**Adding Fractions with Unlike Denominators with Area Models**

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| In this lesson, students will use area models to find equivalent fractions and then use those arrays to determine a common denominator/unit. The lesson builds on prior knowledge from 4th grade of adding with like denominators and finding equivalent fractions. Students will use area models as a way to demonstrate how fractions with unlike denominators can be renamed and recomposed to add with like unit fractions. This lesson assumes that students have had prior experiences and understanding with equivalent fractions and simplifying fractions.  |

**NC Mathematics Standard(s):**

**Numbers and Operations: Fractions**

**5. NF. 1** Add and subtract fractions, including mixed numbers, with unlike denominators using related fractions: halves, fourths, and eighths; thirds; sixths; and twelfths; fifths; tenths; and hundredths.

* Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
* S~~olve one- and two-step word problems in context using area and length models to develop the algorithm. Represent the word problem in an equation.~~

**Standards for Mathematical Practice:**

Standard for Math Practice 7 Look for and Make Use of Structure

* Students will use prior knowledge of fractions from 4th grade and apply what they know in order to determine equivalent fractions to help students find the sums of fractions~~.~~
* Students will notice and use the structure of non-unit fractions as being composed of like unit fractions.

Standard for Math Practice 6 Attend to Precision.

* Students will accurately add fractions using equivalent fractions.

**Student Outcomes:**

#### I can use an area model to represent equivalent fractions.

* + Students will work to create models to show equivalent fractions and be able to explain/see equivalent fractions.
* I can create like units with an area model to add fractions with unlike denominators.
	+ Students will work together to create models to show how to add fractions with unlike denominators.

**Math Language:**

**What words or phrases do I expect students to talk about during this lesson?**

Students should be using words or phrases such as: area model, whole, like units, unit fraction, unlike denominator, simplify, common denominator, sum, difference, equivalent fractions, mixed numbers

**Materials:**

* Colored Pencils or highlighters to represent two different fractions
* Graph paper or plain white paper
* Use the attached grid papers to model fractions

**Advance Preparation**:

* Work through the mathematics yourself and prepare some examples of area models in case you need them to support students in the lesson.

 **Launch:**

1. Say: **What happens to the denominators? (15 Minutes)**

Display the following and ask students: What do you notice/ What do you wonder?

(Possible responses: The two rectangles below {picture below maybe skewed} are the same size but they are divided into different sized parts. One has been partitioned into fourths and one has been partitioned into eighths. They have different amounts shaded in.)

Say: Here we see two different fractions represented with area models.



Say:

How could we figure out the total amount shaded or the sum of both of the shaded parts? Take some ideas and then let students know they will be creating some area models in the next part of the activity.

* Say: With a partner solve the following using area models (this is building on prior knowledge from 4th grade of adding fractions with like denominators). Students should have prior knowledge of equivalent fractions and simplifying fractions before launching this lesson. If they do not, you may want to consider reviewing that concept.

$\frac{1}{4 } $+ $\frac{1}{4}$

$\frac{2}{6}$ + $\frac{1}{6}$

$\frac{2}{12} $+ $\frac{4}{12}$

* The teacher monitors students while they work and strategically looks for students who showed how they arrived at their answer using the area models.
* Choose a few students to share their work on the board and discuss their strategies.
* The answers for each equation are:
	+ $\frac{1}{4 }$+ $\frac{1}{4}$= $\frac{2}{4}$
	+ $\frac{2}{6}$+ $\frac{1}{6}$= $\frac{3}{6}$
	+ $\frac{2}{12}$+ $\frac{4}{12}$ = $\frac{6}{12}$
* Students may notice that all models display a fraction equivalent to ½, even though they are partitioned differently.
* Say: How can we use these models to help us add $\frac{1}{3}$+ $\frac{3}{6}$?

**2. Introduce Area Models working with unlike denominators. (15 minutes)**

**Display the following:**

* Laura is planting a rectangular garden. She planted corn in $\frac{1}{2}$ of the garden and tomatoes in $\frac{2}{8}$ of the garden. How much of the garden has Laura planted so far?

