Standards-Aligned Lesson Plan

Middle School Mathematics: Aileron Sculpture (Nashville, TN)

Developed in partnership with the Metropolitan Nashville Arts Commission.

Ayers Institute for Teacher Learning & Innovation
College of Education at Lipscomb University
One University Park Drive
Nashville, TN 37204-3951

www.AyersInstitute.org

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Planning for a Common Core State Standards Mathematics Lesson

Section I: Planning

Overview: This section focuses on the elements to consider when planning for a CCSS lesson, such as content standards, mathematical practice standards, clear learning targets, task objectives, new learning for students, anticipated learning difficulties, ways to prompt student thinking through assessing and advancing questions, instructional strategies to be used in the lesson, opportunities for differentiation, and materials and resources.

Lesson: The graphic arts design team has been assigned a project by the Metropolitan Nashville Arts Commission to create promotional materials for an event using pictures of *Aileron*, a public sculpture created by Michael Dillon. The graphic arts team will also create a replica of *Aileron* for a display at the McCabe Park Community Center.	**CCSS Domain:** 7.RP Analyze proportional relationships and use them to solve real-world and mathematical problems. **Related Domain:** 7.G Draw, construct, and describe geometrical figures and describe the relationships between them.	**Date:** 2 90-min classes

Standard(s) the lesson is building toward:	
Math Content Standard	**Assessments**
RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.	The students will compare ratios of fractions to help create a proportion.
7.RP.2 Recognize and represent proportional relationships between quantities.	The students will use be able to recognize and represent proportional relationships.
7.RP.2a Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.	The students will demonstrate their understanding of proportional relationships by creating a table and/or graph and explaining their rationale for proportionality based on evidence from the table and/or graph. The students will be able to discuss directly proportional relationships.
7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	The students will demonstrate their understanding of proportional relationships by identifying the constant of proportionality (unit rate).

7.RP.2d Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0,0) and (1,r) where r is the unit rate.	The students will be able to explain the proportional relationship of the pictures in Task 1 based on their graphs. The students will be able to explain the proportional relationship of the sculptures in Task 2 based on their graphs.
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.	The students will create a scale drawing of a created artwork. The students will use the drawing to create a sculpture that has proportional dimensions.
Mathematical Practice Standards	**Assessments**
MP1: Make sense of problems and persevere in solving them.	The students will make sense of real-world problems and persevere in solving a multi-step math task.
MP2: Reason abstractly and quantitatively.	The students will take the numbers that they find in the pattern and use them to create an abstract equation and graph.
MP3. Construct viable arguments and critique the reasoning of others.	The students will present their solutions to each other. The students will analyze and critique the solutions and provide constructive feedback.
MP4: Model with Mathematics	The students will represent the pattern in multiple models; oral language, a table, a graph, manipulatives, and an equation.
MP5: Use appropriate tools strategically.	The students will use visual tools such as charts, graphs, and problem solving strategies.
MP6: Attend to precision	The students will use precision in working with ratios and proportions.
MP7: Look for and make use of structure.	The students will look for patterns in equations and tables in order to make connections to linear equations.
MP8: Look for and express regularity in repeated reasoning.	The students will identify the relationships between two or more quantities.
Clear Learning Targets	• I can solve real-world problems using ratio, rates, and proportions. • I can create a table, graph, and/or equation to represent the relationship between two or more quantities. • I can recognize and represent proportional relationships.
Task Objectives (steps to reach mastery of clear learning target)	• Solve real-world problems using ratios, rates, and proportions. • Create a table, graph, and or equation. • Recognize the pattern in a table by comparing two quantities. • Graph the quantities to show the relationship.

