Grade 2: Solving Addition Problems

2.N.9	
Demonstrate an understanding of addition (limited to 1 and 2-digit numerals) with answers to 100 and the corresponding subtraction by: • using personal strategies for adding and subtracting with and without the support of manipulatives • creating and solving problems that involve addition and subtraction • explaining that the order in which numbers are added does not affect the sum • explaining that the order in which numbers are subtracted may affect the difference.	1. Model addition and subtraction using concrete materials or visual representations, and record the process symbolically. [DEVELOPED ONLY FOR ADDITION] 2. Create an addition or a subtraction number sentence and a story problem for a given solution. [DEVELOPED ONLY FOR ADDITION] 3. Solve a problem involving a missing addend, and describe the strategy used. [DEVELOPED] 4. Solve a problem involving a missing minuend or subtrahend, and describe the strategy used. [NOT DEVELOPED] 5. Match a number sentence to a missing addend problem. [DEVELOPED] 6. Match a number sentence to a missing subtrahend or minuend problem. [NOT DEVELOPED] 7. Add a set of numbers in two different ways, and explain why the sum is the same, (e.g., 2 + 5 + 3 + 8 = [2 + 3] + 5 + 8 or 5 + 3 + [8 + 2]). [DEVELOPED]

Clarification of the outcome:

- ✦ This outcome concerns solving addition problems presented in story format (orally and/or by concrete actions and/or pictorially). It involves the three variations of the addition number sentence: **a + b = ?, a + ? = c, and ? + b = c**.
- ✦ It is preferable that numerical complexity be low. There is no need to involve 2-digit numbers in the problems except perhaps to about 20.
- ✦ The seventh achievement indicator is "out of place". It concerns an arithmetic property, not problem solving. Nevertheless, it is included in the lesson largely because it needs to be done somewhere and it can be helpful for obtaining answers.

Required close-to-at-hand prior knowledge:

- ✤ Understands the meaning of addition as a 'put together' action.
- ✤ Counting to 100 by ones and counting on skills.
- ✤ Comfortable with number words and numerals.

SET SCENE stage

Present students with an addition story problem orally presented. For example: *Harry the Rabbit went looking for food in the forest. He found 3 carrots in the meadow, 5 carrots under the farmer's fence, and 2 carrots near the pond. How many carrots did Freddy find?*

The problem task to present to students:

Have students draw a picture that illustrates the story problem.

Comments:

- Select a story scenario that is familiar to students and that they relate to. The "Harry" stories in this lesson simply are there to provide an example.
- Most student enjoy drawing. The task engages them in thinking about how to show a problem in a drawing.

DEVELOP stage

Activity 1: Revisits SET SCENE and addresses achievement indicator 1.

- ✦ Ask students to show and talk about their drawings. Ensure they explain in some way why the drawing shows what the problem is about.
- ✦ Tell them that we will return to the problem later, but first we need to look at other kinds of problems that Harry the Rabbit may have to solve.

Activity 2: Addresses achievement indicator 7.

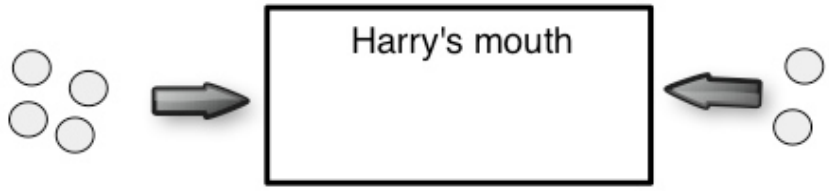
- ✦ Tell students that Harry was asked to do some adding. Show one of the questions (e.g. 2 + 5 + 3). [**Note that the numbers should all be single digit numbers.**] Ask students to add the numbers in different ways (e.g. 2 + 3, then +5; or 5 + 3, then +2, etc.) using counters and counting strategies. Discuss why the results should be the same. Repeat about three times.
- ✦ Provide students with an addition task consisting of four numbers, all less than 10 (e.g. 2 + 8 + 3 + 7). Ask students to add the numbers in different ways (e.g. 2 + 8, then 3 + 7; or 3 + 7, then 2 + 8; or 8 + 3, then 2 + 7, etc.) using counters and counting strategies. Discuss strategies used and why the results should be the same. Repeat about three times.

Note:

Achievement indicator 7 developed in activity #2 does not fit well with the other parts of the outcome. However, to design a 3 stages plan exclusively to develop achievement indicator 7 is overkill. Inserting the development of this achievement indicator at the beginning of the DEVELOP lesson on solving addition problems helps by encouraging students to add in different ways.

Activity 3: Addresses achievement indicators 1, 2, 3, and 5.

