GRADE 3 - MODULE 1 - PROBLEM SOLVING

Big Idea

SOLVE is a problem-solving paradigm that can be applied to support students in understanding and solving mathematical and real-world problems.

Vocabulary

S-Study the Problem, O-Organize the Facts, L-Line Up a Plan**,** addition, subtraction, multiplication, division, equals, together, add, plus, and, increase, incline, deposit, sum, total, rises, grow, above, take away, difference, minus, withdraw, write a check, decline, subtract, fewer, decrease, left over, "How much more?" below, times, product, each, of groups, items, per, double, triple, multiplied, quotient, per equal groups, cut into, divvy, split, is, divide, same, balanced, equivalent, V-Verify Your Plan with Action, E-Examine Your Results, quarter, cents, even, putting together, greater than, >, less than, <, compare, hundreds, tens, ones, hexagon, closed shape

Prior Learning

Standards for Mathematical Practice as applied to Grade 2 Content Standards (SMP 1, 2, 7 and 8)

Essential Questions

- Why is it important to have a problem-solving strategy?
- What do the S and O in SOLVE represent?
- Why is it important to know that the problem is asking?
- Why is it important to organize the facts in a word problem?
- What does the L in SOLVE represent?
- Why is it important to write your plan in words before completing the math?
- Why is it important to determine the operation in the L Step?
- What do the V and E in SOLVE represent?
- Why is it important to estimate the answer?
- Why is it important to examine the results of your problem?
- Why is it essential to understand the steps of solving a problem and not just give an answer?
- How can SOLVE be used to solve problems other than contextual or real-world situations?

Competencies

Apply SOLVE as a problem-solving paradigm to support integration of the Standards for Mathematical Practice throughout all Grade 3 Content Standards.

S: Underline the question.
This problem is asking me to
find_____.

O: Identify the facts.
Eliminate the unnecessary facts.
List the necessary facts.

L: Write in words what your plan of action will be.
Choose an operation or operations.

V: Estimate your answer.
Carry out your plan.

E: Does your answer make sense? (Compare your answer to the question.)
Is your answer reasonable? (Compare your answer to the estimate.)
Is your answer accurate? (Check your work.)
Write your answer in a complete sentence.

SOLVE Modifications for ELL or ESL students: (**Example shown**)

> **Jason has 345 model cars and 487 model trucks. How many model vehicles does he have in all?**

S: TPIAMTF (this problem is asking me to find) – the **total vehicles.**
(The students cannot just restate the question if the response starts with "the.")

O: Be as brief as possible and teach the students abbreviations right away ($, #, lb., cm, pkg, etc.,)

L: ___# of cars___ + ___# of trucks___ = ___total___

   ___345___ + ___487___ = ___832___

V: Estimate (use familiar strategies) then fill in blanks in the "L" step   **About 800**

E: No modifications necessary

Misconceptions

- Students may attempt to solve word problems by computing with given values instead of reading and applying a step-by-step problem-solving paradigm.
- Students may think that SOLVE can only be used with real world problems.
- Students may not understand the importance of a problem-solving paradigm that can be used at any grade level with any concept.

Resources from The Key Elements to Mathematics Success - KEMS Grade 3 for Building the Conceptual Understanding of this Module

LESSON 1 – SOLVE – S
Additional Activities: Quiz – T16-T19
Foldable: "SOLVE" (5 flap foldable)

LESSON 2 –SOLVE – 0
Additional Activities: Quiz – T37-T39
Foldable: "SOLVE" (5 flap foldable)

LESSON 3 –SOLVE – L
Additional Activities: Quiz – T59-61
Foldable: "SOLVE" (5 flap foldable)

LESSON 4 – SOLVE – V
Additional Activities: Quiz – T81-83
Foldable: "SOLVE" (5 flap foldable)

LESSON 5 – SOLVE – E
Additional Activities: Quiz – T99-101
Foldable: "SOLVE" (5 flap foldable)

Standards for Mathematical Practice	Examples:
1. Make sense of problems and persevere in solving them.	In grade 3, students know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Third graders may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, "Does this make sense?" They listen to the strategies of others and try different approaches. They often will use another method to check their answers.
2. Reason abstractly and quantitatively.	In grade 3, students should recognize that a number represents a specific quantity. They connect the quantity to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities.
3. Construct viable arguments and critique the reasoning of others.	In grade 3, students may construct arguments using concrete referents, such as objects, pictures, and drawings. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking.
4. Model with mathematics.	In grade 3, students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Third graders should evaluate their results in the context of the situation and reflect on whether the results make sense.
5. Use appropriate tools strategically.	In grade 3, students consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use graph paper to find all the possible rectangles that have a given perimeter. They compile the possibilities into an organized list or a table, and determine whether they have all the possible rectangles.
6. Attend to precision.	In grade 3, students develop their mathematical communication skills; they try to use clear and precise language in their discussions with others and in their own reasoning. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the area of a rectangle they record their answers in square units.
7. Look for and make use of structure.	In grade 3, students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to multiply and divide (commutative and distributive properties).
8. Look for and express regularity in repeated reasoning.	In grade 3, students should notice repetitive actions in computation and look for more shortcut methods. For example, students may use the distributive property as a strategy for using products they know to solve products that they do not know. For example, if students are asked to find the product of 7×8, they might decompose 7 into 5 and 2 and then multiply 5×8 and 2×8 to arrive at $40 + 16$ or 56. In addition, third graders continually evaluate their work by asking themselves, "Does this make sense?
Works Referenced in the Development of the Module	

