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1. **Statement of Purpose**

The conclusion of our fractions unit contains areas of mathematical confusion for many middle school students. Middle school students at my school often experience a regression in their understanding of basic multiplication facts, multiplication involving the numbers 1-12. Due to this pre-existing deficiency in multiplication, students’ divisional skills often are impacted because students lack of understanding of the relationship between the operations. In order to combat this area of difficulty my instructional design is to amend the manner in which the multiplication and division of fractions are taught in order to provide more step-by-step instructional process while constructing practice repetitions rich in basic multiplication review that better connects to the style students learned multiplication at the elementary level. Each lesson on these concepts will be constructed using the 5-E Learning Cycle Model. In comparison with other styles this model places a greater emphasis on student directed learning. Rather than a teacher-centered approach, students need to build up their skills in these specific areas in a manner meaningful to them individually. The 5-E Learning Model provides an excellent opportunity for students at all levels of learning to expand upon their current understanding as it provides a “concrete reference point for completing the task” assigned with each lesson (Chiarelott, pg. 91, 2006).

Instead of the previously anticipated three days to explore these learning goals I would amend my schedule to allow for a fourth day to better incorporate activities into the instruction that provide for student directed learning experiences. As Ralph Tyler informs “it is necessary for recurring and continuing opportunity for these skills to be practices and developed” which is why the extra day of practice is needed (Ornstein & Hunkins, 2009, p. 188). With an extra day of re-enforcement students can participate in a student, directed learning activity that should provide an opportunity for collaboration among peers while simultaneously guided the learning experience into a more meaningful one for the learner. In this instructional design, we are implementing consistent instruction with the sequence of concepts taught in elementary school as we initiate several methods similar to the way our current seventh graders learn. While the objectives are slightly different between the grade levels the lessons themselves are rather similar. In order for curriculum to remain continuous Ralph Tyler informs us that “it is necessary for recurring and continuing opportunity for these skills to be practices and developed” (Ornstein & Hunkins, 2009, p. 188). At each of the grade levels, the skills of multiplication and division are essential elements in the mathematical expansion of knowledge into the more complex. At the elementary level, students were able to incorporate more collaborative and competitive methods to review multiplication and division. Meanwhile, at the middle school level students are expected to comprehend material that has been taught to them as early back in their learning years as second grade prior to entry into middle school. As a result of this problem some pre and post assessment techniques are going to be important as well because only by identifying specific areas of difficulty can those areas be properly communicated to students so that effort can be made at improving those areas of academic weakness. The pre and post results will be helpful tools measuring the amount of growth individuals and groups make in a brief period.

1. **Sub Unit Learner Outcomes**

**Sub Unit 4: Multiplying & Dividing Fractions**

* Students will be able to develop fluency in addition, subtraction, multiplication, and division of non-negative rational numbers.
  + Analyze computational strategies. {Analysis}
  + Describe the effect of operations on size. {Knowledge}
  + Estimate the results of computations. {Application}
  + Judge the reasonableness of solutions. {Evaluation}
* Students will be able to develop fluency in the use of factors, multiples, exponential notation, and prime factorization. {Synthesis}
* Students will be able to simplify algebraic expressions and verify the results using the basic properties of rational numbers. {Synthesis}
* Students will be able to develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators or computers, and paper and pencil. {Synthesis}
* Students will be able to use and evaluate algebraic expressions. {Application, Evaluation}
* Students will be able to solve simple (one- and two-step) equations or inequalities. {Evaluate}

1. **Pre-Assessment**

**Multiplication & Division with Fractions Pre-Assessment**

1. Janice has 42 marbles in her bag. Melissa has http://www.wcpss.net/isd/resources/ms/instructionalguides/ms-m-g6-ig41_clip_image002.gif as many marbles in her bag. What is the total number of marbles the two girls will have if they combine their bags?
2. 7
3. 135
4. 49
5. 6
6. Timothy has a fish tank. He wants to know how much water it will take to fill it to http://www.wcpss.net/isd/resources/ms/instructionalguides/ms-m-g6-ig42_clip_image002.gif of its capacity. Timothy pours 20 quarts of water into the tank and realizes that it is http://www.wcpss.net/isd/resources/ms/instructionalguides/ms-m-g6-ig42_clip_image004.gif full. How many gallons does he still need?