- Tell or read students a relevant story that involves a ‘’a + b = ?’ problem (restrict numbers to less than 10). For example: “*Harry ate four carrots. He went looking for more. He found 2 behind his rabbit hole and ate them.”* Ask students to describe the mystery/problem in the story. Expect something like; “We do not know how many carrots Harry ate” Draw a box and counters diagram of the problem situation (see diagram). Discuss the diagram. Ask students to provide a number sentence for the problem situation. Discuss the symbol that could be used for the mystery number. Let students provide suggestions and use one of them. They may want to use a circle, a square, a squiggle, and so on. [For purposes here, we will always use ‘?’ to represent the mystery number.] Once the symbol has been determined, write the addition number sentence for the story/action (for example: ‘4 + 2 = ?’). Discuss the relationship between the number sentence and the diagram (‘4’ is the start, ‘2’ is the extra, ‘?’ is the total).



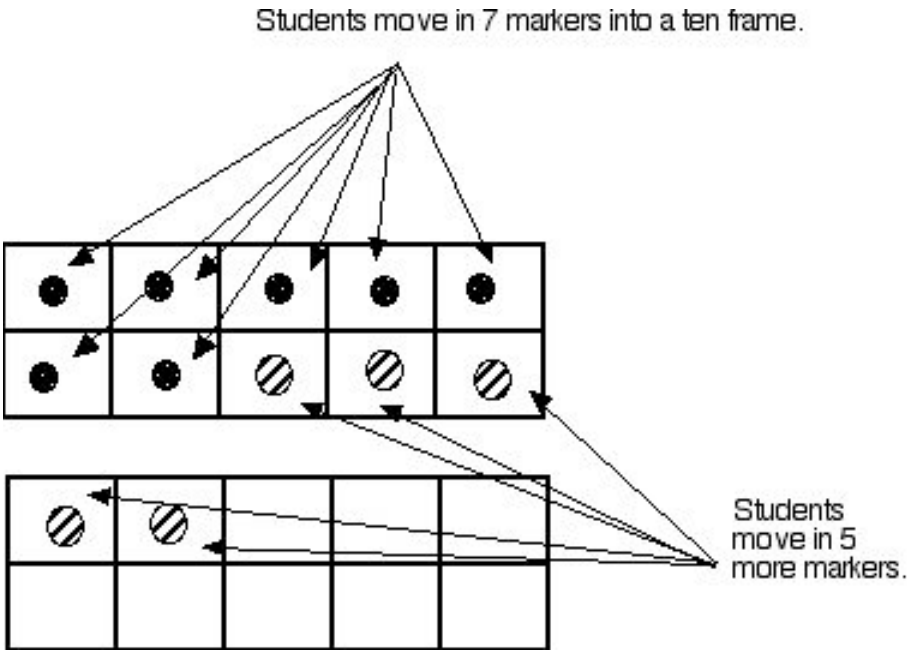
- Ask students to solve the problem by using counters and counting strategies.
- Repeat the activity about three times, using different stories that pose a problem. Restrict the total involved to less than 10.

Note:

The diagram does not show six carrots inside Harry’s mouth. Showing them would eliminate the problem; there would be no need to combine 4 with 2 to determine the answer.

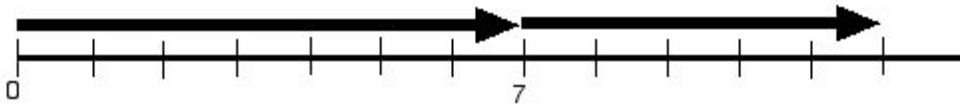
Activity 4: Addresses achievement indicators 1, 2, 3, and 5, and practice.

- Select one of the story problems and discuss how ten frames can be used to solve the problem. (See example for 7 + 5 = ?). Ask students to use ten frames to solve two other story problems.



Activity 5: Addresses achievement indicators 1, 2, 3, and 5, and practice.

- Select one of the story problems and discuss how a number line can show and be used to solve the problem. (See example for 7 + 5 = ?). Ask students to use a number line to solve two other story problems.



Note:

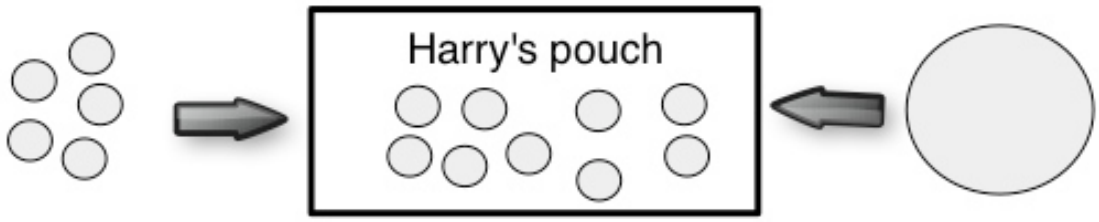
The answer 12 is not shown on the number line. That would give the mystery number away.

