ratio multiplied by a scale factor. Students then divide the figure horizontally into 8 equal parts and place parts of the figure in those fractional areas guided by a proportion diagram. Last, students use math tools and colorful pens to transform their figure into a "Math Action Figure" character with special math powers.

Learning Targets and Assessment Criteria

Target: Uses understanding of ratio and scale to map out a human figure.

Criteria: Uses ratio of 1:8 (head to body) multiplied by a scale factor to establish proportional head and body height in drawing.

Target: Documents proportion calculations.

Criteria: Records ratio multiplied by scale factor equation on drawing.

Target: Uses understanding of proportion to represent additional parts of a human figure.

Criteria: Divides height of figure into 8 equal parts. Sketches head in top 1/8 and sketches parts of figure in other fractional areas guided by diagram and prompts.

Target: Creates a math action figure using craftsmanship.

Criteria: Defines contour of figure and adds invented geometric elements using pen, grid squares, and straight edge to suggest human and math-inspired characteristics.

Vocabulary	Materials	Learning Standards
<p><u>Arts Infused:</u> Horizontal Proportion Ratio Scale Symmetry Vertical Height</p> <p><u>Math:</u> Fraction Grid</p> <p><u>Arts:</u> Figure Craftsmanship Contour</p>	<p>Museum Artworks or Performance</p> <p>Seattle, WA Seattle Art Museum</p> <p>Tacoma, WA Tacoma Art Museum</p> <p>Materials Arts Impact sketchbook; Wooden proportion manikins; Drawing pencil: 4H; Vinyl erasers; Gel pens: variety of colors; 1/2" grid paper: 5.5x8.5", one per student; Human body proportion diagram: one per student; Protractor; Ruler; Geometry template; Class Assessment Worksheet</p> <p align="center"><i>continued</i></p>	<p>WA Arts State Grade Level Expectations <i>For the full description of each WA State Arts Grade Level Expectation, see:</i> http://www.k12.wa.us/Arts/Standards</p> <p>1.1.2 Elements: Shape 1.1.7 Principles of Design: Proportion 1.2.1 Skills and Techniques: Drawing 2.1.1 Creative Process 2.3.1 Responding Process 4.2.1 Connection between Visual Arts and Math</p> <p>Common Core State Standards (CCSS) in Math <i>For a full description of CCSS Standards by grade level see:</i> http://www.k12.wa.us/CoreStandards/Mathstandards/</p> <p>7.G. Draw, construct, and describe geometrical figures and describe the relationships between them. 7.G.1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.</p> <p align="center"><i>continued</i></p>

Seattle Art Museum images:
Amphora, 520-510 B.C. Greek,
Antimenes Painter, 46.61



Victor/Victim, 1982, Randy Hayes, 83.58

Anthony of Padua, 2013, Kehinde Wiley, 2013.8

Fig. 3, 1986, C. T. Chew, 2005.318

CCSS Mathematical Practices

MP.4. Model with mathematics.

MP.5. Use appropriate tools strategically.

MP.6. Attend to precision.

ICON KEY:

 = Indicates note or reminder for teacher

 = Embedded assessment points in the lesson

Pre-Teach

Ask students to search for and share examples of human figures that represent a reduced scale while maintaining human proportion: toys, illustrations, diagrams. Discuss the idea of using a human figure compared to buildings, animals, or other objects to demonstrate scale relationships. Compare the proportion of the same photograph or image of a human figure seen on different electronic devices: phone, tablet, smart board, movie screen.

Lesson Steps Outline

1. Introduce proportions of the human body. Introduce and guide art analysis of *Amphora* by Antimenes Painter, *Victor/Victim* by Randy Hayes, *Anthony of Padua* by Kehinde Wiley, and *Fig. 3* by C. T. Chew from the Seattle Art Museum collection.

 Criteria-based teacher process assessment: Participates in analyzing art and human figure diagram.

