

Lesson: Decimal and Mixed Number Multiplication represented with physical objects

Mathematics for Elementary Teachers I - Thomas Geil

Instructor Notes:

Goals:

- Decimal and Mixed number Multiplication represented by an area model

Prerequisite Knowledge:

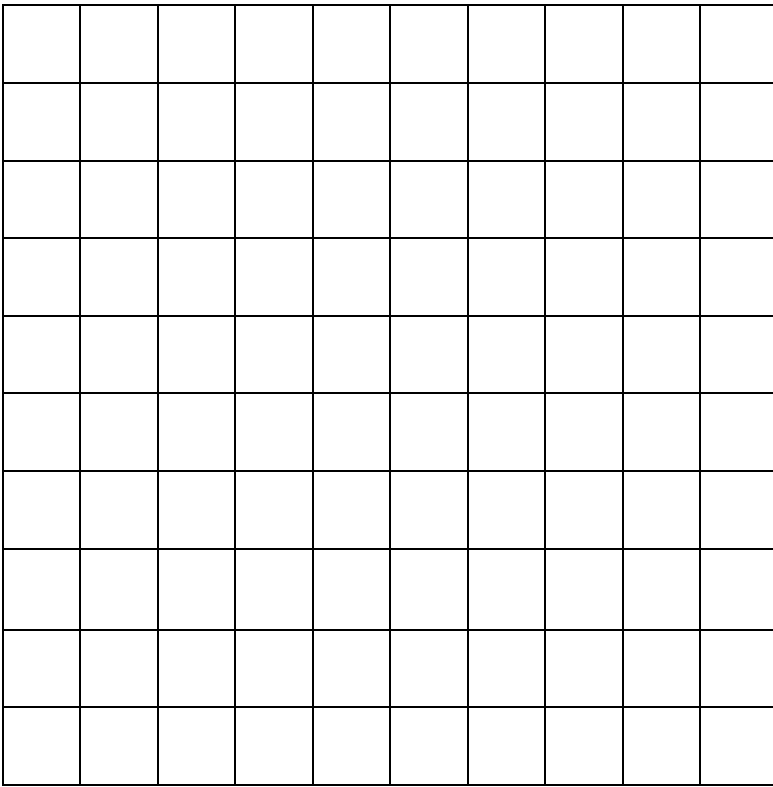
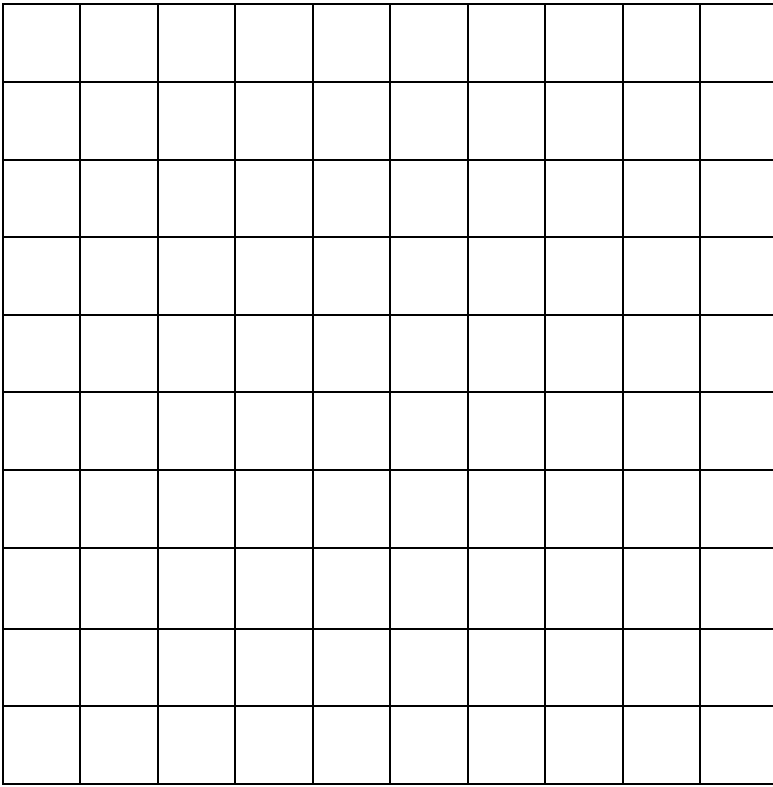
- Meaning of multiplication as taught in this course
- Basic multiplication facts for zero through ten
- Understand multiplication syntax: (use of \times , $*$, \cdot , or parenthesis)
- Understand Base 10 Block and Area models for multiplication