	• Recognize the relationship between two or more quantities as proportional.
New Learning	• Graphing a linear relationship. • Recognizing the relationship between two or more quantities as proportional.
Anticipated learning difficulties (associated with new learning):	• Writing and solving proportions. • Graphing a linear equation. • Recognizing the relationship between two or more quantities as proportional.
Scaffolding (to address learning difficulties):	• The teacher will review the concept of ratios, rates, and unit rates. • The teacher will review how to set-up and solve a proportion. • The teacher will monitor students in small groups and use questioning to guide student learning. • The teacher will demonstrate how to recognize proportional relationships.
Opportunities to differentiate learning: (explain how you address particular student needs by differentiating process, content, or product)	• The teacher will group students strategically. • The teacher will use private think time, small group think time, and whole group think time to help students clarify mathematical thinking. • The teacher will use intervention/enrichment strategies to meet the diverse needs of learners. • The students will complete an individual differentiated assignment.
Questioning (Planning to illuminate student thinking) ***Assessing questions:*** • What patterns do you notice in the table that you created? • What relationship do you notice between the quantities? ***Advancing questions:*** • How might you use previous learning to help solve the task? • What is another way/model you could illustrate your thinking? • What is another tool you could you to solve the problem? • If you change the dimensions to ___, how would that change your answer? • How can you determine if there is a directly proportional relationship?	
Instructional Strategies	• Use of multiple tools • Private think time • Small group think time • Student poster presentations • Whole group discussion • Reflection/Closure • Individual Assignment
Materials and Resources	• *Aileron* Video **http://www.youtube.com/watch?v=YOj7w1mdcR8** • Graph Paper • LCD Projector

	• Document Camera • Math Task 1 • Math Task 2 • Assignment Task

Section II: Presentation
Overview: This section focuses on the steps involved in presenting the lesson. The lesson presentation is divided into segments, such as "Framing the Lesson," "The Task," "Partner Work," and "Solutions." For each of these lesson elements, there is an explanation of the procedure, teacher actions, and student outcomes.

Framing the Lesson for Students (Describe how you will introduce the lesson) (5 minutes)		
Procedure	**Teacher Action**	**Student Outcome**
Day 1 • Introduction of Lesson • Introduction of Math Task 1	• The teacher will introduce the Aileron Math Task. • Set: The Metropolitan Nashville Arts Commission is hosting a dinner at the McCabe Park Community Center. Your graphic arts design team has been assigned a project to create promotional materials for the dinner using pictures of *Aileron*, a public sculpture created by Michael Dillon.	• The students will participate in whole class discussion • The students will work in groups to create a poster presentation.
Day 2 • Review of Day 1 • Introduction of Math Task 2	• The teacher will review Task 1 and will clarify student understanding. • Set: The Metropolitan Nashville Arts Commission has asked your team to create a replica of Michael Dillon's sculpture, *Aileron,* to house inside a display case at the McCabe Park Community Center.	• The students will ask clarifying questions. • The students will work in groups to create a poster presentation.

The Task (Private and Small Group) (30 minutes)		
Procedure **Day 1** • 10 minutes of private think time. • 20 minutes of small group work.	**Teacher Action** **Day 1** • The teacher will circulate the room and monitor student progress. • Illuminate thinking through planned assessing and advancing questions.	**Student Outcome** **Day 1** • The students will read the math task and begin working on Part 1. • The students will collaborate with student group to solve the math task and clarify mathematical thinking. The student will create poster to display their results.
Day 2 • 10 minutes of private think time. • 20 minutes of small group work.	**Day 2** • The teacher will circulate the room and monitor student progress. • Illuminate thinking through planned assessing and advancing questions.	**Day 2** • The students will read the math task and begin working on Part 2. • The students will collaborate with student group to solve the math task. The students will compare their solutions and explain mathematical reasoning.
The Solutions (how do you plan to compare solutions?) (30 minutes)		
Procedure **Day 1** • 15 minutes poster presentations. • 15 minutes of whole group discussion.	**Teacher Action** • The teacher will circulate the room to monitor student groups as they review and critiques student posters. • The teacher will facilitate a discussion of proportional relationships.	**Student Outcome** • The students will participate in a gallery walk of posters. The students will critique student work and provide feedback. • The students will participate in the discussion and make notes of important findings. The students will analyze their findings and make changes as needed.
Day 2 • 15 minutes of whole group discussion. • 15 minutes of assignment task planning	**Day 2** • The teacher will facilitate a discussion of the math task. • The teacher will show the students a video to introduce the assignment task and clarify student questions.	**Day 2** • The students will participate in a discussion of the math task. The students will analyze their work and make changes as needed. • The students will brainstorm ideas and create a sketch of their work of art.