2. Analyze using ratio and fraction concepts to accurately scale up or down human figure proportions. Connect concepts of ratio, proportion, and fractions.

 Criteria-based teacher process assessment: Analyzes how scale, ratio, and fractions relate to representing human proportion.

3. Demonstrate and guide the process of using ratio, fraction, and scale factor concepts to accurately map out the proportions of the human body in pencil on $\frac{1}{4}$ " grid paper.

 Criteria-based teacher checklist: Uses ratio of 1:8 (head to body) multiplied by a scale factor to establish proportional head and body height in drawing. Records ratio multiplied by scale factor equation on drawing.

4. Demonstrate and guide drawing parts of the human figure aligned with fraction guidelines. Emphasize that this is an exercise and that the figures are invented; they have human proportion, but they do not need to be photographically realistic.

☑ Criteria-based teacher checklist: Divides height of figure into 8 equal parts. Sketches head in top $\frac{1}{8}$ and sketches parts of figure in other fractional areas guided by diagram and prompts.

5. Demonstrate and guide creatively merging human proportion and mathematical elements to create a “Math Action Figure” using gel pens. Emphasize using straight lines and/or geometric shapes for parts of the figure and/or for details, shapes, or patterns inside of the figure.

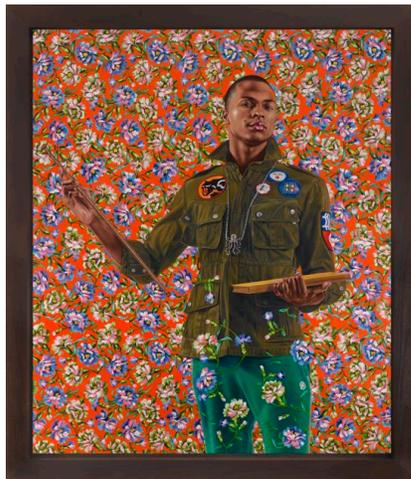
☑ Criteria-based teacher checklist: Defines contour of figure and adds invented geometric elements using pen, grid squares, and straight edge to suggest human and math-inspired characteristics.

6. Facilitate criteria-based peer and group math and art reflection.

☑ Criteria-based peer assessment and group reflection: Checks for proportional accuracy, describes mathematical characteristics and special powers of figure.

LESSON STEPS

1. Introduce proportions of the human body. Introduce and guide art analysis of *Amphora* by Antimenes Painter, *Victor/Victim* by Randy Hayes, *Anthony of Padua* by Kehinde Wiley, and *Fig. 3* by C. T. Chew from the Seattle Art Museum collection.



■ 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.

■ Refer to human figure proportion diagram included in lesson.

- *The human figure has been portrayed in art for thousands of years. There is a basic formula of proportional relationships or fractions relative to a whole that has been developed over time to help artists represent the human figure realistically. Proportions change from babyhood to adulthood. Every body is different, but these basic proportions can form a guide.*
- *What do you think is the proportion of head height to body height? (The ratio of head height to body height of an adult figure is approximately 1:8 or 1/8.)*
- *Compare the human proportion diagram with the SAM artworks. What do you notice?*

- Explore other ratio relationships of the human figure seen on the diagram: bottom of chin to hip, waist to knee, knee to foot. Which fraction and ratio represents each of these parts of the figure relative to the whole?

Criteria-based teacher process assessment: Participates in analyzing art and human figure diagram.

2. Analyze using ratio and fraction concepts to accurately scale up or down human figure proportions. Connect concepts of ratio, proportion, and fractions.

- Using our proportion diagram as a guide, think about ratio, scale, and proportion.
- If you are the sculptor of an 80 foot sculpture of a human, or if you were making a tiny figure that is 4 millimeters high that would go on a piece of jewelry, you would be using the same ratio of head to body: 1:8. How tall would the head be in that sculpture? (10 feet). How tall would the head be on the jewelry? (.5 millimeters)

Criteria-based teacher process assessment: Analyzes how scale, ratio, and fractions relate to representing human proportion.

