



### Developing Multiplicative Thinking-

Habituation of Basic Facts for Multiplication and Division with Lisa Riggs

### Welcome!



### Your host

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GOOD NEW

KCM Launches Multi-Series Virtual PD



Find out more in this month's article!

### Good News!

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HOME

The KCM is hard at work to ensure Kentucky teachers have access to innovative professional development from home.

Through the newly launched <u>KCM Virtual</u> site, mathematics teachers from all grade levels will have access to live zoom meetings, video records and corresponding materials. <u>Read more</u>.

Focus on Fractions - May 4 - May 8

Focus on Geometry - May 11 - May 15

More Multiplicative Thinking - May 18 - May 22



### Today's Agenda

- Standards
- Research
- Strategies
  - Berkley Everett
- Resources
  - Orgio
  - nrich maths



### **Standards**

Operations and Algebraic Thinking Standards for Mathematical Practice	
Cluster: Multiply and divide within 100.	
Standards	Clarifications
KY.3.OA.7 Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division or properties of operations. MP.2, MP.8	Students determine multiplication and division strategies efficiently, accurately, flexibly and appropriately. Being fluent means students choose flexibly among methods and strategies to solve contextual and mathematical problems, they understand and explain their approaches and they produce accurate answers efficiently. Knowing 8 x 5 = 40, one knows $40 \div 5 = 8$ . Note: Reaching fluency is an ongoing process that will take much of the year. Coherence KY.3.OA.7->KY.4.OA.4
Attending to the Standards for Mathematical Practice	

By studying patterns and relationships in multiplication facts, students develop fluency for multiplication facts (**MP.8**). For example, students notice 4 x 6 is equivalent to  $2 \times 2 \times 6$  (doubling strategy). They know 9 facts can be found by thinking of the other factor x 10 and subtracting one group. For example, recognizing  $9 \times 8$  is equivalent to  $10 \times 8 - 8$ . For each fact, the student thinks, "What reasoning strategy can I use that is more efficient than skip counting?" (**MP.2**).



### **Standards**

Operations and Algebraic Thinking		
Standards for Mathematical Practice		
MP.1.Make sense of problems and persevere in solving them.MP.2.Reason abstractly and quantitatively.MP.3.Construct viable arguments and critique the reasoning of others.MP.4.Model with mathematics.	MP.5. Use appropriate tools strategically.         MP.6. Attend to precision.         MP.7. Look for and make use of structure.         MP.8. Look for and express regularity in repeated reasoning.	
Cluster: Understand properties of multiplication and the relationship between multiplication and division.		
Standards	Clarifications	
KY.3.OA.5 Apply properties of operations as strategies to multiply and divide. MP.3, MP.4	Students need not use formal terms for these properties. If 6 x 4 is known, then 4 x 6 = 24 is also known (Commutative property of multiplication). 3 x 5 x 2 can be found by 3 x 5 = 15, then 15 x 2 = 30, or by 5 x 2 = 10, then 3 x 10 = 30 (Associative property of multiplication). Knowing that 8 x 5 = 40 and 8 x 2 = 16, one can find 8 x 7 as 8 x (5+2) = (8 x 5) + (8 x 2) = 40 + 16 = 56 (Distributive property). 7 = 8 = 8 = 56 = 40 + 16 = 56 7 = 8 = (5 = 8) + (2 = 8) = 40 + 16 = 56 ( $V = 40 + 16 = 56 = 40 + $	
KY.3.OA.6 Understand division as an unknown-factor problem. MP.2	Find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8. Coherence KY.3.OA.6→KY.4.NBT.6	
Attending to the Standards for Mathematical Practice		
Students use strategies beyond skip counting to solve multiplication pro- use strategies like Adding a Group, thinking 5 groups of 9 (45) plus one n groups of 6 (60) minus one group of 6 (54) ( <b>MP.7</b> ). Students explain their strategies, considering which strategies make sense and are efficient ( <b>M</b> 84 items?" or "How many in a group, if there 84 items and 4 groups?" ar	blems. They decide how to use known facts to solve facts like 6 x 9. Students nore group (54) and Subtracting a Group, thinking 9 x 6 and reasoning 10 r selected reasoning strategy and listen and critique other students' <b>P.3</b> ). Students think about 84 ÷ 4 as, "How many sets of 4 can be made from nd use this relationship to solve the problem ( <b>MP.2</b> ).	







https://www.mathisfigureoutable.com/development/

## Foundational Facts Must Precede Derived Fact Strategies

**Multiplication Fact Fluency Flexible Learning Progression** 



\*We acknowledge that all the derived fact strategies are break apart (distributive property) strategies. We focus on specific ways to break apart (e.g., adding a group) and move towards generalizing the Break Apart strategy.



Bay-Williams, J., & Kling, G. (2019). *Math Fact Fluency:* 60+ Games and Assessment Tools to Support Learning and Retention. Alexandria, VA: ASCD.

### Instructional Phases of Multiplication and Division

1. Building on students' emergent strategies

Developing Number

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- 2. Instruction on sequences of multiples
- 3. Structuring numbers multiplicatively
- 4. Developing strategies for 1- digit factors
- 5. Habituation of basic facts
- 6. Extending to multi-digit factors and beyond 100.



# Examples of a strategy for a given multiplier, table 7.1, pg.154

Multiplier	Strategy
2	Double Ex: 7 x 2 is 7 + 7
3	Double and add again: 9 x 3 is double 9 + another 9
4	Double and double again: 7 x 4 is 14 + 14
5	Half of 10 times: 6 x 5 is half of 60
6	Double 3's: 4 x 6 is 4 x 3 + 4 x 3
7	Use 5 times or 6 times facts: 4 x 7 is 4 x 5 + 4 x 2 or 4 x 6 + 4
8	Double and double and double a third time: 6 x 8 , double 6 is 12, double 12 i 24, double 24 is 48.
9	10 times - 1 time: 4 x 9 is 40 - 4
4.0	The corresponding tens number: 7 x 10 is 70

Developing Number

Knowledge

David Ellemor-Collins

Wright, R. J., Tabor, P. D., & Ellemor-Collins, D. (2011). *Developing Number Knowledge*. "SAGE ".

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### **Multiplication Relationships**









### **Origo: Pick a Product**





### **Origo: Missing Divisors**





### **Factors and Multiples**

#### **Factors and Multiples**

Longest Chain 5 Start again

Click on a number to move it between the left and right squares. Numbers in the right grid can be dragged to reorder them. Aim to make the longest possible chain where each number is a factor or a multiple of its predecessor. Each number may be used once only. Chains are bracketed in green. Blue numbers are not part of a chain





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