Lesson Closure (how do you plan to close the lesson/give opportunities for reflection?) (5 minutes)		
Procedure **Day 1** • Group discussion • Group analysis and reflection • Exit Ticket 3-2-1	**Teacher Action** **Day 1** • The teacher will facilitate a discussion of student work by asking assessing and advancing questions. • The teacher will monitor student groups as they analyze and reflect on their math task and poster. • The teacher will distribute the exit ticket and ask students to write 3 things they learned, 2 things they wish they knew more about, and 1 question they have about the math task.	**Student Outcome** **Day 1** • The students will participate in the group discussion. The students will ask questions to clarify understanding of the assignment. • The students will analyze and reflect on their math task and poster. The students will make additions to their work as needed. • The students will complete the 3-2-1 Exit Ticket.
Day 2 • Group discussion • Groups analysis and reflection • Assignment Task Proposal	**Day 2** • The teacher will facilitate a discussion of student work by asking assessing and advancing questions. • The teacher will monitor student groups as they analyze and reflect on their math task. • The teacher will introduce the assignment task and clarify questions.	**Day 2** • The students will participate in the group discussion. The students will ask questions to clarify understanding of the assignment. • The students will analyze and reflect on their math task. The students will make additions to their work as needed. • The students will provide a written description of their creative artwork design.

Opportunities to extend learning: (homework?, additional assignments?)
Assignment Task: The Metropolitan Nashville Arts Commission has asked your team to create an additional piece of artwork to be a part of the McCabe Park Community Center. Create a proposal poster to submit for review.

Appendices: (list all accompanying documents, such as assignment handouts, reflection forms,)

- Math Task 1
- Math Task 2
- Assignment Task
- 3-2-1 Exit Ticket
- Assignment Task Proposal

<u>Math Task 1:</u> The Metropolitan Nashville Arts Commission is hosting a dinner at the McCabe Park Community Center. Your graphic arts design team has been assigned a project to create promotional materials for the dinner using pictures of *Aileron*, a public sculpture created by Michael Dillon.

Part 1: Create a poster that is proportional to the photograph of *Aileron*.

You are given a photograph of *Aileron* that is 4 inches tall and 6 inches wide. Determine the height of the poster if the width is 12 inches. *Hint: Label each photograph*.

Show your calculations:

Explain how you solved the problem:

Part 2: Create a dinner program that includes a photograph of *Aileron*.

You are given a photograph of *Aileron* that is 4 inches tall and 6 inches wide. Determine the height of the program picture if the photograph is 2 inches tall. *Hint: Label each photograph*.

Show your calculations:

Explain how you solved the problem:

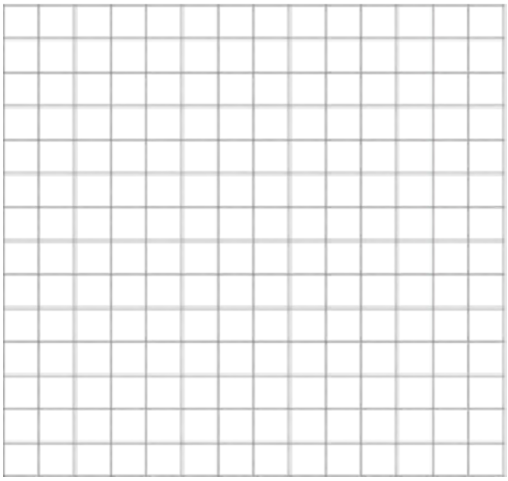
Part 3: Determine the proportionality of the photographs.

