

## Lesson Plan: Using Scale Drawing to Enhance Creativity

### Introduction

During activities in which students are creating their own individual designs with the Extraordinaires Design Studio®, the following lesson may be conducted at any time to emphasize the relationship between measurement and design thinking. *For the purposes of differentiation, this lesson may be given to students who have advanced farther with their designs than other students who require more time to develop their work.*

### Learning Objective & Standards

Given the current status\* of their Design Challenge project and Idea Pad paper, students will use their knowledge of multiplication and scaling to compare their designs with known objects in order to calculate measurements, diagram their design, and verify their creative concepts.

- **CCSS.MATH.CONTENT.5.NF.B.5.** Interpret multiplication as scaling (resizing), by:
  - **CCSS.MATH.CONTENT.5.NF.B.5.A.** Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
  - **CCSS.MATH.CONTENT.5.NF.B.5.B.** Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence  $a/b = (n \times a)/(n \times b)$  to the effect of multiplying  $a/b$  by 1.
- **CCSS.MATH.CONTENT.5.NF.B.6.** Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

\*Status of the students' designs: This lesson may work at a variety of intervals in the design process, but is best implemented when a student has developed ideas for meeting the goals of a Design Challenge.

### Materials

- Each student's current iteration of his or her Design Challenge creation.
- Copies of the Idea Pad paper, or a shared Extraordinaires Design Studio®.
- A handout or display of the resource "Math on an Idea Pad."

### Anticipatory Set or Do Now

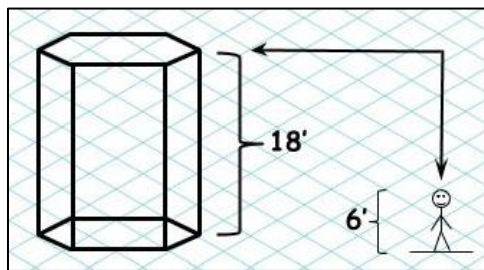
The teacher will present the following Extraordinaire-based problem to the students: "A pocket flashlight for the Giant needs to shine three times farther than your pocket flashlight, which has a range of 6 feet. How far does the Giant's pocket flashlight need to shine? Calculate the answer, and then, on any piece of paper, draw a picture of yourself and the Giant using pocket flashlights to illustrate the difference in ranges." Adding background images to the picture may also encourage students to use a variety of thinking strategies to illustrate scale differences.

### Direct Instruction

The teacher will activate students' prior knowledge of fraction equivalence by using the Anticipatory Set example [Three times the range of 6' equals 18', or  $6 \times 3 = 18$ ] to identify multiplicative patterns. Phrasing the example as "For every 1 foot of light from your pocket flashlight, the Giant would need 3 feet of light from her pocket flashlight," the teacher articulates the proportions to the scale of the example.

The teacher then puts the information in the form of  $1/3 = (n \times 1)/(n \times 3)$  to give the students the fractional version of the word statement. When plugging in the data to the written version of the answer's explanation, the scaling becomes  $(n \times 1)/(n \times 3) = 6/18$  when  $n=6$ .

The teacher will then present the following section of the "Math on an Idea Pad" sheet:



The teacher will explain how the same scaling and resizing calculations can be applied to drawings. Looking at the drawing, the teacher shows how this designer made each box equal 3' and used a 6' person to show how high the object was in relation.

### Formative Assessment

- Before making their own drawings, students should decide what they will use as a measurement reference. Once they have that, they should create their own mathematical scale in inches or feet as an equation.
- The teacher circulates to evaluate students' comparisons and check their equations.

### Student Activities

Once students have their equations, they can sketch their scale drawings. During sketching, students should:

- Use the isometric Idea Pad to capture depth as well as height and width of their design.
- Calculate scaling and include all fractions on the drawing.
- Evaluate their ideas with this new perspective on their design.

### Independent Practice

Students should create a presentation-worthy version of the sketching that they do in class.

### Summary

The teacher will note to the class that working in scale both in numbers and drawings can lead to creative inspiration. The teacher will ask students what new ideas about their designs did they discover by incorporating numerical measurement in their concept.