A.  20 gallons  
B.  45 gallons  
C.  65 gallons  
D.  80 gallons

3. A middle school softball team won http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig43_clip_image002.gif of its games this season. The team lost 4 games. There were no ties. How many games did the team play?

A.  5  
B.  9  
C.  16  
D.  20

4. There are 16 slices of pizza in one pie.  Don ate http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig44_clip_image002.gif of the pie.  Karen ate http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig44_clip_image004.gif times as much as Don.  About how many slices of pizza are left?

A.  4 slices  
B.  10 slices  
C.  6 slices  
D.  16 slices

5. The Thomas family went for a drive. Before they left, Mr. Thomas noticed the gas tank was http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image002.gif full. When they returned home the gas tank was http://www.wcpss.net/isd/resources/ms/instructionalguides/ms-m-g6-ig45_clip_image002_0000.gif full. The gas tank holds 18 gallons. How many gallons of gas did the car use on the drive?

A. http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image006.gif  
B. http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image008.gif  
C. http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image010.gif  
D. http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image012.gif

6. Tyrone has soccer practice for a total of http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig46_clip_image002.gif hours a week. He goes to practice 5 days a week and spends an equal amount of time at each practice. How long is each soccer practice?

A. http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig46_clip_image004.gif hours

B. http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig46_clip_image006.gif hours

C.  http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig46_clip_image008.gif hours

D.  1 hour

7. Sandra bought 18 yards of material to make pillows.  She cut the material into http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig47_clip_image002.gif yards long to make each pillow.  How many pillows did she make?

A.  9  
B.  10  
C.  20  
D.  32

8. Adam weighs 96 pounds. His father weighs http://www.wcpss.net/isd/resources/ms/instructionalguides/ms-m-g6-ig48_clip_image002.gif times as he does. How much does Adam’s father weigh?

1. 158 pounds
2. 168 pounds
3. 175 pounds
4. 188 pounds

 9. The bookshelf in the library is http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig49_clip_image002.gif inches long. If each book is http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig49_clip_image004.gif inches thick, then how many books can fit on the shelf?

1. 30 books
2. 15 books
3. 36 http://www.wcpss.net/isd/resources/ms/instructionalguides/ms-m-g6-ig49_clip_image002_0000.gif books
4. 46 books
5. **Lesson Plans**

**5-E Learning Cycle Model Lesson 1: Multiplying Fractions By Whole Numbers**

# Concept to Be Learned: Multiplying Fractions by Whole Numbers

# Standard Course of Study Objectives

A. Develop fluency in addition, subtraction, multiplication, and division of non- negative rational numbers. (1.04)

# Procedure {2 minutes}

## Phase

### As a result in learning, students should be able to…understand how to multiply whole numbers by fractions using models.

## Engagement {5-10 minutes}

### Introduce the lesson by starting with simple examples of multiplying whole numbers and fractions.

### Can a drawing be useful in determining a fraction of a whole number?

### What is ½ of 12? How do we know? How could I represent that using pictures?

## Exploration {10-15 minutes}

### Facilitate a class discussion on using pictures to model the multiplication of whole numbers and fractions using the “[Modeling Fraction Multiplication](http://www.wcpss.net/isd/resources/ms/math/resources/g6m-modelingfractionmultip-mt-d41.pdf)” handout (Wake County Public Schools, 2010).

