PLACE VALUE ART Grades 3-8

PROJECT OVERVIEW

The art of Wassily Kandinsky "Several Circles" at right is the inspiration for this project. Place value is connected to object size in this project. If the ones place is represented by a small circle, it stands to reason that a circle representing the tens place must have ten times the area of the small circle and the 100's place must be ten times the area of the 10's circle. Students demonstrate their understanding of place value by representing numerical values with illustrations of those values using different sized geometric shapes.

CCSS MATH PRACTICE and NATIONAL CORE ART STANDARDS

National Core Art Anchor standards 6 and 8: Convey and interpret meaning in visual art.
Math Practice Standard 1: Make sense of problems and persevere in solving them.
Math Practice Standard 2: Reason abstractly and quantitatively
Math Practice Standard 6: Attend to precision
Math Practice Standard 7: Look for and make sense of structure
Math Practice Standard 8: Look for and express regularity in repeated reasoning

MATERIALS

This project can be done with myriad art supplies. One possibility is circle stickers. Another is circle templates (cups, lids, coins, etc). The most precise tool for circle making is a compass or circle template. The project can be done as a quick sketch or an elaborate art project with colored pencils, watercolor pencils and paints. Paper can range from plain bond paper or journals (for quick sketches) to watercolor paper or canvas.

LESSON SEQUENCE

Students should know that our number system uses a "place value system" of ones, tens, hundreds, etc. Use the resource page (back) to discuss how this could be shown visually. The first question allows the student to represent 10 as either 1x10 or 2x5 but the next question restricts the possibility to a square. This is challenging because the square can easily be 2x2 or 4 sq. units or 3x3 (9 sq. un) or 16, but 10 is an irrational number. Logically, it has to be a little more than 3 units wide and 3 units tall to be 10 squares total. (The exact amount is $\sqrt{10}$ or about 3.16)

In the third problem, students may be confused about the overlapping shapes. They need to know the black squares represent 1 whether you see all of the square or not. Artists use "overlap" to create depth or space in their images. Have students practice representing different quantities as suggested at the bottom of the page before moving to circles. Stay with squares if that is appropriate for your students.

The conceptual leap from squares to circles is challenging. The concept is that if we want to have a circle with ten times the area of a smaller circle, then it too must be about 3 times the diameter of the smaller circle. Resource page to help this discussion provided. At this point students can represent any number using small, medium, large, etc circles as long as each is about 3 times the diameter of the previous circle. (4 large, 2 medium, 3 small means 4x100 + 2x10 + 3x1= 423) Notice the use of expanded notation.

EXTENSIONS

One challenge could be representing numbers with 0's in a place value such as 2,034. The value of an circle representation is only known when we know the ***meaning*** of any one of the circles. If a large circle is 1 (instead of 100), then 4 large, 2 medium and 3 small could mean 4x1 + 2x0.1 + 3x0.01 or 4.23. Jumps in place value are also challenging. If a circle with a diameter of 2 cm represents tens place, what is the diameter of a circle representing 1000? (since we jumped over two place values, it must be 20 cm instead of about 6.3 cm) Deciding how much structure to provide is important. How much can students figure out on their own? It is important that students justify the object sizes they have chosen based on mathematical reasoning. There are tremendous opportunities for productive struggle in this project; teachers must resist the urge to do the thinking for the students in order to expedite the process.