3. Demonstrate and guide the process of using ratio, fraction, and scale factor concepts to accurately map out the proportions of the human body in pencil on 1/4" grid paper.

▣ Lesson can be differentiated by assigning a scale factor that yields a certain number of units (factor of 4 for 32 unit height for instance) for height of human figure or students can choose different factors for enlarging using the same ratio.

- Since you are dividing this area from top of head to bottom of feet into fractions that represent the 1:8 head to body ratio, think about what the scale factor will be when you map out the figure on your grid paper. What number of squares will you use? If your factor is 3 how many units high will your figure be? (24)
- Orient your paper vertically. Multiply the body proportion ratio of by the scale factor that has been assigned or that you have chosen (makes sure that you are enlarging/scaling up so that your figure fits on the paper). Note the equation representing scale factor multiplied by ratio in the upper right corner of your paper.
- Make a mark horizontally towards the top of your paper to indicate the top of the head then count and mark the bottom of the feet. This number of units should be the same as the product of your equation noted in the last step.
- Now divide the height of the figure into equal parts or fractions using horizontal lines in pencil guided by a straightedge and grid lines.
- Switch papers with a partner and check for accuracy. Correct multiplication of ratio by a scale factor and horizontal division of figure height into eight equal amounts.

Criteria-based teacher checklist: Uses ratio of 1:8 (head to body) multiplied by a scale factor to establish proportional head and body height in drawing. Records ratio multiplied by scale factor equation on drawing.

4. Demonstrate and guide drawing parts of the human figure aligned with fraction guidelines. Emphasize that this is an exercise and that the figures are invented; they have human proportion, but they do not need to be photographically realistic.

- *Note the other ratio relationships represented by body proportions. What is the ratio of chin to belly button compared with whole figure? (2:8) How does that translate into fractions? (from chin to waist represents $\frac{1}{4}$ of the total height of the figure) Use the diagram to help you draw a head shape in the top $\frac{1}{8}$ section.*
- *Notice the second fraction section includes part of the neck, shoulders, and part of the chest. Lightly draw in a shape for the torso above the waist. It can have soft oval like edges or can be more of a polygon shape.*
- *The fourth section starts at about the belly button and extends to close to the top of the legs/hip area. Lightly sketch in a shape that represents that part of the figure. Again, it can have soft oval like edges or can be more of a polygon shape.*
- *The fifth section starts at the top of the legs/hip area and extends to the mid-thigh; the sixth section starts mid-thigh and extends to the knee. Lightly sketch in oval or polygon shapes for the thighs.*
- *The seventh section starts at the knee and extends to the shin area, and the eighth section extends from shin to bottom of foot. Lightly sketch shapes for lower leg and feet.*
- *Using the diagram as a guide sketch in ovals or polygon shapes for upper and lower arm and hands. Do not worry about being super-realistic.*

Criteria-based teacher checklist: Divides height of figure into 8 equal parts. Sketches head in top $\frac{1}{8}$, and sketches parts of figure in other fractional areas guided by diagram and prompts.

5. Demonstrate and guide creatively merging human proportion and mathematical elements to create a "Math Action Figure" using gel pens. Emphasize using straight lines and/or geometric shapes for parts of the figure and/or for details, shapes, or patterns inside of the figure.

- *Sometimes mythical or imaginary beings from literature or movies (think science fiction or superheroes) have human and machine or robotic qualities. Sometimes human-like qualities/proportions combined with geometric shapes elements makes those characters especially interesting, creepy, or seemingly powerful.*
- *Define and highlight the shape of your figure by tracing over pencil lines in color gel pen. If you created polygon shapes for body parts in proportion, use a straight edge to draw over your lines for craftsmanship and mathematical precision.*
- *Color in grid squares, add geometric shapes for features, or details to emphasize the "math" of your "Math Action Figure".*
- *Give your "Math Action Figure" a great name and note if he/she has any special math powers on your artwork.*

Criteria-based teacher checklist: Defines contour of figure and adds invented geometric elements using pen, grid squares, and straight edge to suggest human and math-inspired characteristics.

