NATIONAL MUSEUM OF THE UNITED STATES AIR FORCE™

Mosaic Mural Mathematics

Students will learn about an amazing example of mosaic/ceramic tile artwork, as well as to learn about basic mathematics and how they are applied to the design of this mural.

LESSON PLAN

Learning Objectives:

The students will:

- Learn about the incredible 'first flight' mural, and how it was designed and built
- Learn about basic mathematics and how they may be applied to this ceramic tile masterpiece
- Learn about the Wright brothers and their first powered, controlled, heavier-than-air flight

Purpose:

Students will learn about significant milestones in the history of the Wright brother's innovations for flight. Students will learn how to find percentages of all the pieces within the Wright brother's mosaic mural. They will also learn how to categorize each section of the mural to better understand the best way to organize unique pieces of work.

Introduction:

In the early 1900s, the Wright brothers, from Dayton Ohio, started to develop gliders that were controlled by human interaction. This was the first time all three axes of motion had been controlled in the air by a human (roll, pitch and yaw). The Wright brothers developed a small, 12-horsepower engine to power their aircraft, and they also designed the two large propellers that would be required. The propellers were counter-rotating and they actually 'pushed' the airplane through the air. On December 17, 1903, Orville flew the aircraft 120 feet in 12 seconds. Wilbur piloted their fourth flight that day and it lasted for 59 seconds. The 'first flight' mosaic/ceramic tile masterpiece was created by Read Viemeister of Yellow Springs, Ohio, and it is 61 feet long and 17 feet high. The mural consists of 163, 296 ceramic tiles, and each one is only .91 inch square. There are 20 different designs on the tiles themselves, and the artistry includes a likeness of Orville, one of Wilbur, the date of the first flight, a side silhouette of the 'Flyer,' a wind tunnel, seagulls, an in-flight view of the aircraft, a plan view of the airplane, Icarus, etc. The print was made from the original glass negative taken at Kitty Hawk, N.C. on December 17, 1903.

Grade Level: 6 - 8

Ohio Learning Standards/Social Studies (2018)
History:
Heritage

Ohio Learning Standards/Mathematics (2017)
Ratios & Proportional Relationships
6.RP.3.c.: Find a percent of a quantity
7.RP.1: Compute unit rates associated with ratios of fractions

Number System
7.NS.2: Extend previous understandings or multiplication & division

Expressions & Equations
7.EE.4: Use variables to represent quantities in mathematical problems
8.EE.7: Solve linear equations in one variable

Materials Required:

- Magic board and markers
- Overhead/digital projector
- Demo items and materials for students as listed within lesson plan

Procedure:

A. Warm-up

1. Review the introduction section and important information regarding the Wright brother's mosaic mural:
   a. 61 feet long and 17 feet high
   b. 163,296 ceramic tiles
   c. Each tile is .91 inches per square
   d. 20 different designs within mural

2. Review equations, units, and other mathematical practices that can define area, count of objects, and percentages.

3. Pass out copies of the ceramic tile 'symbols' chart on page 4. You may wish to round the numbers off before making copies for students (to reduce large amount of decimals).

B. Activity

1. Find the area of the mosaic mural, define the units being used, and explain the equation being used.

   Area = length times width

   Area = 61 feet times 17 feet = 1,037 $feet^2$

2. Find the surface area of the rectangular mosaic mural in **square inches**. Show work, units, and understand the equations being used.

   First, find the area of a single square foot in inches: 12 inches times 12 inches = 144 $inches^2$

   Then, multiply the square inches in 1 foot times the number of square feet in the mural:

   144 times 1,037 = 149,328 $inches^2$

3. FACT: Each tiny ceramic tile of the First Flight mural is 0.91 $inches^2$. Since 0.91 $inches^2$ is smaller than a square inch, there are <u>more</u> .91 square inch tiles on the mural's surface than square inches.

4. Ask the students what the percent-to-total mural tiles the Orville Wright ceramic tiles represent.

5. Ask students how they arrived at the solution to this percentage problem.

6. One method to get the percent-to-total is to divide the Orville tile number (17,746) by the total number of tiles in the mural (163,296) and the quotient is 10.85 (10.85 is the percentage of all the mural tiles that the Orville tiles represent).

$$\frac{17{,}746}{163{,}296} = 0.1087 \text{ times } 100 = 10.87\ \%$$

7. Another way to find the answer is to use the ratio method: 163,000 is to 100 percent as 17,700 is to 'x' (where the value for 'x' is the Orville tile percentage).

$$\frac{163{,}296}{100}\ times \frac{17{,}746}{x}$$

Cross multiply 17,746 times 100 and that yields 1,774,600. Divide that number by 163,296 and the value for 'x' (the percent-to-total for Orville's tiles) is 10.87 %.

