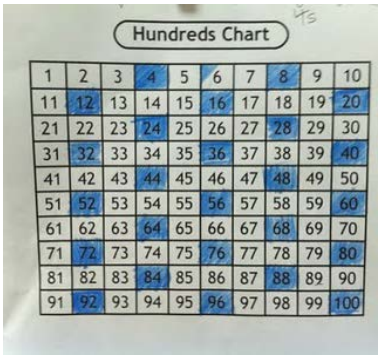
PRACTICE TASK: TAKE THE EASY WAY OUT!

Portions of this lesson were adapted by Elizabeth Wistrom and Donna Cosmato.



STANDARDS FOR MATHEMATICAL CONTENT:

MCC.3.OA.9. Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.*

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE AND MISCONCEPTIONS

Learning multiplication facts does not seem as daunting when you tell your students they will only have to memorize a total of 10 facts! How is this possible, they might ask? The answer is multiplication patterns.

From very early on, children have been taught to identify patterns - in reading, in spelling, in art, in music and of course, in mathematics. The Multiplication Table is no exception. It is made almost entirely of repeating patterns. Once these patterns are identified and understood, it can be noted that there are only 10 remaining multiplication facts that do not fit a specific pattern. For these problems, the only available learning tool is memorization. Still...the thought of having to memorize 10 problems is much less overwhelming than the thought of memorizing an entire table!

Misconceptions

There are many misconceptions about how students should learn their multiplication facts. Most think that multiplication facts should be taught in numerical order starting with 0 and 1, then facts less than 5, and from there on out in order, facts 6 through 12. They also believe that multiplication should be taught in isolation with no connection to addition. A third misconception is that multiplication should be taught separately from division. (Wallace & Gurganus, 2005).

Many times these misconceptions are based on a teacher's or parent's personal learning experience. Fortunately, we now know from the research of Van de Walle, Fosnot et. al., Heibert, and others that there are more effective strategies for teaching and learning the multiplication facts. Several of these strategies are outlined in Teaching Student Centered Mathematics, by John A. Van de Walle.

ESSENTIAL QUESTIONS

- What is a pattern?
- How are patterns related to multiplication?
- How can an addition table help you explain the Commutative Property of Multiplication?

MATERIALS

- Construction paper and writing paper
- Hundreds charts
- Amanda Bean's Amazing Dream (A mathematical story) - Cindy Neuschwander
- The Mathemagician's Apprentice -Brian Boyd
- The Best of Times - Greg Tang
- Grapes of Math - Greg Tang
- Math journal/learning log
- Printable Task Games

GROUPING

Individual/Partner

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task, students will explore patterns in multiplication. They will also create a book of multiplication rules to learn relationships that exist within the multiplication family and apply the concepts to a hundreds chart.

By showing your students how to use multiplication patterns, you will demonstrate that it is really only necessary to memorize 10 multiplication facts. The lesson could open with one of the above multiplication books. Each book is about patterns in multiplication. However, the ability levels are different. Select the book that best fits the level of your class. Following the reading of the book, engage the students in the following task:

Tell students they are going to create their own multiplication book. Provide each student with two pieces of construction paper and eight sheets of manuscript paper. This will serve as the basis for your book. The title of the book will be My Multiplication Book. The first page of the book should define the word "multiplication":

What is multiplication?
After eliciting responses from your students, you should (together) construct a definition that reads something like this:

- **Multiplication is a way to add groups of equal size. 3 x 4 = 12 (How many groups x How many in each group = How many all together)**

Have your students write the agreed upon definition on the first page of their multiplication book.

