

The Power of Context: Making Sense of Multiplication and Division

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Session Outcomes

- Examine how to Decontextualize Multiplication and Division Situations
- Explore how Connecting Context to Multiplication and Division Tools/Strategies Supports Conceptual Understanding
- Make Connections to the Common Core Standards (OA and NBT) and the Standards for Mathematical Practice

Why is Context in Mathematics a Powerful Support for Students?

- Allows students to act out or visualize the mathematical situation
- Students can draw on their prior experience to make sense of the mathematics in a problem
- It gives meaning to processes, procedures and algorithms

Conceptualizing Multiplication

- What are the different ways we can conceptualize multiplication?

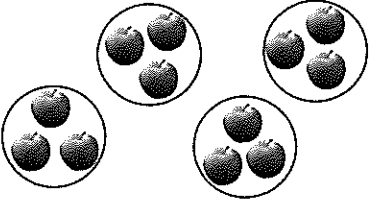
Multiplication: Context Matters

factor \times factor = product

\uparrow multiplier \uparrow multiplicand
 how many groups how many in each group

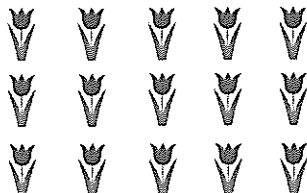
“Seeing” the Multiplier

There are 4 baskets with 3 apples in each basket. How many apples are there in all?



“Seeing” the Multiplier

There are 3 rows of tulips in the garden with 5 tulips in each row. How many tulips are there?



“Seeing” the Multiplier

What is the area of a 2 cm by 6 cm rectangle?



Connecting Context to Multiplication Tools & Strategies

A popsicle stick is 5 inches long. If you put 4 popsicle sticks end to end, what is their total length?

- What is the multiplier? multiplicand?
- What equation models the situation?
- What tool or strategy would help you represent this situation?

Connecting Context to Multiplication Tools & Strategies

There are 12 clowns at the parade. Each clown is carrying 3 balloons. How many balloons are there all together?

- What is the multiplier? multiplicand?
- What equation models the situation?
- What tool or strategy would help you represent this situation?

Connecting Context to Multiplication Tools & Strategies

You are buying blinds for a bedroom window. It measures 3 feet long by 4 feet wide. What is the area of the blinds that will cover the window?

- What is the multiplier? multiplicand?
- What equation models the situation?
- What tool or strategy would help you represent this situation?

Connecting Context to Multiplication Tools & Strategies

An ice cream shop sells 16 cones each hour. If the shop is open for 5 hours, what is the total number of ice cream cones that they sell?

- What is the multiplier? multiplicand?
- What equation models the situation?
- What tool or strategy would help you represent this situation?

Connecting Context to Multiplication Tools & Strategies

<p>A lion in captivity eats 21 pounds of meat each day. If the zoo is ordering meat for two weeks, how many pounds should they order for the lion?</p>	<ul style="list-style-type: none"> • What is the multiplier? multiplicand? • What equation models the situation? • What tool or strategy would help you represent this situation?
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Reflect

- How does connecting context to the multiplication equation support conceptual understanding?
- How does connecting context to the tool/strategy support conceptual understanding of multiplication?
- What Standards for Mathematical Practice did you engage in?

Conceptualizing Division

- What are the different ways we can conceptualize division?

Division Word Problem Sort

- Sort the problems into categories
- Use the post-its to "name" your categories
- Be prepared to share your thinking

Two Types of Division

<p>PARTITIVE</p> <ul style="list-style-type: none"> • How many in each group? • Fair sharing or dealing out • Most intuitive and most exposure 	<p>MEASUREMENT</p> <ul style="list-style-type: none"> • How many groups? • Repeated subtraction • Limited exposure
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Understanding the Two Types of Division

- Multiplication and Division Problem Type Table (Table 2 in Common Core)
- Partitive vs. Measurement Division Contextual Chart

Two Types of Division: Word Problem Sort

PARTITIVE (How many in each group?)	MEASUREMENT (How many groups?)
<ul style="list-style-type: none"> • Luis • Keisha • Michaela • Martin 	<ul style="list-style-type: none"> • Sun • Sandwiches • Isabel • Cupcakes

Representing the Two Types of Division

<p>Anna baked 18 cookies. If she gives 3 cookies to each of her friends, how many friends can she feed?</p>	<p>Anna baked 18 cookies. If she shares them equally among 3 of her friends, how many cookies does each friend get?</p>
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Connecting Context to Division Tools & Strategies

<p>Zeke wants to make blueberry pancakes so that there are the same number of blueberries in each pancake. If he has 54 blueberries and he makes 6 pancakes, how many blueberries are in each pancake?</p>	<ul style="list-style-type: none"> • What type of division does this situation represent? • What equation models the situation? • What tool or strategy would help you represent this situation?
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Connecting Context to Division Tools & Strategies