8. Use these problem solving techniques to find the rest of the percentages of mural tiles on the worksheet provided. (Answers on page 5)

9. Possible extension: have students hypothesize/research the relationship between each symbol and the first flight.

C. Wrap-up

1. Review all problems, answers, and units to make sure that there are no mistakes or errors.

Assessment/Evaluation:

The students should be evaluated on their class participation, listening skills and ability to follow instructions.

Resources/References:

Wright brothers' history:
https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197462/meeting-the-challenge-the wright-brothers/
http://wings.avkids.com/Book/Wright
https://www.nps.gov/wrbr/index.htm
https://www.history.com/topics/inventions/wright-brothers
https://www.biography.com/news/orville-wilbur-wright-brothers-first-flight
https://airandspace.si.edu/exhibitions/wright-brothers/online/

Wright Brothers Mosaic Mural:
https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/196846/first-flight-mural/

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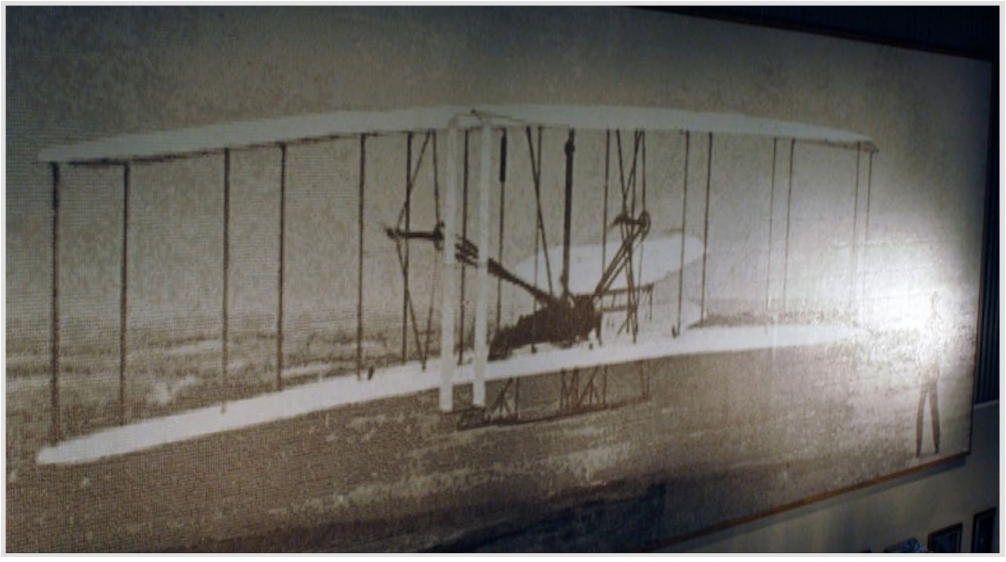
Ceramic Symbols Sheet

(THE FOLLOWING CHART DOES NOT INCLUDE EVERY TILE SYMBOL CONTAINED IN THE MURAL)

'SYMBOLS' ON CERAMIC TILES	# OF TILES
ORVILLE WRIGHT	17,746
WILBUR WRIGHT	17,889
ORVILLE DRESSED FOR FLIGHT	16,371
ICARUS	13,474
DATE OF FIRST FLIGHT	12,610
HAND TOOL USED	11,218
SEAGULLS	10,896
IN-FLIGHT VIEW OF FIRST AIRPLANE	9,873
PLAN VIEW OF FIRST AIRPLANE	8,745
YEAR OF FIRST FLIGHT	6,898
BICYCLE AND EARLY WRIGHT PROPELLER	6,331
SOLID COLOR TILE (LIGHT)	6,058
WRIGHT WIND TUNNEL	4,579
OTHER	20,608



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Ceramic Symbols ANSWER Sheet

(THE FOLLOWING CHART DOES NOT INCLUDE EVERY TILE SYMBOL CONTAINED IN THE MURAL)

'SYMBOLS' ON CERAMIC TILES	# OF TILES	% of Total
ORVILLE WRIGHT	17,746	10.87%
WILBUR WRIGHT	17,889	10.95%
ORVILLE DRESSED FOR FLIGHT	16,371	10.02%
ICARUS	13,474	8.25%
DATE OF FIRST FLIGHT	12,610	7.72%
HAND TOOL USED	11,218	6.87%
SEAGULLS	10,896	6.67%
IN-FLIGHT VIEW OF FIRST AIRPLANE	9,873	6.05%
PLAN VIEW OF FIRST AIRPLANE	8,745	5.36%
YEAR OF FIRST FLIGHT	6,898	4.22%
BICYCLE AND EARLY WRIGHT PROPELLER	6,331	3.88%
SOLID COLOR TILE (LIGHT)	6,058	3.71%
WRIGHT WIND TUNNEL	4,579	2.80%
OTHER	20,608	12.63%
TOTAL	163,296	100%