stage 14:
introduction to fractions

Big Idea: Repeated Equal Groupings with Parts-to-Whole

The big idea of Repeated Equal Groupings with Parts-to-Whole is the most complex of the big ideas addressed so far. Similar to Repeated Equal Groupings this big idea involves repeating an equal sized group, or partitioning an amount into equal groups. It also involves a trio of parts to the whole. Not only do students have to keep track of the whole and its equal groups as with multiplication and division, but they also have to be mindful of the number of parts relative to the whole.

For example, with multiplication and division we need to work with the total, the size of the parts and the number of parts. There are 30 students in the class (the whole equals 30), the teacher divides the class into 5 groups (the number of parts equals 5), there are six students in each group (the size of the parts equals 6). This leads us to 30 divided by 5 equals 6.

Let's take the same Equal Groupings sample and add the Parts-to-Whole component. What if the teacher said that 1/5 of the class had siblings in lower grades: how can we determine how many students have siblings in lower grades? The fraction of one-fifth is a parts-to-whole representation. It means one part out of five parts. To determine how many students is equal to 1/5 of 30 we can first use Equal Groupings. Five equal groups of 30 means that there are 6 students in each group. Therefore, 1/5 of 30 equals 6.

It is for this reason that an in-depth understanding of Repeated Equal Groupings with Parts-to-Whole is fundamental to understanding fractions. Students need to understand that the big idea of Parts- to -Whole is fundamental to understanding fractions. Students need to understand the big idea of Parts-to-whole developed with addition and subtraction as well as the big ideas of Repeated Equal Groupings developed with multiplication and division. These two big ideas coordinated together give us Repeated Equal Groupings with Parts-to-Whole, the foundational idea for fractions. This perspective also helps us understand why fractions can be so difficult for students. Not only do they need to have mastery of the proceeding big ideas, but they need to coordinate them together.

Why are Repeated Equal Groupings Important?

When students are confronted with the complexity of fractions and do not have sufficient mastery of the necessary big ideas, they may resort to memorized strategies that lead to correct answers. They learn rules like "find the common denominator, then add." Or, "flip it and multiply." They might remind themselves that "the bigger the denominator the smaller the fraction." While these memorized strategies may lead to correct answers, on their own they do not lead to deep understanding of fractions.

Symphony Math launches students into fraction concepts by insuring they construct knowledge based on ideas of magnitude and numeracy, rather than on procedural steps.

Stage 14 Learning Progression

Concept	Standard	Example	Description
14.1: Making a Whole	3.NF.1	Make 'Thirds'.	Symphony Math introduces students to fractions with the idea that any whole can be divided into any number of equal parts, and that all these parts together make up that 1 whole. In visual form, the big idea of Equal Groupings with Parts-to-Whole are displayed with a new tool, the fraction bar.
14.2: Unit Fractions of 1	3.NF.1	Create 1/3.	Students are introduced to unit fractions using generally familiar fractions of 1/2, 1/3 and 1/4. Using the fraction bar, which sits on top of a number line calibrated from 0 to 1, students partition into these familiar fractional parts. The whole resembles a rectangle, and students color in one part after partitioning into the designated equal parts. They then see one such part written in fraction form with a 1 in the numerator.
14.3: Non-Unit Fractions of 1	3.NF.2	1/4 + 1/4 = ?	Using the Symphony Math visual environment, students watch how they partition for example, 1/4 and 1/4 and end up with 2/4. They use unit fractions to create non-unit fractions, using the part-part-whole model explicitly. In this way, students see how repeated equal groupings with parts-to-whole unveil before their eyes. They witness copies of unit fractions combining to form non-unit fractions.
14.4: Whole Numbers as Fractions	3.NF.3	4 = 4/?	This concept relates to fractions as division problems, where the fraction 3/1 is 3 wholes divided into one group. The visual environment of Symphony Math helps students understand the concept of a/1: how any number can be divided into 1 group: and thus still be that same number. It sets the stage for work where a set of any number of objects can be divided into any number of groups.
14.5: Comparing Fractions	3.NF.3	2/5 ? 3/5	As stated above, while students have learned that 8 > 4, now 1/8 < 1/4. Putting fractions with either the same numerator or the same denominator within the same fraction bar / number line model helps students visualize the size of the parts. Thus they can make comparisons. Such comparisons build on the crucial idea of magnitude and numeracy with fraction numbers.
14.6: Equivalent Fractions	3.NF.3	1/2 = ?/4	Students' work with equivalent fractions throughout 14.6 is supported with visual fraction models. In this way, the important concept of equivalent fractions is established with a strong foundation. As students go on to work with generating equivalent fractions and decimal equivalencies they have strong visual experiences.

Using the Extra Practice Worksheets

The Symphony Math Worksheets provide extended practice using the Multiples Ways of Knowing from the Symphony Math program. Students should work through all worksheets in the order given:

Worksheet	Purpose	Instructions
Manipulatives	Use a visual model to represent the concept.	Create bars, dot cards, or number lines for each item.
Bridge	Connect symbols to their visual representations.	Create objects, numbers, and symbols to complete each item.
Symbols	Understand the concept at the abstract level.	Create numbers and symbols to complete each item.
Apply	Extend understanding to real-life problem solving.	1) Read the story presented at the top of the page. 2) Create a number model of the full solution. 3) Write the number sentence that matches the model.

Group Learning

The Symphony Math Extra Practice materials are designed to promote a conversation about the Big Ideas in math. One-on-one or small group instruction with the materials is recommended for students who need more time to make connections between the mathematical concepts in the Stage and the application of those concepts in their math curriculum.

Fraction Bars