

Building Fraction Sense Using “Fractions Intro PhET Simulation”

Designed for a 6th-8th Grade Math Academic Support Class
(Could be used for 3rd, 4th, or 5th Grade)

Pre-Planning:

Students will come into this lesson with prior knowledge and exposure to fractions (Grades 3-5). Most, and probably all, students will have seen these representations and concepts in a previous math class but have not fully consolidated understanding of fraction and fraction number sense into their math abilities.

Materials:

- Each student will need a Chromebook to access <https://phet.colorado.edu/en/simulation/fractions-intro>
- [Student Handout](#) for each student
- [Exit Ticket](#) (there are 3 to a page)
- Optional - colored pencils

Learning Goals:

Students should be able to...

- Identify the parts of a fraction (numerator and denominator) and identify the differences and similarities of proper fractions, improper fractions and mixed numbers.
- Describe that the numerator and denominator have specific meanings and are represented in models as the number of shaded pieces and the total number of pieces respectively. (Example: that larger denominators indicate smaller pieces)
- Represent fractions through a variety of different representations including circle, rectangle, volume, and number line models.

Standards (from <http://www.corestandards.org/Math/>)

Develop understanding of fractions as numbers.

[CCSS.MATH.CONTENT.3.NF.A.1](#)

Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

[CCSS.MATH.CONTENT.3.NF.A.2](#)

Understand a fraction as a number on the number line; represent fractions on a number line diagram.

[CCSS.MATH.CONTENT.4.NF.A.1](#)

Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions..

[CCSS.MATH.CONTENT.6.NS.C.6.C](#)

Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Curriculum Alignment

- Aimed at gap filling for middle school students in a math support class.
- Supports 6th Grade CMP3 books “Let’s Be Rational” and “Comparing Bits and Pieces”
- Supports 7th Grade CMP3 books “Stretching and Shrinking” and “Comparing and Scaling”

Building Fraction Sense Using “Fractions Intro PhET Simulation”

Lesson Flow

Estimated Time: 50 minutes (1 class period)

	Teacher will...	Student will...
Warm-Up: (10 min)	<ul style="list-style-type: none"> ● Direct students to Fractions Intro PhET Simulation. ● Distribute Student Handout ● As students are exploring “Fraction Intro” ask them: <ul style="list-style-type: none"> ○ <i>What does the top number mean?</i> ○ <i>What does the bottom number mean?</i> ○ <i>Can you make a fraction that is bigger than 1?</i> ○ <i>What happens when you check the “Mixed Number” box?</i> ○ <i>What does the “Max” box do?</i> ○ <i>What are all the different ways to show a fraction?</i> ○ <i>How big can you make the bottom number?</i> ○ <i>How big can you make the top number?</i> ○ <i>What is the biggest number you can make?</i> ○ <i>What is the smallest number you can make?</i> ● Lead a short debrief of student’s observations of simulation and answers to Question 2. <ul style="list-style-type: none"> ○ Ask students to share any observations about the simulation. ○ Pick students to share out their answers from Question 2. ○ Make sure to emphasize that the numerator and denominator have specific meanings and are represented in models as the number of shaded pieces and the total number of pieces respectively. 	<ul style="list-style-type: none"> ● Explore PhEt simulation “Fraction Intro” only using the Intro tab at the bottom of the screen ● Fill in Questions 1 and 2. ● Participate in class discussion.
Activity Part 1: (10 min)	<ul style="list-style-type: none"> ● Support students in using PhET sim to answer Question 3, 4 and 5. ● Make sure the “Mixed Number” button is unchecked. <ul style="list-style-type: none"> ○ <i>How can you make the simulation show the picture on your activity sheet?</i> <ul style="list-style-type: none"> ■ <i>How many total sections do you need?</i> ■ <i>How many shaded sections do you need?</i> ■ <i>Which number does the denominator represent?</i> ■ <i>Which number does the numerator represent?</i> ○ <i>How many sections do you need to draw on your number line?</i> ○ <i>Do your number line sections need to be the same size?</i> ● Lead debrief of strategies and answers to Questions 3, 4, and 5. <ul style="list-style-type: none"> ○ Display (whiteboard, poster paper or digitally) student answers to Question 3 and determine <i>correct answers</i>. ○ <i>Which model did you look at to identify the largest and smallest numbers? Why?</i> ○ <i>Which model did you not use to identify the largest or smallest number? Why?</i> 	<ul style="list-style-type: none"> ● Use PhET sim to complete Questions 3-5 ● Participate in class discussion

	<ul style="list-style-type: none"> ○ Emphasize the similarities between the different models. Specifically the relationship between rectangle and number line. Also, discuss strategies that can be used to efficiently plot a fraction on a number line (denominator is number of equal sections). ○ Discuss strategies for determining larger and smaller fractions using each type of model. 	
Activity Part 2: (10 min)	<ul style="list-style-type: none"> ● Support students in using PhET sim to answer Question 6. ● Make sure the “Mixed Number” button is checked. <ul style="list-style-type: none"> ○ <i>Between which two whole numbers on the number line should your fraction be placed?</i> ○ <i>How many circles/rectangles do you need to draw for this fraction?</i> ○ <i>How are the fractions in this table different than the previous table?</i> ○ <i>What is the point of the “Mixed Number” button?</i> ● Lead debrief of strategies and answers to Question 6. <ul style="list-style-type: none"> ○ Emphasize that if the numerator is greater than the denominator then the fraction is greater than 1 and will require multiple circles/rectangles in those representations and will be larger than 1 on the number line. ● Display (whiteboard, poster paper or digitally) student answers to Question 6 and determine <i>correct answers</i>. 	<ul style="list-style-type: none"> ● Use PhET sim to complete Questions 6 ● Participate in class discussion
Activity Part 3/ Summary: (15 min)	<ul style="list-style-type: none"> ● Support students in answering Question 7. ● Give students/groups time to discuss and answer 7a, 7b. ● Guided questions for groups that are struggling with finding similarities and/or differences. <ul style="list-style-type: none"> ○ <i>What is the relationship between numerator and denominator of proper fractions (Table 1)?</i> ○ <i>What is the relationship between numerator and denominator of improper fraction (Table 2)?</i> ○ <i>What does a proper fraction represent?</i> ○ <i>What does the whole number in a “Mixed Number” mean?</i> ○ <i>What does the fraction in a “Mixed Number” mean?</i> ● Lead summary of activity <ul style="list-style-type: none"> ○ <i>Can you think of a quick way to go from “Improper Fraction” to “Mixed Number” without using a drawing?</i> ○ Emphasize proper fractions are between 0 and 1. ○ Emphasize improper fractions and/or mixed numbers are greater than or equal to one. 	<ul style="list-style-type: none"> ● Discuss with partner(s) about similarities and differences of proper, improper fractions and mixed numbers ● Complete Question 7 ● Participate in class summary
Exit Ticket: (5 min)	<ul style="list-style-type: none"> ● Hand out Exit Ticket 	<ul style="list-style-type: none"> ● Complete and submit Exit Ticket.
Extension Activity:	<ul style="list-style-type: none"> ● Have students work through Fraction Matcher Simulation 	<ul style="list-style-type: none"> ● Work individually on simulation.