Lesson Materials:

- Base 10 Blocks or grid paper
- Printed handout (Student notes) for each student
- Tape

Lesson Breakdown:

Activity	Size of Group	Time in Activity Total Time: 75-90 minutes
Homework questions, collection and attendance	Whole class	5 minutes
Form groups of 2-3 and distribute Base 10 Blocks or grid paper	Groups of 2-3	5 minutes
Pose the problem "Using the Flat as the unit (whole) represent 1.5 and 2.5 using Base 10 blocks"	Groups of 2-3 students, then whole class	5 minutes
Handout the Student Notes pages for this lesson and explain what to do	Groups of 2-3 students, then whole class	25-30 minutes
Extend this concept to fraction multiplication	Groups of 2-3 students, then whole class.	25-30 minutes
Challenge question if there is time. Try to draw a picture (or base 10 blocks) of $1.2 \times .3$	Groups of 2-3, then post results	10-15 minutes



Goals:

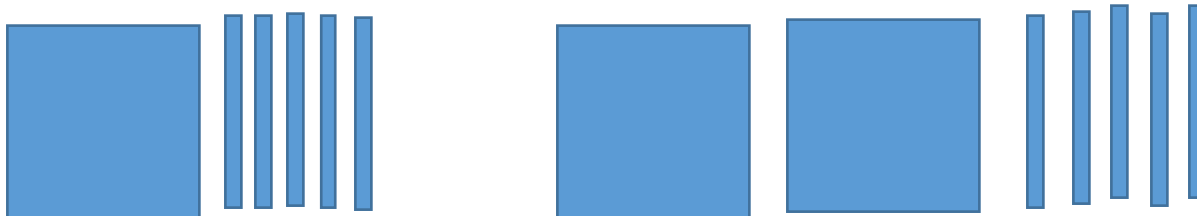
- Decimal and Mixed number Multiplication represented by an area model

Prerequisite Knowledge:

- Meaning of multiplication as taught in this course
- Basic multiplication facts for zero through ten
- Understand multiplication syntax: (use of \times , $*$, \cdot , or parenthesis)
- Understand Base 10 Block and Area models for multiplication

1. Homework questions, homework collection, attendance.
2. Form groups of 2-3 and distribute Base 10 Blocks or grid paper.
3. Pose the problem "Using the Flat as the unit (whole) represent the numbers 1.5 and 2.5 using Base 10 blocks"

Watch for the following representations within the groups.

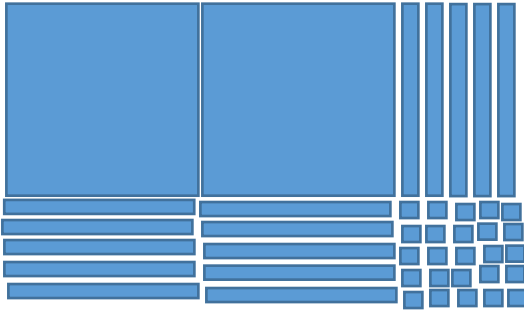


4. Student Handout - Read the problem aloud "You have several full 2.5 gallon gas cans. You start with a full tank of gas in your lawn mower. While cutting the grass you use 1.5 of those full cans of gas and when you finish you refill the gas tank on the lawn mower. How many gallons of gas have you used?"

Ask the groups to answer the following questions included on the student handout:

- A. What represents the "whole group" in this story? How much is in each "whole group"? What unit is being used?
- B. How many "whole groups" are used in this problem?
- C. Use the Base 10 blocks (or grid paper) to represent the multiplication problem used to solve the story problem.
- D. Use your unused Base 10 blocks to make trades to end with the fewest number of blocks possible. Without using multiplication, determine the answer from the Base 10 blocks you end up with after trades.
- E. Check your answer using the standard algorithm for multiplying decimals. How do the trades show up in the algorithm?
- F. Determine a way to check the reasonableness of your solution.

- A. Don't rush this activity. Give ample time and walk around giving hints and asking questions. See if they are identifying the gas can as the whole group and that there are 2.5 gallons in each whole group. See if they name one gallon as the unit or object. You want them to see this as 1.5×2.5 rather than 2.5×1.5 . You are trying to get them to see the gas can as the whole group (with 2.5 gallons in each) and you use 1.5 whole groups. Some students may see one gallon as the whole but it is really the unit.
- B. Watch to see if they figure out that you use 1.5 or 1 and a half cans as the number of whole groups used.
- C.

