Fractions as Area Models

Guide for using *Extending Children's Mathematics: Fractions and Decimals*
by Susan B. Empson and Linda Levi

Students have to reason about fractions using two different models: area models and number lines.
This resource specifically addresses **area models**, not number lines.
Standards: 3.G.A.2; 3.NF.A.1; 3.NF.A.3

Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8

3.G.A.2

- Partition shapes into parts with equal areas.
- Express the area of each part as a unit fraction of the whole.

For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.

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Instructional Guidelines for Equal Sharing Problems and Introducing Fractions

Begin with equal sharing problems using the following fractions, in this order:
(See pages 29-31)

- whole numbers, 1/2, 1/4, 1/8 (unit fractions)
  - Problems: A, B, C, D, E, H
- 1/3, 1/6
  - Problems: F, G, I

During conversations be sure to discuss the following: (See pages 32-35)

- What is a half, fourth, etc?
- A fourth is made of ____ equal parts (discuss for each denominator)
- Strategies for whole numbers can be the same for fractions
- What do we call that piece? (when students answer "Everyone gets one piece")
- What is a unit fraction?

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 *For example: Unit fractions are fractions with a numerator of 1 derived from a whole partitioned into equal parts and having 1 of those equal parts (1/4 is 1 part of 4 equal parts).*
- Understand a fraction *a*/*b* as the quantity formed by *a* parts of size 1/*b*. *For example: Unit fractions can be joined together to make non-unit fractions (¼ + ¼ + ¼ = ¾).*

In other words:

- Understand a fraction ¼ as the quantity formed by 1 part when 1 whole is partitioned into 4 equal parts
- Understand a fraction ¼ as the quantity formed by 1 part of size ¼. (You would reiterate ¼ four times to make the whole)

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Instructional Guidelines for Equal Sharing Problems and Introducing Fractions

Address with equal sharing problems using the following fractions, in this order:
(See pages 29-31)

- Any fraction part with denominators of 2, 4, 8
  - Problems: A, B, C, D, E, H
- Any fraction part with denominators of 3, 6
  - Problems: F, G, I

During conversations be sure to discuss the following (See pages 32-35)

- Student learning goal: I can decompose fractions into unit fractions.
- How many ____ are in ____? (Example: How many fourths are in 3/4?)
- Review what is a half, fourth, etc?
- How do I use a number sentence to represent my thinking?

Sample Problems:
See chapter 3 pages 54 -56 for background information on how students solve these problems

- Measurement Division
  - It takes ¼ of a banana to feed a monkey during snack time. The zookeeper has ¾ of a banana. How many monkeys can he feed during snack time?
  - Tucker eats 1/6 a block of cheese each day. How many days will it take for Tucker to eat 5/6 a block of cheese?

- Multiplication
  - It takes 1/8 a box of frog food to feed my pet frog. How much frog food would I need to feed my pet frog for 7 days?
  - Molly gives her dog ½ of a treat every time he does a trick. If Molly's dog does 5 tricks, how many treats will Molly give him?

3.NF.A.3 Explain equivalence of *fractions* in special cases and compare *fractions* by reasoning about their size.

- Understand two *fractions* as equivalent (equal) if they are the same size or same point on a number line.
- Recognize and generate simple equivalent *fractions* (e.g., 1/2 = 2/4, 4/6 = 2/3).
- Explain why the fractions are equivalent, e.g., by using a visual fraction model.

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Understanding Fraction Equivalence and Order

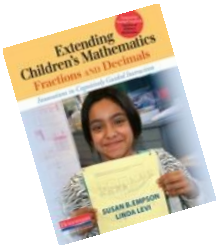
Address with equal sharing problems (See pages 139-143)

- Pose problems that lend themselves to multiple strategies for sharing, which will lead to equivalent answers
- See page 127, Figure 6-6, for number choices that will lead to multiple equivalent answers

During conversations be sure to discuss the following (See pages 144-147)

- Compare student answers and strategies
  (Example: Is her answer of 1/2 the same as his answer of 2/4?)
- Who would get more?
  (Example: Someone in her picture where they each get 1/2 or someone is his picture where they each get 2/4?)
- Are these answers the same?

- Express *whole numbers* as *fractions* and recognize *fractions* that are equivalent to *whole numbers* (e.g., Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a *number line diagram*.)
- Compare two fractions with the same *numerator* or the same *denominator* by reasoning about their size. Recognize that comparisons are valid only when the two *fractions* refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions (e.g., by using a visual fraction model.)



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