Common Core State Standards Initiative www.corestandards.org	Ohio Department of Education http://education.ohio.gov/Topics/Learning-in-Ohio/Mathematics
Illustrative Mathematics Project https://illustrativemathematics.org/	North Carolina Math Tools for Teachers https://tools4ncteachers.com/
Mathematics Assessment Project https://www.map.mathshell.org/index.php	Smarter Balanced Assessment Consortium https://smarterbalanced.org/
PARCC http://parcconline.org/	Utah Education Network https://www.uen.org/core/math/
NOYCE Foundation: https://www.insidemathematics.org/	

Other Strategies for using SOLVE problems

- Pass Back Activity: This activity works if students are sitting in rows or it can be adapted to sitting in groups. Each row or group is given a SOLVE problem. The first student completes the S Step and then passes the paper back or to the next student. The second student checks the "S" Step and then marks it with their initials and completes the "O" Step. The SOLVE problem is then passed to the next person who checks and initials the "S" and "O" steps and completed the "L" step. This continues until the problem goes back to the first person who reviews all steps. Student groups can then share their responses as a whole group.
- Have students work in groups of 4 or 5 and assign them one of the SOLVE problems to complete as a group. Students can then transfer answers to chart paper and present to the whole group for discussion and feedback.
- Have a copy of one of the SOLVE problems at each table or group (5 groups). Have students complete the S Step and then pass the problem on to the next group when you give a signal. Students will continue this process until they get back their original problem.
- SOLVE Gallery Walk: Post each SOLVE problem on a chart around the room. Have students work in 5 different groups, each group having a different color marker. Student groups can start at one poster and complete the "S" step. After a few minutes, have student groups move to the next poster, read the "S" step (noting any corrections as necessary with their marker), and then complete the "O" step. (**Note:** Each time a group moves to a new station they should read the steps that were completed by the previous group(s) and note any comments/corrections using their color marker. This helps to guide the discussion of any differences at the end of the activity.) After a few minutes, have students move to the next poster, read the "S" and "O" steps, and complete the "L" step. Continue with this procedure until student groups have returned to their original problem.

Additional real-world problems to use for SOLVE

1. The students in Ms. Stone's 3rd grade class voted on their favorite sport. How many students chose either basketball or football? (2.MD.10)

Favorite Sports
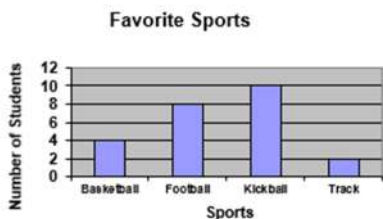
2. Brook is working on a math problem about place value. How can she write the number 742 using the place value of each digit? (2.NBT.1)

3. During a football game, Union High School scored 21 points and the Davison High team scored 27 points. Two players were hurt during the game. Which team won the game and by how many points? Use a number line to represent the problem. (2.MD.6)

4. Sarah goes to the store with $5.00 in her pocket. She buys milk and bread for her mother. After she buys those two items, she has 2 quarters, 2 dimes and 4 pennies. How much money does she have left? (2.MD.8)

5. Kyle is creating an art project using rectangles. He draws the rectangle shown below and divides it into equal size squares. How many squares are in the rectangle? (2.G.2)
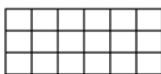
6. Mike read six books during summer vacation. June read 10 books during summer vacation. Daniel read seven more books than June did. What was the total number of books read by the three students? (2.OA.1)

7. When the students in Ms. Gerald's class chose their favorite sport, the most popular sport was kickball. How many total students voted on a favorite sport? (2.MD.10)

Favorite Sports
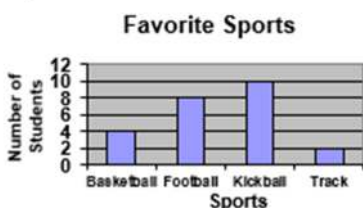
8. During math class, Ms. Whitney gave the following math challenge question to students:
"What's My Name?"
I am a number greater than 20.
I am an even number.
I am less than 35.
When you count by 5's you say my name.

What number is the answer to the math challenge question? (2.NBT.2)

9. Kiley has 3 quarters in her pocket. She buys a pack of stickers that costs 59 cents. How much money does she have left? (2.MD.8)

10. In math class, the students were given a list of numbers and asked to identify which was an even number. Which of the following numbers is even? 3, 5, 9, 13, 16, 19   Explain how you determined the answer. (2.OA.3)

11. There are three math groups working on a project. One group has four students, one group has six students and one group has seven students. How many total students are in the three groups? (2.OA.1)

12. Gina has 125 crayons and Mark has 152 crayons. Who has more crayons? Compare the numbers using symbols and explain how you determined the answer. (2.NBT.4)

13. During the geometry lesson, the teacher asks the students to draw a closed shape that has six sides. What is the name of the closed shape that has six sides? (2.G.1)

14. William and Kate are growing a vegetable garden. During the month of July, they picked 195 tomatoes. During the month of August, they picked 304 tomatoes. How many total tomatoes did they pick during July and August? (2.NBT.7)

15. Four children are playing in the backyard. Karla's mom calls them in to have a snack. She has 16 cookies. If each child gets the same number of cookies, how many cookies did each child get? (2.OA.4)

16. Ten friends were playing kickball at the park. Six more friends came and joined the game. How many friends were playing kickball altogether? (2.OA.1)

17. Abby had a string that was 46 inches long. She cut off 14 inches. How much string did she have left? Show your work. (2.OA.1)

18. Matt made 35 paper airplanes and Jessica made some paper airplanes. Jessica made 15 more paper airplanes than Matt. How many airplanes did they make altogether? Use drawings to solve the problem. Write an equation with a symbol for the unknown number to represent the problem. (2.OA.1)