### Work through problems 1-4 as a class.

### Select students to come to the board/overhead to model solutions for the class.

### Have the students complete the remainder of the worksheet.

## Explanation {5-10 minutes}

### Have students share their methods for multiplying a whole number by a fraction.

### Have student turn in Holt textbook to page 194

#### Teacher will model how to solve problems 9-12 where students have to substitute a variable for an assigned vale

#### Students will complete problems 22-25 modeling the same skill

## Extension {5-10 minutes}

### Students will complete a short-answer written response in their notes to the following question.

#### When you multiply a fraction and a whole number, why is the product smaller than the whole number?

## Evaluation

### When students are working on the practice problems 5-8 on the “[Modeling Fraction Multiplication](http://www.wcpss.net/isd/resources/ms/math/resources/g6m-modelingfractionmultip-mt-d41.pdf)” handout, students can work in small groups (Wake County Public Schools, 2010).

### Teacher can work with small groups to monitor student understanding and progress

### Teacher can modify the assignment by choosing only a few problems to complete.

# Materials and Resources

## Modeling Fraction Multiplication Worksheet (100 copies)

## Holt Middle School Math Textbook (35 copies)

**5-E Learning Cycle Model Lesson 2: Multiplying Fractions**

# Concept to Be Learned: Multiplying Fractions

# Standard Course of Study Objectives

## Develop fluency in addition, subtraction, multiplication, and division of non-negative rational numbers. (1.04)

# Procedure {2 minutes}

## Phase

### As a result in learning, students should be able to…understand how to multiply fractions.

## Engagement {5 minutes}

### How do you use a number line to multiply fractions by a whole number?

## When you multiply a whole number and a fraction the product can be a fraction, a whole number or a mixed number, why?  Explain.

## Exploration {15-25 minutes}

* + 1. How do you multiply fractions?
       1. Teacher will model examples of multiplying fractions from Holt textbook pg. 212
    2. How can you use rectangles to model fraction multiplication?
       1. Students will use graph paper to model multiplication of fractions
       2. Teacher will work on completing “Modeling Fraction Multiplication” worksheet with students (Wake County Public Schools, 2010)

## Explanation {25 minutes}

### Have students share their preferred methods for multiplying fractions.

### Students will work on completing “Fraction Card Flip” Worksheet (Wake County Public Schools, 2010)

#### Teacher will distribute sheets of graph paper and ½ decks of cards to the different groups

#### Students will work in groups of 2-3 to complete worksheet.

* + - * 1. Groups members will each be assigned a role: card flipper & recorder
      1. Students must model their work on graph paper

## Extension {5 minutes}

### Students will complete a short-answer written response in their notes to the following question.

* + - 1. Why is it helpful to look for common factors in a numerator and a denominator before multiplying fractions?  Explain.

## Evaluation

### When students are working on the “Fraction Card Flip” worksheet teacher can work with small groups to monitor student understanding and progress (Wake County Public Schools, 2010)

### Teacher can modify the assignment by choosing only a few problems to complete.

# Materials and Resources

## Fraction Card Flip Worksheet (100 copies)

## Holt Middle School Math Textbook (35 copies)

* 1. Deck of playing cards (10 decks)
  2. Graph paper (2 sheets per student – 200 total)
  3. Modeling Fraction Multiplication Worksheet (100 copies)

**5-E Learning Cycle Model Lesson 3: Multiplying Mixed Numbers**

# Concept to Be Learned: Multiplying Mixed Numbers

# Standard Course of Study Objectives

## Develop fluency in addition, subtraction, multiplication, and division of non-negative rational numbers. (1.04)

# Procedure {2 minutes}

## Phase

### As a result in learning, students should be able to… understand how to multiply mixed numbers.

## Engagement {10 minutes}

* + 1. Why is estimating an answer important or useful?
    2. Students may need a review of mixed numbers, improper fractions, and simplest form before beginning today’s lesson.
    3. Put up the following mixed number on the overhead and have students convert to an improper fraction: http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image015.gif
    4. Put up the following improper fraction on the overhead and have students convert to a mixed number: http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image017.gif
    5. Put up the following mixed number on the overhead and have students write in simplest form: http://www.wcpss.net/isd/resources/ms/instructionalguides/images/ms-m-g6-ig45_clip_image019.gif

