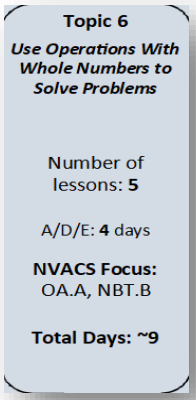
Grade 4 Topic 6: Use Operations with Whole Numbers to Solve Problems



[4th grade Curriculum Pacing Framework: Balanced Calendar]

Big Conceptual Idea: Operations and Algebraic Thinking (pp. 29-31)

Prior to instruction, view the Topic 6 Professional Development Animation located in Pearson Realize online. Read the Teacher Edition (TE): Cluster Overview/Math Background (pp. 325A-325F), the Topic Planner (pp. 325I-325J), all 5 lessons, and the Topic Assessments (pp. 363-364A).

Mathematical Background: Read Cluster Overview (TE, pp. 325A-325E)	Topic Essential Questions: How is comparing multiplication different from comparing addition? How can you use equations to solve multi-step problems? *Reference TE (p. 325) and Answering the Topic Essential Questions (TE, pp. 361-362) for key elements of answers to the Essential Questions.*

The lesson map for this topic is as follows:

6-1	6-2	6-3	6-4	6-5	Assessment

4 A/D/E days used strategically throughout the topic

Instructional note:

This topic focuses on comparison type problems, especially multiplicative comparison and solving multi-step problems. Focus instruction on Nevada Academic Content Standards (NVACS) 4.OA.A.1, 4.OA.A.2 and 4.OA.A.3. Emphasis for standard 4.OA.A is the use of four operations with whole numbers to solve problems. "Comparison situations involve two distinct sets or quantities and the difference between them. In multiplicative comparison problems, there are really two different sets, as there were with comparison situations for addition and subtraction. One set consists of multiple copies of the other" (Van de Walle, Karp, Bay-William, 2010, p. 155). Multiplicative comparison problems do not contain an action within the problem itself making this difficult for students working in the concrete or direct model phases.

In solving multi-step problems, students sometimes find solving multi-step problems difficult. Van de Walle, et al., suggest when giving students multi-step problems consider using the following ideas to show students how multi-step problems "are chained together;

- first give students a one-step problem and have them solve it
- make hidden questions and have students identify the questions
- pose standard two-step problems and have students identify the hidden question

(2010, p. 163-164).

Focus Math Practice 1: Make sense and persevere

Focus opportunities for students to develop *Mathematical Practice 1* behaviors, as this is the focus of the Math Practices and Problem Solving, lesson 6-5. Reference the Teacher's Edition (pp. F21-F21A) and the NVACS (2010, p. 6).

Note: The purpose of the curriculum guides is for additional considerations. Therefore, not all components may have additional notes included in this guide.

Essential Academic Vocabulary Use these words consistently during instruction.	
New Academic Vocabulary: (First time explicitly taught)	Review Academic Vocabulary: (Vocabulary explicitly taught in prior grades or topics)
	variable *equation*

Additional terminology that students may need support with: comparison, hidden questions, square units

*Collaborative Team Conversations (CTC)

Consider using *one* of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for evidence of mathematical understanding:

Guiding question: "Are students persevering and making sense of multi-step problems?"

Lesson	Evidence	Look for
6-3	*Quick Check* (digital platform) Item 5	Focus CTC around the big idea: • student reasoning around multi-step problem solving. Printable version available under "Teacher Resources".
6-5	*Solve & Share* (student work samples)	Focus CTC around the big idea: • student reasoning around multi-step problem-solving. • student sense making and persevering.

Learning Cycle Assessments (summative)	*Topic Assessments* SE pp. 361-364	Use *Scoring Guide* TE pp. 361-364A

Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 6-1: Solve Comparison Situations		
4.OA.A.1 4.OA.A.2 4.NBT.B.5 MP.1 MP.2 MP.3 MP.4 MP.5 MP.6	Access Prior Learning: In previous grades and topics, students developed computational skills using various strategies, models or algorithms to solve problems. Developing the Big Idea: In this lesson, students will use various skills to solve problems involving comparisons.	Solve & Share: Consider removing the bar diagram from the *Solve & Share* to elicit additional student strategies or models. Consider having students who used the bar diagram share their strategies. If students did not use a bar diagram, consider showing the bar diagram model that "a student from last year used". Look Back: Have students think about the equation that can be written from the problem. Have a discussion based on the "4 times as long" being a multiplicative comparison problem. Reference back to the bar diagram and ask students why the problem may be a multiplicative comparison problem. Visual Learning: In the *Visual Learning Animation*, the problem is shown as a multiplicative comparison and as an addition comparison. Consider facilitating a discussion by comparing the two types of comparison problem types (additive and multiplicative). Convince Me: Consider facilitating a discussion around the *Convince Me!,* so students can continue comparing a multiplicative comparison with an addition comparison problem. Connect the *Convince Me!* to the *Solve & Share* and *Visual Learning Animation*. Guided Practice: Note: The Error Intervention focuses in on key word strategies to tell the difference between a multiplicative comparison and addition comparison (TE, pp. 329-330). Consider giving students opportunity to find and explain the difference between these comparison types on their own rather than teaching key word strategies.
Lesson 6-2: Continue to Solve Comparison Situations		
4.OA.A.2 4.OA.A.1 4.NBT.B.5 4.NBT.B.6 MP.1 MP.2 MP.3 MP.4	Access Prior Learning: In the previous lesson, students learned to distinguish between comparison situations involving multiplication and addition. Developing the Big Idea: In this lesson, students will continue solving multiplicative comparison problems, including some that require division to solve.	Solve & Share: Consider removing the sentence frames and "Complete the sentences and equation to show a way to compare the height of the tree". Doing so, will increase the cognitive demand and elicit more strategies and different comparisons to solve the problem. For example, some students may use an additive comparison or multiplicative comparison. Whereas others may use division to compare the heights. Convince Me: Consider facilitating a discussion around the *Convince Me!*, as students are asked to determine when division is used to comparison situations. Assess and Differentiate/Intervention Activity: Consider using the *Intervention Activity* with all students, as students are asked to use a bar diagram to solve a multiplicative comparison problem.

Lesson 6-3: Solve Multi-step Problems		
4.OA.A.3 4.OA.A.1 4.NBT.B.5 4.NBT.B.6 MP.1 MP.4 MP.7 MP.8	Access Prior Learning: In previous topics, students developed computational skills by using models and equations to solve problems. Developing the Big Idea: In this lesson, students will use computational skills, modeling and problem solving to solve multi-step problems using all four operations.	Solve & Share: Consider giving students the opportunity to use concrete tools, various representations or models and other strategies to solve the multi-step problem. Look Back: Consider facilitating a discussion around the *Look Back!* as the question ties to estimation and mental math to check for reasonableness. Students should have multiple opportunities to estimate. Visual Learning: The *Visual Learning* addresses hidden questions in problems. Hidden questions can be difficult for some students to find in a multi-step problem, though they had some exposure to it in topic 5 or previous grades. Give students opportunities to use tools and/or models to support their understanding of multi-step problems. Some students might realize they only need to do 2 X 18 to find the difference. Independent Practice/Math Practices and Problem Solving: Students do NOT have to do all the problems in their Student Edition. Ask students to complete the *Quick Check* items (marked with a pink check mark) first and continue on to other items as appropriate. *CTC: *Quick Check* (digital platform)
Lesson 6-4: Solve More Multi-step Problems		
4.OA.A.3 4.NBT.B.5 4.NBT.B.6 MP.1 MP.3 MP.4	Access Prior Learning: In previous topics, students developed computational skills by using models and equations to solve problems. In the previous lesson, students used computational skills, modeling and problem solving to solve multi-step problems using all four operations. Developing the Big Idea: In this lesson, students will extend their work to solving problems with more than two steps.	Solve & Share: Consider encouraging students to use concrete tools, various representations, models or other strategies to solve the multi-step problem. Look for students who used the partial product algorithm to solve the problem. Assess and Differentiate/Intervention Activity: Consider using the *Intervention Activity* with all students, as students use multiple bar diagrams to solve multi-step problems.
Lesson 6-5: Math Practices and Problem Solving- Make Sense and Persevere		
4.OA.A.2 4.OA.A.3 4.NBT.B.5 4.NBT.B.6 MP.1 MP.2 MP.4 MP.6	Access Prior Learning: In previous lessons and topics, students have had to persevere to solve multi-step problems using the four operations. Developing the Big Idea: In this lesson, students will persevere in finding hidden questions and solving multi-step problems using the four operations.	Solve & Share: The *Solve & Share* is an area problem. Consider encouraging students to use tools or representations, like a grid to support them in solving the problem. *CTC: *Solve & Share* (student work samples)

Table 2: Addition and subtraction situations by grade level.