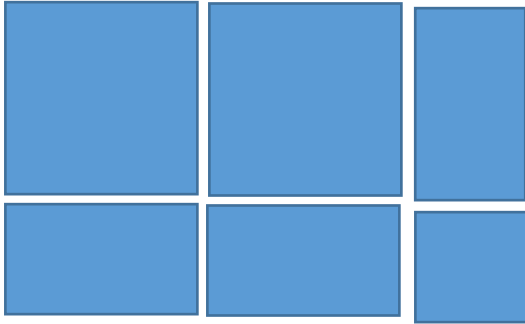


Make sure the students are remembering to have the groups on the vertical side of model and the objects on horizontal side to match our past representations of multiplication. Again, remind them of the commutative property of Multiplication. As they work through this ask them to circle a group, and tell you what is in that one group. They should see that the top row is a group and within it would be 2.5 gallons of gas. The bottom region would contain only half of a group.

- D. Watch to see if they trade 10 small cubes for a rod. This should occur twice. Then see that they convert 10 rods into a flat. The final answer should be 3 flats, 7 rods and 5 small cubes or 3.75
 - E. See if they find the connection between trading in blocks and carry. Ask why kids might struggle seeing a 2 as carry. What is it actually?
 - F. How reasonable is 3.75? Help the groups see that the original question of $1.5(2.5)$ is between $1(2)$ and $2(3)$.
5. Pose the following problems for the groups to work on
- A. Write a recipe story problem for $(1 \frac{1}{2})(2 \frac{1}{2})$ and solve using an area model. Explain what your whole group is and how many objects are in each whole group. Share your problem with another group. Make changes according to the input you receive.
 - B. Draw an area model representing the problem you write.
 - C. Use the area model to find the answer to the story problem. Write an equation represented in your area model.
 - D. A student in your class says that $(1 \frac{1}{2})(2 \frac{1}{2}) = (1)(2) + (\frac{1}{2})(\frac{1}{2})$. What is the student missing in this solution?
 - E. Use the standard algorithm to calculate the answer to your story problem.

A. We have already worked with converting decimals to fractions. Walk around and help the groups make comparisons to the decimal problem that we did. Their whole should now be a batch of something and each of those batches should need $2\frac{1}{2}$ units of something. Ask what their unit is. Cups, gallons??? Ask how many wholes (batches) they are making.

B.



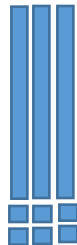
C. There are 2 wholes, 3 halves, and one quarter. That is $3\frac{3}{4}$. This matches the 3.75 from earlier problem.

D. No!! Many students multiply mixed numbers this way but it is wrong. Missing two of the regions.

E. $\frac{3}{2} * \frac{5}{2} = \frac{15}{4} = 3\frac{3}{4}$

6. If time permits, use the Base 10 blocks or an area model to find the solution to $1.2 \times .3$

Unit:



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Mathematics for Elementary Teachers I

Student Notes:

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- Understand Base 10 Block and Area models for multiplication

1. Homework questions, homework collection, attendance
2. Form groups of 2-3 students depending on class size.
3. Using the Flat as the unit represent the numbers 1.5 and 2.5 with the Base 10 blocks you were given.

4. You have several full 2.5 gallon gas cans. You start with a full tank of gas in your lawn mower. While cutting the grass you use 1.5 of those full cans of gas and when you finish you refill the gas tank on the lawn mower. How many gallons of gas have you used?

- A. What represents a whole group in this story?
- B. How much is in each whole group?
- C. What is the unit?
- D. How many whole groups were used in this problem?

- E. Use the Base 10 blocks (or grid paper) to represent the multiplication problem used to solve the story problem.
- F. Use your unused Base 10 blocks to make trades to end up with the fewest number of blocks possible. Without using multiplication, determine the answer from the Base 10 blocks you end up with after trades.
- G. Check your answer using the standard algorithm for multiplying decimals. How do the trades show up in the algorithm?
- H. Determine a way to check the reasonableness of your solution.

5. A. Write a recipe story problem for $(1\frac{1}{2})(2\frac{1}{2})$ and solve using an area model. Explain what your whole group is and how many objects are in each whole group. Share your problem with another group. Make changes according to the input you receive.

B. Draw an area model representing the problem you write.

C. Use the area model to find the answer to the story problem. Write an equation represented in your area model.

D. A student in your class says that $(1\frac{1}{2})(2\frac{1}{2}) = (1)(2) + (\frac{1}{2})(\frac{1}{2})$. What is the student missing in this solution?

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