Create a table that includes the width and height of the three pictures used.

Width	Height

What observations can be made from the table?

Graph the width and height of the photographs on the coordinate plane:



Are the photographs directly proportional? Explain your reasoning.

Part 4: The project manager asks you to create a postcard with a photograph of *Aileron* that is 3 inches tall and 4.5 inches wide. Determine if the photograph is directly proportional to the other photographs in your assignment.

Explain your thinking. Use a table, graph, and/or equation as evidence to support your conclusions.

<u>Math Task 2:</u> The Metropolitan Nashville Arts Commission has asked your team to create a replica of Michael Dillon's sculpture, *Aileron,* to house inside a display case at the McCabe Park Community Center.

Part 1: *Aileron* is 18 feet tall and 25 feet wide. Create a replica that is 4 ½ feet tall and is proportional to the sculpture of *Aileron*.

Draw a sketch and show your calculations:

Explain how you solved the problem:

Part 2: *Aileron* is 18 feet tall and 25 feet wide. Create a replica that is 12 ½ feet wide and is proportional to the sculpture of *Aileron*.

Draw a sketch and show your calculations:

Explain how you solved the problem:

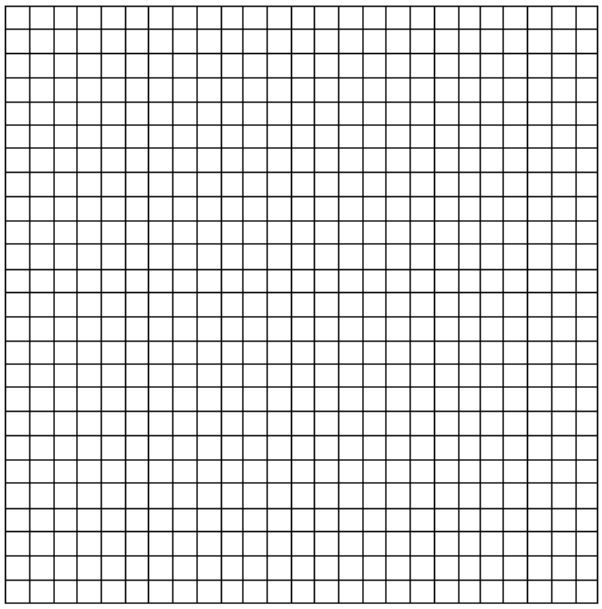
Part 3: Determine if the Aileron sculpture and replicas are directly proportional.

Create a table that includes the width and height of the sculpture and replicas.

Width	Height

What observations can be made from the table?

Graph the width and height of the photographs on the coordinate plane:



Are the photographs directly proportional? Explain your reasoning.

The Metropolitan Nashville Arts Commission has asked your team to create an additional piece of artwork to be a part of the McCabe Park Community Center. Create a proposal poster to submit for review.

Part 1: Watch the video of artist Michael Dillon.
http://www.youtube.com/watch?v=YOj7w1mdcR8

Part 2: Sketch an initial design for a new piece of artwork to be displayed at the McCabe Park Community Center.

Write a brief description/overview of your design:

Determine the height and width of your artwork. Include the dimensions of your artwork in proportion to the initial design. Show your work and explain your reasoning.

Assignment Task Description of your artwork: Width and Height of sketch:	**Assignment Task** Description of your artwork: Width and Height of sketch:
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3-2-1

Write 3 things that you learned:
1)
2)
3)

Write 2 things that you want to know more about:
1)
2)

Write 1 thing that you do not understand.
1)

3-2-1

Write 3 things that you learned:
1)
2)
3)

Write 2 things that you want to know more about:
1)
2)

Write 1 thing that you do not understand.
1)

3-2-1

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1)
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1)

3-2-1

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1)
2)

Write 1 thing that you do not understand.
1)