

# ARTFUL CONNECTIONS WITH MATH GRADE 2

## Place Value Sculpture

3 sessions – 90 minutes each

**Essential Question:** How can we use sculpture to depict a number?

**Lesson Goal:** Students group objects in ones, tens and hundreds to count to a 3-digit number. They use color and length to visually differentiate between place values, and create an abstract wire sculpture that depicts their 3-digit number.

### Lesson Objectives:

Students will be able to:

- count out a given number in groups of ones, tens, and hundreds
- say and write the given number in word and expanded form
- demonstrate beginning skill in the use of watercolor paint
- create three-dimensional form

### Common Core State Standards

#### Number and Operations in Base Ten 2.NBT: Understand Place Value

1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:
  - a. 100 can be thought of as a bundle of ten tens — called a “hundred.”
  - b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).
2. Count within 1,000; skip count by 5’s, 10’s, and 100’s.
3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.
4. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using  $>$ ,  $=$ , and  $<$  symbols to record the results of comparisons.

### California Visual Art Content Standards

ARTISTIC PERCEPTION 1.3: *Identify the elements of art in objects in nature, the environment, and works of art, emphasizing line, color, shape/form, texture, and space.*

CREATIVE EXPRESSION 2.2: *Demonstrate beginning skill in the use of art media, such as watercolors.*

HISTORICAL AND CULTURAL CONTEXT 3.1: *Explain how artists use their work to share experiences or communicate ideas.*

AESTHETIC VALUING 4.2: *Compare different responses to the same work of art.*



## **Materials**

- Aluminum wire: 14 gauge
- Salad Macaroni
- Water colors/brushes
- Water cups
- Insulation foam/sheathing (cut into 4" squares)
- Butcher paper/newspaper
- Pencils
- Pipe Cleaners

Preparation: Cut insulation foam into 4" squares; cut wire into lengths for ones, tens hundreds

## **Key Vocabulary**

Visual art: sculpture; form; key

Math: hundreds; tens; ones; digit; place value

## Pre-Session Math Lesson

- **Focus Question 1:** What does the word value mean? Explain.
- **Focus Question 2:** Why is place value important in mathematics? Explain.

Students can do this in cooperative groups. Students can use other forms of the word value (such as valuable) to get an idea of the definition. Have students discuss what they think value means.

### Manipulative use:

Students use base ten blocks to “create” numbers on their place value mat (Workmat 6). Start out with a small number (0-19). Say a number and have student create that number using base 10 blocks. Walk around the room to check for understanding. Be very specific about the words you use

Ex. How many ones are in the number 19? How many tens are in the number 19?  
How many tens are in the number 67? How many ones are in the number 67?

As they gain more confidence, allow students to choose their own numbers for their table or group.

Students can divide a paper into fourths and visually represent four different numbers.

- Students need to understand that digits are symbols representing a numerical amount or **value**.
- The base 10 system has 10 digits (0-9) and is the way we organize our numbers. We cannot have any more than nine in each place value. If there are more than nine in any place value, we must regroup.

## Place Value Chart & Key

- Students create three columns in their journals and label them “hundreds,” “tens,” and “ones.”
- Have three small pieces of paper available for each student.
- Review meaning of digit. Ask students to choose 3 digits and write one on each piece of paper. All three digits must be different and students should not include zero.
- Students arrange their digits and read out the three-digit number it creates. Students write this number in word form and expanded form in their math journals.
- Shuffle digits to create a new three-digit number and repeat so that students understand that one digit can have different values, depending on its place. Students should attempt to find all 6 numbers that their digits can create.

| Hundreds | Tens  | Ones | Word Form                | Expanded Form |
|----------|-------|------|--------------------------|---------------|
| 3        | 5     | 6    | Three-hundred fifty-six  | $300+50+6$    |
| 3        | 6     | 5    | Three-hundred sixty-five | $300+60+5$    |
| 6        | 3     | 5    | Six-hundred thirty-five  | $600+30+5$    |
| 6        | 5     | 3    | Six-hundred fifty-three  | $600+50+3$    |
| 5        | 3     | 6    | Five-hundred thirty-six  | $500+30+6$    |
| 5        | 6     | 3    | Five-hundred sixty-three | $500+60+3$    |
| Yellow   | Green | Blue |                          |               |

## Session 1 – Place Value Key, Pipe Cleaner Warm-Up, Begin Counting Macaroni

### ACCESS PRIOR KNOWLEDGE (5 min)

- What is a digit?
- What do you know about place value?

Show students a sample place value sculpture and tell them it represents a number. Ask them to figure out what number it represents. Discuss how both artists and mathematicians use systems.