**Questions:**

* What do you know? (The garden is rectangular. $\frac{1}{2}$ of the garden is corn. $\frac{2}{8}$ or $\frac{1}{4 }$ of the garden is tomatoes.)
* What do you notice about these two amounts? (They are fractions with unlike denominators students should also notice that $\frac{1}{2}$ is $\frac{4}{8.}$)
* What are you trying to find? (How much of the garden was used?)
* How can you represent this problem using an area model?
* Ask the students to work in pairs to represent this problem.

**Questions to consider while students are working:**

* Explain your thinking behind your model.
* What do you notice about the models? What similarities do you notice? What differences?
* Ask students to estimate how much of the garden is being used:
	+ Did Laura use more than half of the garden so far? How do you know?
	+ What do you think are some estimates for how much of the garden she has used so far?

**Other Questions to consider:**

* Does your model need to change in order to add the fractions?
* What do you notice about your model now?
* Is your model the same or different and why?
* Is there a way that you can combine these two fractions?
* Is there something your model should have in common so that you can add these two fractions?

**Explore:**

1. **Drawing area models: (20 minutes)**
* Before going into this task, discuss with students what an area model is and looks like.
* Ask students to work with a partner to determine how they would draw the fractions you displayed on the board using two different representations. IE ( 2/ 4 + 3/8)
* As students are working, walk around and ask different groups what they are noticing about the two different fractions they are modeling. Probe to see if they can explain that the two fractions are from the same size wholes, but that each whole has been partitioned into a different number of parts. The first whole has the unit fraction ¼ and there is two fourths shaded. The second whole has the unit fraction one eighth and there are three eighths shaded. (Possible Responses: different size parts, two different wholes, one is larger than the other, 2/4 is larger than 3/8 because 2/4 is equal to ½ but 3/8 is less than ½ ) .

Choose three partnerships to model what they found during this exploration. Be strategic about what you are choosing to display - make sure to choose groups that are different and not necessarily correct.

\* If you do not have any groups that represented their drawing this way; have students come back together and discuss how as a group this equation could be represented.

**Questions to consider:**

* Why did you choose to represent this fraction equation the way that you did?
* Explain your how your representation helps you combine the two fractions.
* Show me where the two fractions are in your representation.
* What do you notice about the models that are on the board?
* Is there something that is the same or different between the representations?
* What connections can we make between adding fractions with like denominators like we did in the launch and the representations you created.

**2. Adding fractions with unlike denominators using area models (25 minutes)**

* Refer back to the launch, have students consider how they added fractions with like denominators and how that can help them add fractions with unlike denominators.

Ask students to work with a partner to determine how they would add the two fractions using the area model they just created.



 

**Questions to consider while students are working and you are walking around:**

* How can you use the area model to combine the two fractions? What will need to change? What will remain the same?
* What do you notice about your area model now?
* How can you describe the number of parts in each square/ area model? Are the numbers of parts the same or different and why?
* Is there a way that you can combine these two fractions? What do you need to pay attention to?
* Is there something your area model should have in common so that you can add these two fractions?

**3. Discuss:**

Common Denominators / Adding Related Fractions with Unlike Denominators (20 minutes)

* Choose three partnerships to model what they found during this exploration. Be strategic about what you are choosing to display - make sure to choose groups that are different and not necessarily correct.

\* Have students come back together and discuss how as a group this equation could be represented.

**Evaluation of Student Understanding**

Informal Evaluation: The discussion questions posed in the lesson will provide the teacher with enough information as to whether students understand the concepts or not.

Formal Evaluation/Exit Ticket: Have students reflect on questions they may still have; what is something that they learned; and something they could use to help others.

**Meeting the Needs of the Range of Learners**

**Intervention:** You may need to return to 4th grade standards and review equivalent fractions; and adding like denominators. Additional work with area models with fractions with unlike denominators to develop visual models for those fractions.

**Extension:** Ask the students to create a story problem that involves adding fractions with unlike denominators. Students will connect the context to the area models.

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| Students use a common denominator that is larger than the first common multiple.  | Have students create a chart of the multiples of that denominator |
| Students may not clearly model their fractions, therefore their model is not accurate.  | Use rulers and marked paper. Ask students to double check that the problem they are working on matches what they are drawing. Ask questions that help them connect the parts of the problem to the representations.  |
| Students may multiply the denominators which may not be the smallest number they could have used thus making it harder for them to simplify.  | Students will create a chart of multiples of the denominators. |