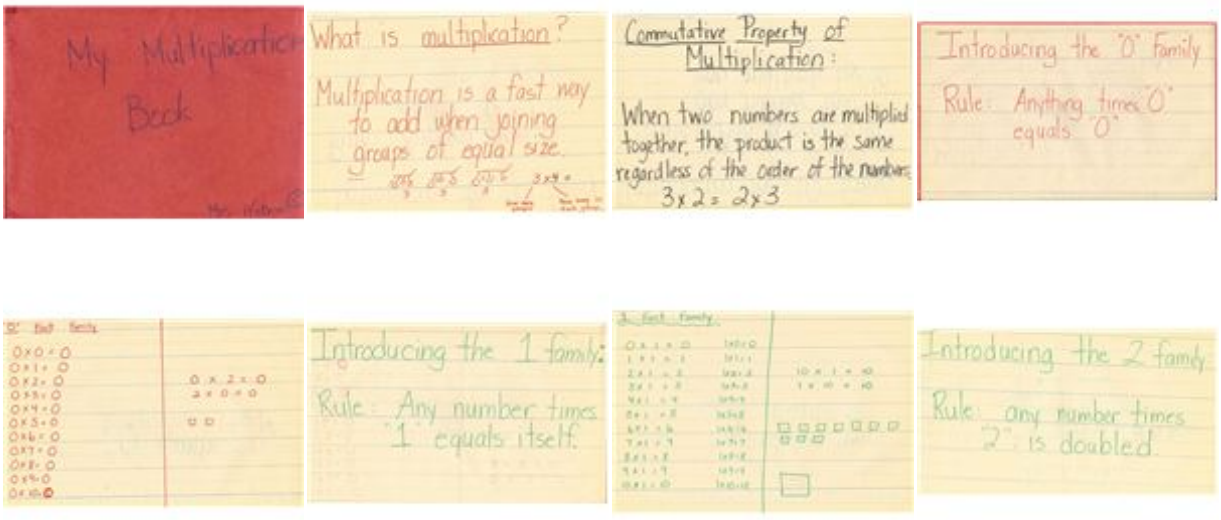
The next step is to have students explain the Commutative Property of Multiplication, and determine a definition:

When two numbers are multiplied together, the product is the same regardless of the order of the factors. For example 3 x 2 = 2 x 3.

By understanding this principle, students see that many problems can be overlooked because they are actually duplicates. Have them write the agreed upon definition on the second page of their book.

The following pages of the book will cover the fact families that show definitive patterns, the associated rules, the numerical sentences that make up the fact family and a pictorial representation of the Commutative Property of Multiplication. Below you will find examples of each of these pages.

My Multiplication Book



Using a Multiplication Table as a Visual Aid

An effective way to manage the lessons is to introduce one Rule/Family each day. Using a large multiplication table can be a terrific visual aid. As you learn each fact family, cross them off on the multiplication table. That way, your students can actually see the progress they are making in learning the multiplication facts:

Multiplication Table after the 1's Family is studied

	1	2	3	4	5	6	7	8	9	10	11
1	X	X	X	X	X	X	X	X	X	X	X
2	X	4	6	8	10	12	14	16	18	20	22
3	X	6	9	12	15	18	21	24	27	30	33
4	X	8	12	16	20	24	28	32	36	40	44
5	X	10	15	20	25	30	35	40	45	50	55
6	X	12	18	24	30	36	42	48	54	60	66
7	X	14	21	28	35	42	49	56	63	70	77
8	X	16	24	32	40	48	56	64	72	80	88
9	X	18	27	36	45	54	63	72	81	90	99
10	X	20	30	40	50	60	70	80	90	100	110
11	X	22	33	44	55	66	77	88	99	110	121

Only 10 Problems Left!

The last page of your Multiplication Book will include the 10 multiplication problems that are not covered by the fact family patterns studied:

3x3, 3x6, 3x7, 3x8, 6x6, 6x7, 6x8, 7x7, 7x8 & 8x8

(Remember…due to the Commutative Property of Multiplication, there are only 10 problems instead of 20.)

This is how the multiplication table you are using for demonstration will look when you have completed teaching multiplication facts. (The circled problems are the 10 that must be learned through an alternative strategy)

Multiplication Table at Completion

Task Directions: After teaching the 2's and 4's pattern, have the students do the following task:

2's Rule!- Have the students work in groups of two and supply them with the attached sheet called 2's Rule! This is a game. The students will cut out the cards and place them face down in a pile. They will take turns flipping over a card 1 at a time. However, the first person to give the correct answer wins the card. The person with the most cards wins the game. Since the 2's rule is double the number and add, some of the cards will simply have an even number. The students must then tell what number was doubled and say the 2's multiplication sentence that correlates with it. **Van de Walle states that division should be taught in connection with multiplication.**

4 Score 4 Sure!- ***This task can be completed as a 4 man game, which will be intense fun! Or, it can be a cut and paste activity with a partner***. Break students into teams of 4. Give them the attached reproducible page and have them cut out the numbers. Once completed, revisit the rule of 4. Then, have the groups move to separate locations around the room. Rules: The teacher will say a number. Let's say it's 3. She can say, "I need to see this number's double, and then its double." Thus, working cooperatively, the students must send up two people from the team holding up the number 6 and 12. For an extra point, the teacher can have them give the 4's multiplication sentence that corresponds with 3 which would be 4 times 3.