### WARM UP ACTIVITY (30 min)

- Ask students to choose a 3-digit number from the chart in the pre-session math lesson.
- Give students pipe cleaners of three different lengths and three different colors. Students assign a color and length to each place value on their chart. (The long length to the hundreds column, medium length to the tens column, and short length to the ones column).
- Students take the amount of pipe cleaners needed to represent the digits in each place value of their 3-digit number (e.g. 3 long yellow pipe cleaners for 3 hundreds).
- Demonstrate different ways to manipulate wires (curved line, angular lines etc...) and link wires together to create three-dimensional form.
- Students experiment with bending their wire to create different shapes and forms.  
*Note: This can also be done with different lengths and colors of yarn. Students can glue the different pieces of yarn on a piece of paper. This can also be a drawing exercise in which students use different colors to create different lengths and types of lines.*

### ART ACTIVITY (40 min)

*Note: Numbers higher than 199 will be difficult for students to complete in one session if working alone. For numbers greater than this, students can work in pairs or groups.*

#### Hundreds

- Use a long piece of wire (about 30") for each digit in the hundreds place.
- Create a hook (or bend) at one end of the wire to prevent macaroni from falling off.
- String macaroni onto wire in groups of ten. After each ten beads, poke a small piece of paper on to wire, so groups of ten will be separate and students can keep track of counting. When finished, tie another hook at opposite end.

#### Tens

- Students use a shorter piece of wire (about 6") for each digit they have in the tens place.
- Create a hook at one end of the wire to prevent macaroni from falling off.
- String ten macaroni onto wire and tie another hook at the opposite end.
- Repeat for as many tens as there are in the three-digit number.

#### Ones

- Students use a small piece of wire (about 2") for each digit they have in the ones place.
- Create a hook at one end of the wire so macaroni does not fall off.
- Place one macaroni bead on the wire and tie another hook.
- Repeat for as many ones as there are in the number.

### CLOSURE (15 min)

- Why do we need place value? How can you make two different numbers using the same digits? How will you know which number is greater?

## Session 2 – Finish Counting Macaroni, Paint Macaroni

### **ACCESS PRIOR KNOWLEDGE** (5 min)

- How can you create a sculpture that represents a 3-digit number?
- What do you know about the way artists and mathematicians use systems?

### **WARM UP ACTIVITY** (40 min)

- Students finish beading the number they began during the previous session.

*Note: Students who are struggling can work with a partner to create one number. Students or groups who finish early can create a higher number by adding more beaded wires or they can create another 3-digit number, putting the same digits in a different order.*

### **ART ACTIVITY** (30 min)

- Students assign a color to each column on their place value chart.

*Note: The teacher can designate a place value color key for the whole class to use (e.g. all hundreds are yellow, all tens are blue etc...). This will make it easier to identify the number each sculpture represents, but will limit the individuality of each student's work. Alternately, students who understand color theory can be given guidelines such as choose three warm/cool, primary/secondary colors, etc....*

- Demonstrate how to use a watercolor brush. Show students that color appears darker with more paint and less water. Tell students that too much water will make their macaroni soggy.
- Paint macaroni beads with long strokes up and down the full length of the wire. Continually rotate the wire to paint all sides.

### **CLOSURE** (15 min)

- Place all the macaroni beads on desks. Ask students to walk around the room and write down what number they think each student created.
- How long did you think it would take to count your number? Were you right?
- What did you learn about using watercolor?

## Session 3 – Look at Art, Create Sculpture, Reflect

### **ACCESS PRIOR KNOWLEDGE** (5 min)

- How does place value help you count a number?
- What do you know about sculpture?

### **ART OBSERVATION** (20 min)

Show students “Star Cage” and ask the following questions; comparing different students’ responses:

- What do you see?
- How would you describe the lines that you see?
- How would you describe the shapes/forms that you see in this sculpture?
- What materials do you think this sculpture is made of?
- How do you think this artist attached all the pieces together?
- The title of the first sculpture is “Star Cage”. What ideas or experiences do you think this artist is trying to communicate through his sculptures?

Tell students about the life of artist David Smith.

### **ART-MAKING ACTIVITY** (35 min)

- Once students have explored different shapes for their sculpture, pass out foam bases.
- Students write their number in standard, expanded and word form on the bottom of the foam.
- Students compose a sculpture by intertwining wire to create three-dimensional form.

*Note: Teacher can require students to create particular 3-dimensional forms (e.g. a head, building, etc...) to connect to other content areas or subjects being studied in the classroom. To vary forms, some students can hang their sculpture upside down from the base, create a mass out of their wires, rather than a line sculpture, or combine with classmates’ sculptures.*

*Extension: Students who finish early can create a drawing of their sculpture in their notebooks.*

### **CLOSURE** (30 min)

- Students conduct a gallery walk around the classroom. As they look at each sculpture, they write the person’s name and what number they think the sculpture represents.