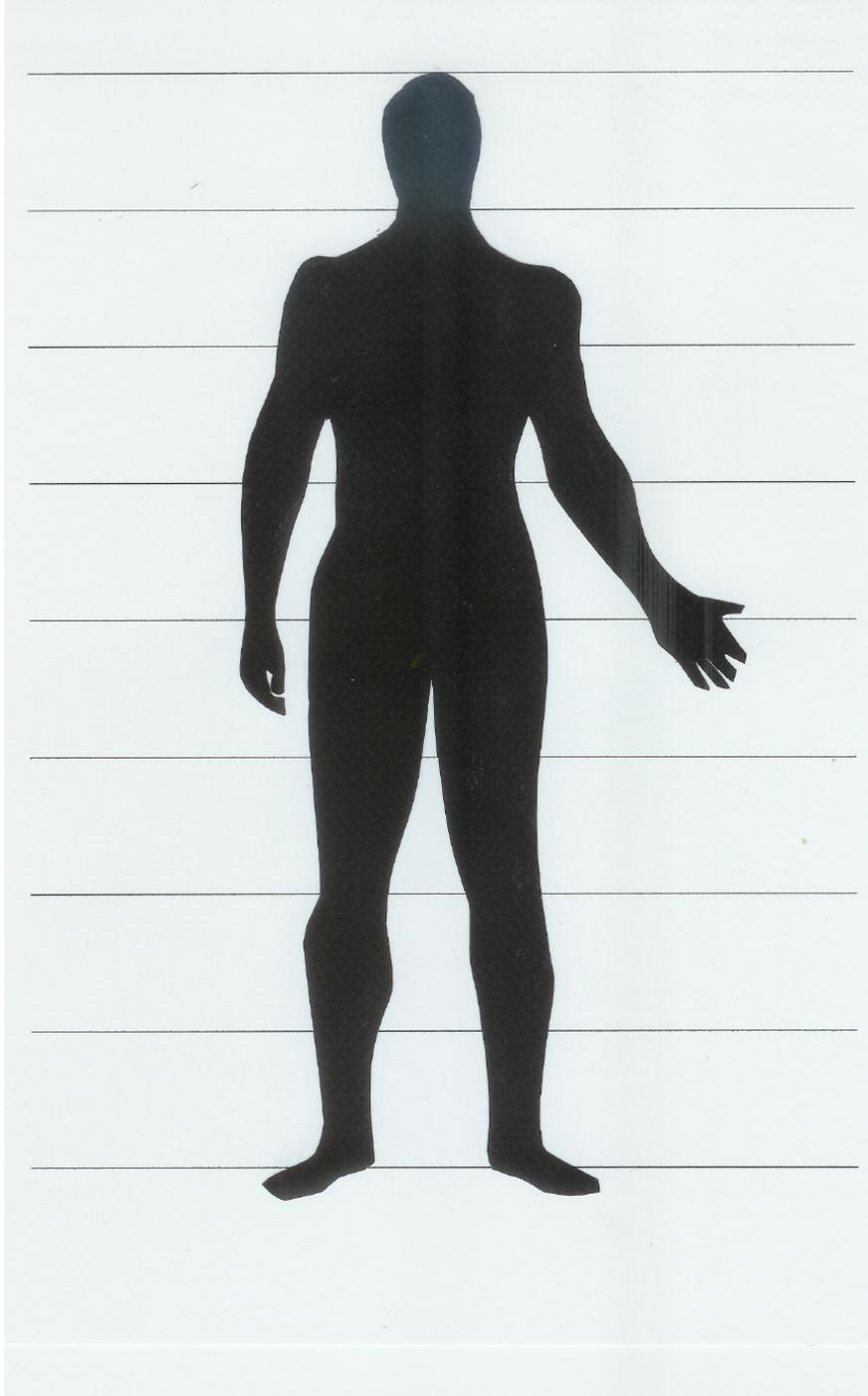
6. Facilitate criteria-based peer and group math and art reflection.