To advance the game, the teacher could make them think backward. She could only give the product and they would have to send up two people with half the product and then half of that. This would once again, as Van de Walle states, show connections to division while still reinforcing multiplication and teaching pattern relationships. Of course, the same procedure for the extra point would apply. The team with the most points wins. **(Suggestion**: The numbers for the games can be written on large index cards or construction paper so they are visible to all learners during the game.)

FORMATIVE ASSESSMENT QUESTIONS

- How does learning patterns aid mastery in multiplication?
- How does the commutative property of multiplication aid mastery of multiplication facts as well?

DIFFERENTIATION

Extension

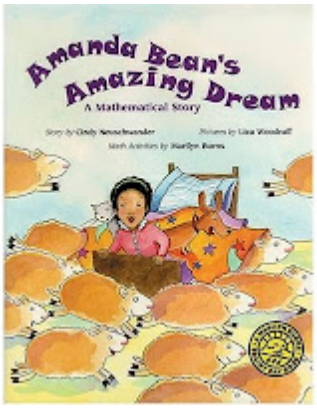
- The lessons could be extended by creating similar tasks or games using different factors and products.

Intervention

- Having the students work in small groups will provide support for students who struggle with this concept and will enable them to develop the ability to describe their thinking.

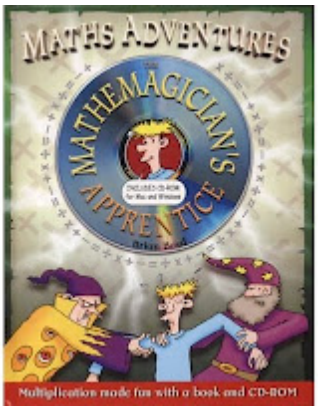
Math Book Synopsis

Amanda Bean's Amazing Dream (A mathematical story) - Cindy Neuschwander



Amanda Bean happily counts "anything and everything" by ones, twos, fives, and tens. Although her teacher tells her that learning multiplication is important, Amanda remains unconvinced until a strange dream presents her with arithmetic challenges that overwhelm her counting skills. She awakens to learn to multiply "anything and everything." Recommended for 6-8 yrs but another fun introduction.

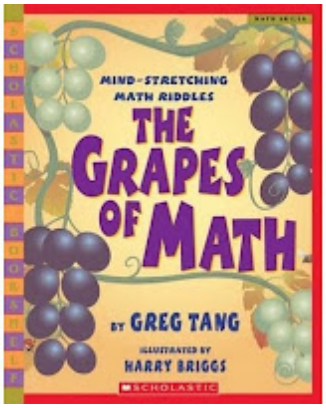
The Mathemagician's Apprentice -Brian Boyd



Oz, the mathemagician's apprentice, needs help with his final test. Teaching times tables whilst you help Oz. Packed on each page with an activity to do, the book also includes a CD. Princess really enjoyed working with this, and needed Michelangelo's help.

The Best of Times - Greg Tang

Greg Tang uses rhymes and commonsense tricks to walk through the multiplication tables from zero to 10. For example, if you know how to multiply by two ("Two is very fast and fun, quickly double and you're done. What's that you say, be more precise? Okay then, just add it twice!"), then fours ("... please just always double twice!") and eights. This book does not promote the memorization of multiplication facts, but teaches the reader to problem solve and use different approaches and strategies. Does move fast but we found it excellent! 5 Star.



Grapes of Math - Greg Tang

Tang shows readers creative ways to use patterns and combinations of numbers to solve math puzzles quickly and effectively. Rather than laboriously counting 24 mushroom slices on a pizza, Tang suggests: "Let me give you some advice, / Just do half and count twice." And in adding the number of dots on a fan: "Instead of seeing groups of threes, / Count by fives and it's a breeze!"
Each riddle offers a clue, the "Answers" section at the back of the book, offers an explanation of each problem and shows how to group objects together and look for patterns. Recommended for 8-10 years. An easier introduction than 'The Best of Times.' Excellent!

2's Rule!

2 X 0	2 X 8	10
2 X 1	2 X 9	12
2 X 2	2 X 10	14
2 X 3	0	16
2 X 4	2	18
2 X 5	4	20
2 X 6	6	
2 X 7	8	

4's The Score!

1	12	7	36
2	16	14	10
4	5	28	20
8	10	32	40
3	20	9	
6	24	18	