Regroup students and ask the following question, comparing different students’ responses:

- What kind of lines do you see? What kind of forms do you see?
- Is there anything you saw in the art example that gave you ideas for your own artwork?
- What ideas were you trying to communicate in your artwork?

**POST-SESSION DEBRIEF:** The day after this session, review what the students have learned about place value.

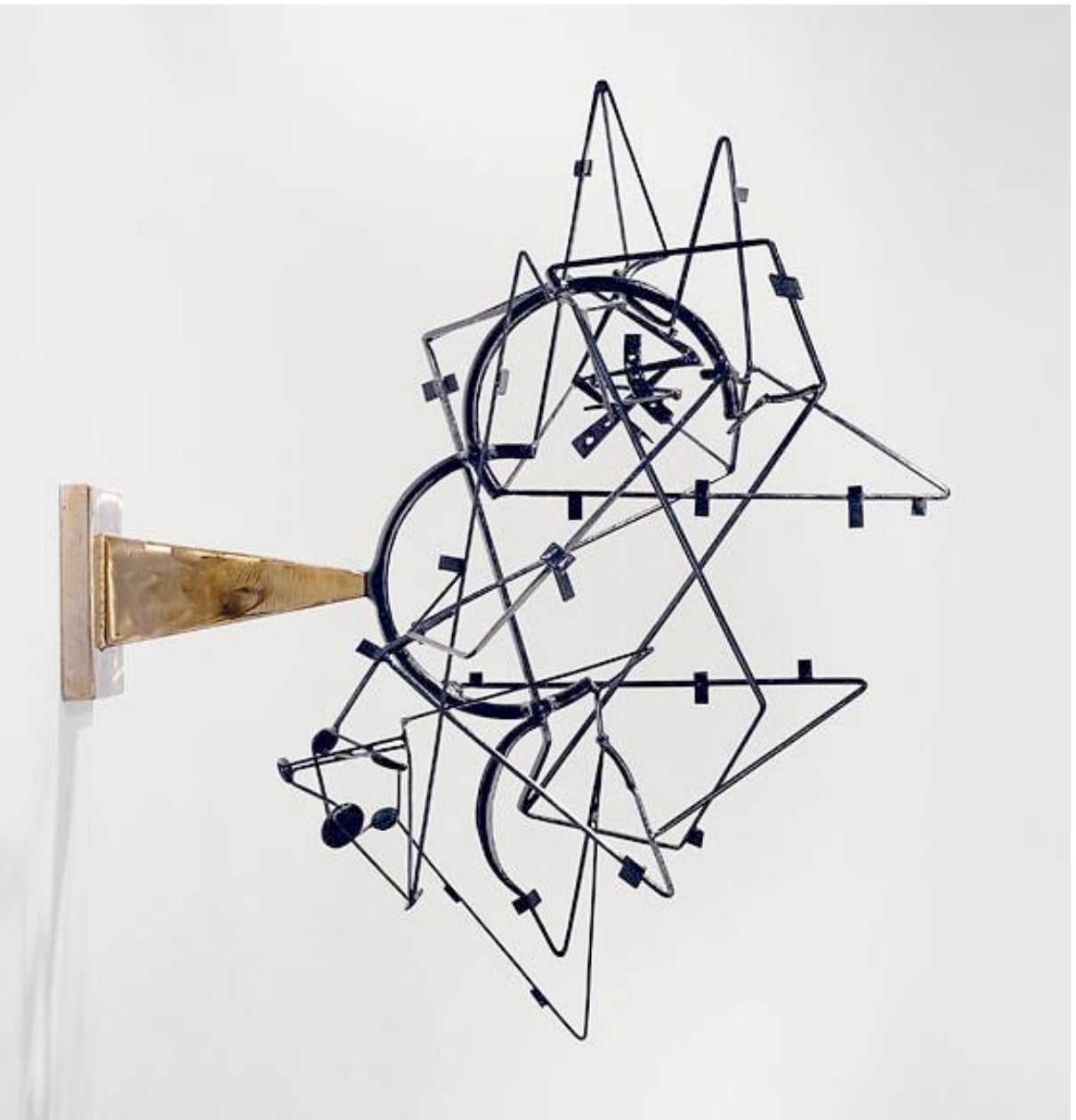
- **Focus Question 3:** How did the place value sculpture help explain or clarify place value as we understand it in mathematics? Explain.

Answers can be brainstormed by the class as a whole and then recorded in art journals with pictures to help clarify students' understanding.