- *Switch Action Figures with a partner and check placement of parts of the figure for proportional accuracy.*
- *Describe the effect of figures in human proportion embellished with mathematical machine-like shapes or lines. Share the name and possible special math powers of your character.*

Criteria-based peer assessment and group reflection: Checks for proportional accuracy, describes mathematical characteristics and special powers of figure.

Math Action Figures: Human Body Proportion

Human Proportion Diagram



ARTS IMPACT LESSON PLAN Visual Arts and Math Infusion

Seventh Grade Lesson One: *Math Action Figures: Human Body Proportion*

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

STUDENT SELF-ASSESSMENT WORKSHEET

Disciplines	VISUAL ARTS AND MATH			ARTS	Total 4
Concept	Ratio and Proportion			Craftsmanship/ Characterization	
Criteria	Uses ratio of 1:8 (head to body) multiplied by a scale factor to establish proportional head and body height in drawing.	Records ratio multiplied by scale factor equation on drawing.	Divides height of figure into 8 equal parts. Sketches head in top 1/8, and sketches parts of figure in other fractional areas guided by diagram and prompts.	Defines contour of figure and adds invented geometric elements using pen, grid squares, and straight edge to suggest human and math-inspired characteristics.	
Student Name					

ARTS IMPACT LESSON PLAN Visual Arts and Math Infusion

Seventh Grade Lesson One: *Math Action Figures: Human Body Proportion*

CLASS ASSESSMENT WORKSHEET

Disciplines	VISUAL ARTS AND MATH			ARTS	Total 4
Concept	Ratio and Proportion			Craftsmanship/ Characterization	
Criteria	Uses ratio of 1:8 (head to body) multiplied by a scale factor to establish proportional head and body height in drawing.	Records ratio multiplied by scale factor equation on drawing.	Divides height of figure into 8 equal parts. Sketches head in top 1/8, and sketches parts of figure in other fractional areas guided by diagram and prompts.	Defines contour of figure and adds invented geometric elements using pen, grid squares, and straight edge to suggest human and math-inspired characteristics.	
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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: *Math Action Figures: Human Body Proportion*

Dear Family:

Today your child participated in an **Arts and Math** lesson. We looked at human figures created by different artists.

- We discovered that all of the figures we looked at showed similar proportional relationships of parts to the whole height of figure from feet to head.
- We talked about the role of fractions, ratio and proportion in making an image bigger or smaller (scaling it up and down).
- We talked about how a set of guidelines based on dividing the human figure into 8 equal parts from top to bottom has been developed to help artists portray figures in proportion. The ratio of height of head to height of body guiding proportion is 1:8.
- We multiplied our ratio by a scale factor to determine how many grid squares the height of our head and figure should be to help us draw our human figure in proportion. We wrote this as an equation on our drawing.
- We divided the entire height of our figure into 8 equal parts horizontally then lightly sketched in the head in the top section. Next we used a traditional proportion diagram with guidelines for aligning sections of the body with marks showing fractions to help us sketch our figure in proportion.
- We defined the contour or edge of our figure using pens.
- We embellished upon our figures using math tools, grid lines, and colorful pens to create a "Math Action Figure" with human proportion and machine or robotic-like characteristics. We gave our character a great name and identified some of their special math powers.

At home, you could draw proportional human figures in different poses using your understanding of proportion as a guide. You could also use your knowledge of figure drawing to invent and draw characters for comics or storyboards.

Enduring Understanding

Ratio and proportional relationships can guide accurate portrayal of human figures of any size.