Lesson 3: Patterns in Multiplication

Standards Alignments

Addressing 4.NF.B.4, 4.NF.B.4.a

Teacher-facing Learning Goals

- Evaluate multiplication expressions and recognize that $n \times \frac{1}{b} = \frac{n}{b}$.

Student-facing Learning Goals

- Let's look at patterns in multiplication of a fraction by a whole number.

Lesson Purpose

The purpose of this lesson is for students to understand that every fraction can be written as the product of a whole number and unit fraction.

In this lesson, students analyze two sets of multiplication expressions: one in which the number of groups is kept constant, and another in which the size of each group (a unit fraction) is kept constant. They look for regularity as they reason repeatedly about the expressions and their values (MP8). The patterns that emerge in the series of expressions formalize their prior observations about the value of $a \times \frac{1}{b}$ as $\frac{a}{b}$. They also enable students to see any fraction as a product of a whole number and unit fraction.

Note that students may write either $a \times \frac{1}{b} = \frac{a}{b}$ or $\frac{1}{b} \times a = \frac{a}{b}$ as long as they understand what each factor represents. Teachers can reinforce the meaning of each factor by consistently writing the multiplication in this order: $\text{number of groups} \times \text{size of each group} = \text{total amount}$. This corresponds to how we tend to express situations with equal groups, which in the case of fractional amounts, is "_____ (whole number) groups of _____ (fraction)."

Access for:

Students with Disabilities

- Representation (Activity 1)

English Learners

- MLR8 (Activity 2)

Instructional Routines

Choral Count (Warm-up)

Materials to Gather

- Paper: Activity 2

Lesson Timeline

Warm-up	10 min
Activity 1	15 min
Activity 2	20 min
Lesson Synthesis	10 min
Cool-down	5 min

Teacher Reflection Question

In tomorrow's lesson, students multiply a non-unit fraction by a whole number, such as $5 \times \frac{2}{3}$. How can students apply their understanding from today to reason about these expressions tomorrow?

Cool-down (to be completed at the end of the lesson)

5 min

Fraction Multiplication

Standards Alignments

Addressing 4.NF.B.4

Student-facing Task Statement

1. Complete each equation to make it true. Show your thinking using words or diagrams.
   a. $5 \times \frac{1}{8} =$ _____
   b. _____ $\times \frac{1}{3} = \frac{7}{3}$
2. Write each fraction as the product of a whole number and unit fraction.
   a. $\frac{8}{9} =$ _____ $\times$ _____
   b. $\frac{6}{5} =$ _____ $\times$ _____

Student Responses

1. a. $5 \times \frac{1}{8} = \frac{5}{8}$. Sample response: Five groups of 1 eighth make 5 eighths.
   b. $7 \times \frac{1}{3} = \frac{7}{3}$. Sample response: A diagram showing 7 groups of $\frac{1}{3}$
2. a. $8 \times \frac{1}{9}$
   b. $6 \times \frac{1}{5}$