<p>Adan has a collection of 48 marbles. If he puts 8 marbles in a paper cup, how many paper cups will he use?</p>	<ul style="list-style-type: none"> • What type of division does this situation represent? • What equation models the situation? • What tool or strategy would help you represent this situation?
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Connecting Context to Division Tools & Strategies

<p>Damon has 138 Skittles to share equally among his 6 friends. How many Skittles will each friend get?</p>	<ul style="list-style-type: none"> • What type of division does this situation represent? • What equation models the situation? • What tool or strategy would help you represent this situation?
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Connecting Context to Division Tools & Strategies

<p>Rachel bakes 156 cookies. If she puts 12 cookies into a baggie, how many baggies can she fill?</p>	<ul style="list-style-type: none"> • What type of division does this situation represent? • What equation models the situation? • What tool or strategy would help you represent this situation?
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Connecting Context to Division Tools & Strategies

<p>Nana made 340 cupcakes for the party. If each batch makes 16 cupcakes, how many batches did Nana make?</p>	<ul style="list-style-type: none"> • What type of division does this situation represent? • What equation models the situation? • What tool or strategy would help you represent this situation?
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Reflect

- How does connecting context to the division equation support conceptual understanding?
- How does connecting context to the tool/strategy support conceptual understanding of division?
- What Standards for Mathematical Practice did you engage in?


Reviewing Session Outcomes

- Examine how to Decontextualize Multiplication and Division Situations
- Explore how Connecting Context to Multiplication and Division Tools/Strategies Supports Conceptual Understanding
- Make Connections to the Common Core Standards (OA and NBT) and the Standards for Mathematical Practice

In Closing...

- What questions do you have?
- What are your "take aways"?
- If you have questions or if you would like contact me, please feel free to do so!

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Table 2. Common multiplication and division situations.⁷

	Unknown Product	Group Size Unknown Partitive Division ("How many in each group?" Division)	Number of Groups Unknown Measurement Division ("How many groups?" Division)
	<p>$3 \times 6 = ?$</p> <p>There are 3 bags with 6 plums in each bag. How many plums are there in all?</p> <p><i>Measurement example.</i></p> <p>You need 3 lengths of string, each 6 inches long. How much string will you need altogether?</p> <p>There are 3 rows of apples with 6 apples in each row. How many apples are there?</p> <p><i>Area example.</i></p> <p>What is the area of a 3 cm by 6 cm rectangle?</p> <p>A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost?</p> <p><i>Measurement example.</i></p> <p>A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?</p>	<p>$3 \times ? = 18$, and $18 \div 3 = ?$</p> <p>If 18 plums are shared equally into 3 bags, then how many plums will be in each bag?</p> <p><i>Measurement example.</i></p> <p>You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?</p> <p>If 18 apples are arranged into 3 equal rows, how many apples will be in each row?</p> <p><i>Area example.</i></p> <p>A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?</p> <p>A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost?</p> <p><i>Measurement example.</i></p> <p>A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?</p>	<p>? $\times 6 = 18$, and $18 \div 6 = ?$</p> <p>If 18 plums are to be packed 6 to a bag, then how many bags are needed?</p> <p><i>Measurement example.</i></p> <p>You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?</p> <p>If 18 apples are arranged into equal rows of 6 apples, how many rows will there be?</p> <p><i>Area example.</i></p> <p>A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?</p> <p>A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat?</p> <p><i>Measurement example.</i></p> <p>A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?</p>
<p>Equal Groups</p> <p>Arrays,⁴ Area⁵</p> <p>Compare (Grade 4 and above)</p>	<p>$a \times b = ?$</p>	<p>$a \times ? = p$, and $p \div a = ?$</p>	<p>? $\times b = p$, and $p \div b = ?$</p>

⁷The first examples in each cell are examples of discrete things. These are easier for students and should be given before the measurement examples.

⁴The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns.

How many apples are in there? Both forms are valuable.

⁵Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations.

PARTITIVE DIVISION (how many in each group)

Mario has 42 baseball cards. If he puts the same amount of baseball cards into 6 envelopes, how many cards are in each envelope?

42 baseball cards	÷	6 envelopes	=	? baseball cards in each envelope
Known Dividend		Known Divisor		Unknown Quotient
Total Amount		How many groups		How many in each group
6 envelopes	x	? baseball cards in each envelope	=	42 baseball cards
Known Multiplier		Unknown Multiplicand		Known Product
How many groups		How many in each group		Total Amount

MEASUREMENT DIVISION (how many groups)

Mario has 42 baseball cards. If he puts 6 baseball cards in an envelope, how many envelopes can he fill?

42 baseball cards	÷	6 baseball cards in each envelope	=	? envelopes
Known Dividend		Known Divisor		Unknown Quotient
Total Amount		How many in each group		How many groups
? envelopes	x	6 baseball cards in each envelope	=	42 baseball cards
Known Multiplier		Unknown Multiplicand		Known Product
How many groups		How many in each group		Total Amount