### Activities

Sculptures can be used to do interactive math activities using 3-digit numbers.

- Find the person at your table with the least/greatest number.
- Order all sculptures in the class from least to greatest
- Which sculpture has the most hundreds? Tens? Ones?
- Add the numerical value of your neighbor's sculpture to the numerical value of your sculpture.
- Add together all the sculptures at your table/in the class.
- Subtract the numerical value of your neighbor's sculpture to the numerical value of your own.



**Star Cage, David Smith, 1950**

Frederick R. Weisman Art Museum, University of Minnesota, the John Rood Sculpture Collection

Photo courtesy the Frederick R. Weisman Art Museum at the University of Minnesota

## David Smith

This sculpture shows students how wires can be manipulated to create 3-dimensional space. “drawing with wire”, connecting wires, creating intersections that are structurally important to holding the sculpture together. David Smith explore balance, metal pieces that are attached to wire, are reminiscent of the way students string objects onto their wire. Discuss the title of the sculpture. There are open spaces and intersections where the sculpture is stuck together.

David Smith was born March 9, 1906, in Decatur, Indiana. During high school, he took a correspondence course with the Cleveland Art School. He worked as an automobile welder and riveter in the summer of 1925. He then attended University of Notre Dame, Indiana, for two weeks before moving to Washington, D.C. In 1926, Smith moved to New York, where he studied at the Art Students League with Richard Lahey and John Sloan and privately with Jan Matulka. In 1929, Smith met John Graham, who later introduced him to the welded-steel sculpture of Pablo Picasso and Julio González.

In the Virgin Islands in 1931–32, Smith made his first sculpture from pieces of coral. He began making completely metal sculpture in 1933, and in 1934 he set up a studio at the Terminal Iron Works in Brooklyn. From 1935, Smith committed himself primarily to sculpture. In 1937, he made sculpture for the WPA Federal Art Project. Smith’s first solo show of drawings and welded-steel sculpture was held at Marion Willard’s East River Gallery in New York in 1938.

In 1940, he settled permanently in Bolton Landing. From 1942 to 1944, Smith worked as a locomotive welder in Schenectady, New York. In 1962, at the invitation of the Italian government, Smith went to Voltri, near Genoa, and executed 27 sculptures for the Spoleto festival. In 1963, he began his *Cubi* series of monumental, geometric steel sculptures. Smith died May 23, 1965, in an automobile accident near Bennington.

selection from [www.guggenheim.org](http://www.guggenheim.org)

## Place Value Sculpture Rubric

|                                                                                                                                 | <b>1</b><br>Does not meet<br>Expectations                                         | <b>2</b><br>Approaching<br>Expectations                                      | <b>3</b><br>Meets<br>Expectations                                                                                        | <b>4</b><br>Exceeds<br>Expectations                                                                                     | Total<br>Score |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>A. Sculpture is a free-standing three-dimensional form.</b>                                                                  | Most wires are not connected to the base and sculpture does not stand on its own. | All wires are connected to the base but sculpture does not stand on its own. | Sculpture is free-standing but all wires are not connected to the base.                                                  | All wires are connected to the base and sculpture is free-standing.                                                     |                |
| <b>B. Sculpture demonstrates an ability to use watercolor paint.</b>                                                            | No macaroni beads are painted.                                                    | Color is evident on some macaroni beads.                                     | Most macaroni beads are painted.                                                                                         | All macaroni beads are painted fully.                                                                                   |                |
| <b>C. Macaroni bead colors correspond to place values.</b>                                                                      | Place values cannot be determined by the colors.                                  | Macaroni beads in the same place value are painted different colors.         | Most macaroni beads in the same place value are painted the same color. A distinct color is chosen for each place value. | All macaroni beads in the same place value are painted the same color. A distinct color is chosen for each place value. |                |
| <b>D. Sculpture depicts number on bottom of foam core.</b>                                                                      | None of the three place values depicted match the number.                         | Only one place value is depicted correctly.                                  | At least two place values are depicted correctly.                                                                        | Sculpture shows the correct number of hundreds, tens, and ones.                                                         |                |
| <b>E. Wire lengths correspond to place value.</b><br><i>Optional depending on whether lengths of wires were pre-cut or not.</i> | Place values cannot be determined by the lengths of pipe cleaners.                | Different length wires represent the same place value.                       | Most wire representing the same place value are the same length.                                                         | All wires representing the same place value are the same length.                                                        |                |
| <b>F. Artwork demonstrates an understanding of warm/cool colors.</b><br><i>Optional</i>                                         |                                                                                   |                                                                              |                                                                                                                          |                                                                                                                         |                |