	Result Unknown	Change Unknown	Start Unknown
Add To	A bunnies sat on the grass. B more bunnies hopped there. How many bunnies are on the grass now? $A + B = \square$	A bunnies were sitting on the grass. Some more bunnies hopped there. Then there were C bunnies. How many bunnies hopped over to the first A bunnies? $A + \square = C$	Some bunnies were sitting on the grass. B more bunnies hopped there. Then there were C bunnies. How many bunnies were on the grass before? $\square + B = C$
Take From	C apples were on the table. I ate B apples. How many apples are on the table now? $C - B = \square$	C apples were on the table. I ate some apples. Then there were A apples. How many apples did I eat? $C - \square = A$	Some apples were on the table. I ate B apples. Then there were A apples. How many apples were on the table before? $\square - B = A$
	Total Unknown	**Both Addends Unknown[1]**	**Addend Unknown[2]**
Put Together /Take Apart	A red apples and B green apples are on the table. How many apples are on the table? $A + B = \square$	Grandma has C flowers. How many can she put in her red vase and how many in her blue vase? $C = \square + \square$	C apples are on the table. A are red and the rest are green. How many apples are green? $A + \square = C$ $C - A = \square$
	Difference Unknown	**Bigger Unknown**	**Smaller Unknown**
Compare	*"How many more?" version.* Lucy has A apples. Julie has C apples. How many more apples does Julie have than Lucy? *"How many fewer?" version.* Lucy has A apples. Julie has C apples. How many fewer apples does Lucy have than Julie? $A + \square = C$ $C - A = \square$	*"More" version suggests operation.* Julie has B more apples than Lucy. Lucy has A apples. How many apples does Julie have? *"Fewer" version suggests wrong operation.* Lucy has B fewer apples than Julie. Lucy has A apples. How many apples does Julie have? $A + B = \square$	*"Fewer" version suggests operation.* Lucy has B fewer apples than Julie. Julie has C apples. How many apples does Lucy have? *"More" version suggests wrong operation.* Julie has B more apples than Lucy. Julie has C apples. How many apples does Lucy have? $C - B = \square$ $\square + B = C$

Table 3: Multiplication and division situations

	$A \times B = \square$	$A \times \square = C$ and $C \div A = \square$	$\square \times B = C$ and $C \div B = \square$
Equal Groups of Objects	Unknown Product There are A bags with B plums in each bag. How many plums are there in all?	Group Size Unknown If C plums are shared equally into A bags, then how many plums will be in each bag?	Number of Groups Unknown If C plums are to be packed B to a bag, then how many bags are needed?
		Equal groups language	
Arrays of Objects	Unknown Product There are A rows of apples with B apples in each row. How many apples are there?	Unknown Factor If C apples are arranged into A equal rows, how many apples will be in each row?	Unknown Factor If C apples are arranged into equal rows of B apples, how many rows will there be?
		Row and column language	
	Unknown Product The apples in the grocery window are in A rows and B columns. How many apples are there?	Unknown Factor If C apples are arranged into an array with A rows, how many columns of apples are there?	Unknown Factor If C apples are arranged into an array with B columns, how many rows are there?
		$A > 1$	
Compare	Larger Unknown A blue hat costs \$$B$. A red hat costs A times as much as the blue hat. How much does the red hat cost?	Smaller Unknown A red hat costs \$$C$ and that is A times as much as a blue hat costs. How much does a blue hat cost?	Multiplier Unknown A red hat costs \$$C$ and a blue hat costs \$$B$. How many times as much does the red hat cost as the blue hat?
		$A < 1$	
	Smaller Unknown A blue hat costs \$$B$. A red hat costs A as much as the blue hat. How much does the red hat cost?	Larger Unknown A red hat costs \$$C$ and that is A of the cost of a blue hat. How much does a blue hat cost?	Multiplier Unknown A red hat costs \$$C$ and a blue hat costs \$$B$. What fraction of the cost of the blue hat is the cost of the red hat?

Adapted from box 2–4 of *Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity*, National Research Council, 2009, pp. 32–33.

Notes

Equal groups problems can also be stated in terms of columns, exchanging the order of A and B, so that the same array is described. For example: There are B columns of apples with A apples in each column. How many apples are there?

In the row and column situations (as with their area analogues), number of groups and group size are not distinguished.

References

Common Core Standards Writing Team. (2011, May 29). *Progressions for the Common Core State Standards in Mathematics (draft). K, Counting and Cardinality; Grades K-5, Operations and Algebraic Thinking.* Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

Council of Chief State School Officers. (2010). The Nevada Academic Content Standards. Retrieved from http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf.

Van De Walle, J., Karp, K., & Bay-Williams, J. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7th ed.). Boston, MA: Pearson.

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