## Exploration {10minutes}

* + 1. How do you multiply mixed numbers?
    2. Teacher will model examples from Holt textbook page 216

## Explanation {5-10 minutes}

* + 1. Hand out “Multiplying Mixed Numbers” notes (Wake County Public Schools, 2010)

## Extension {20-30 minutes}

### Students will break into groups of 2-4

* + 1. Each group will be given a set of 3 dice
    2. To practice multiplying mixed numbers, students will play a game called “Roll a Mix.”
    3. Give each group of students (2-4 players in each group) 3 dice.
    4. Player one rolls all three dice and decides how to use the dice to form a mixed number.
    5. Each player records the first mixed number on his/her white board.
    6. Player two rolls all three dice and decides to use the dice to form a mixed number.
    7. Each player records the second mixed number on his/her white board.
    8. Each player finds the product of the two mixed numbers, writing answers in simplest form.
    9. Once everyone reaches a solution, one player can check the answer on a calculator.
    10. Each person who gets the right answer gets one point.
    11. Play continues during the allotted time.
    12. The winner is the player with the most points.
    13. Winners receive a piece of candy

## Evaluation {5 minutes}

# Students will provide a written short-answer response in their notes to the following question:

# Why do you have to change the mixed numbers into improper fractions before multiplying them?

* + 1. Teacher can do evaluation of student learner through observation of student collaboration during the “Roll A Mix” game.

# Materials and Resources

## “Multiplying Mixed” Numbers Notes (100 copies)

* 1. Dice (30)
  2. Candy (30 pieces individually wrapped)
  3. Holt Middle School Math textbook

# Materials Needed

See attached files for copies of used materials.

# Post-Assessment

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_ ID:A**

**Multiplying & Dividing Fractions Post Assessment**

**Multiple Choice**

*Identify the letter of the choice that best completes the statement or answers the question.*

\_\_\_\_ 51. Multiply . Write the answer as a mixed number in simplest form, if necessary.

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 52. Evaluate 9*d* for *d* = . Write the answer as a mixed number in simplest form, if necessary.

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 53. A farmer collected 42 eggs from his henhouse one morning, and  of the eggs were brown. How many brown eggs were there?

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. | 22 |
| b. | 10 | d. | 21 |

\_\_\_\_ 54. The Reynolds family saw 48 butterflies at an exhibit, and  of them were Monarch butterflies. How many of the butterflies were Monarchs?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 18 | c. | 33 |
| b. | 32 | d. |  |

\_\_\_\_ 55. Multiply. Write the answer in simplest form.

4  

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 56. Multiply. Write the answer in simplest form.

  

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 57. Multiply. Write the answer in simplest form.

  

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 58. Divide. Write the answer in simplest form.

 ÷ 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 59. Divide. Write the answer in simplest form.

 ÷ 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 60. How many -inch lengths of wood can you cut from a board that is  inches long?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 5 | c. |  |
| b. | 4 | d. |  |

\_\_\_\_ 61. The center ring in a circus is  feet around the edge. If an elephant is  feet long, how many elephants can you place head to tail around the edge of the ring?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 20 | c. | 11 |
| b. | 12 | d. | 27 |

\_\_\_\_ 62. Suppose an ant can carry  times its own weight. If the ant weights  mg, how much can it carry?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | mg | c. | mg |
| b. | mg | d. | mg |

\_\_\_\_ 63. Multiply the following fractions, and simplify if possible.

 • 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 64. Evaluate the expression *g* •  for *g* = .

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 65. Multiply the following fractions, and simplify if possible.

  

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 66. Multiply the following mixed numbers, and simplify if possible.

  

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 3 | c. |  |
| b. |  | d. |  |

\_\_\_\_ 67. What is the reciprocal of ?

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 68. Divide, and simplify if possible.

  

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

Works Cited

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