Activity 6: Addresses achievement indicators 1, 2, 3, and 5, and practice on a + b = ?

- Organize students into groups. Ask each group to create a story problem (orally only) and a diagram for it. [They will "naturally" create story problems for the 'a + b = ?' type of number sentence.] Ask three groups to tell their story problem and to show the diagram for it. Ask the other children to solve the problems, obtaining answers by using counters and counting strategies.

Activity 7: Addresses achievement indicators 1, 2, 3, and 5.

- Tell or read students a relevant story that involves a 'a + ? = c' problem (restrict numbers to less than 10 for now). For example: *Harry had 5 carrots in his pouch. As he was hopping home, he found a bag with some carrots in it. He put the carrots in his pouch but did not count them. At home he emptied his pouch and counted all the carrots he had. He counted 9 in all.* Ask students to describe the mystery/problem in the story. Expect something like; "We do not know how many carrots Harry found." Draw a box and counters diagram of the problem situation (see diagram). Ask students to provide a number sentence for the problem situation, using the agreed upon symbol for the mystery number (for example: '5 + ? = 9'). Discuss the relationship between the number sentence and the diagram. Ask students to solve the problem by using counters and counting strategies. Discuss their solutions.



- Repeat the activity about four times, using different stories that pose a problem. Restrict the totals involved to less than 10. Discuss the strategies used to figure out the answer. Ensure that students write an addition number sentence each time of the form: a + ? = c.

Note:

The picture, ten frame, and number line diagrams for the number sentence forms, a + ? = c and ? + b = c, may be "mind shaking" to you. There is an 'action' way to see the situation. For example, for 5 + ? = 9, have 5 students move into a "container" area of the room. Then have 4 students hidden under a blanket move into that area as well. Quickly lift the blanket from the students to reveal that 9 students are now in the "container". The question is: How many students were under the blanket?

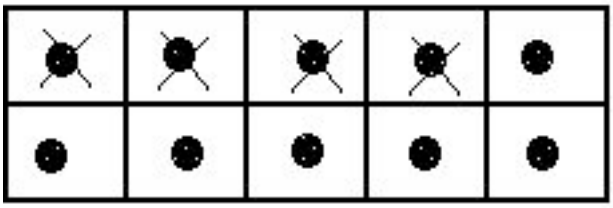
Activity 8: Addresses achievement indicators 1, 2, 3, and 5, and practice on a + ? = c.

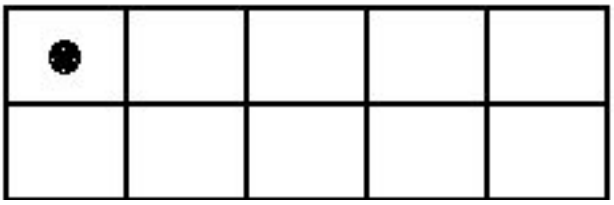
- Select one of the story problems and discuss how ten frames can show and be used to solve the problem. (See here for an example for 4 + ? = 11). Ask students to use ten frames to solve two other story problems.

Students place 11 markers in the ten frames.

Students put an X over each of the first 4 markers.

Students then count how many markers are needed to reach 11.





Activity 9: Addresses achievement indicators 1, 2, 3, and 5, and practice on a + ? = c.

- Select one of the story problems and discuss how a number line can show and be used to solve the problem. (See example for 4 + ? = 11). Ask students to use a number line to solve two other story problems.

Note:

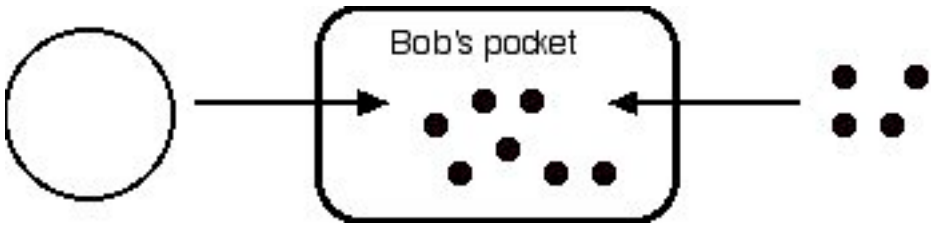
The number line does not show the marks from 4 to 11. That would give the mystery number away.

Activity 10: Addresses achievement indicators 1, 2, 3, and 5, and practice on a + ? = c

- Organize students into groups. Ask each group to create a story problem (orally only) for the number sentence 3 + ? = 12. Ask three groups to tell their story problem. Ask the other children to solve the problem, obtaining answers by using counters and counting strategies.

Activity 11: Addresses achievement indicators 1, 2, 3, and 5.

- Tell or read students a relevant story that involves a '? + b = c' problem (restrict numbers to less than 10 for now). For example: *Bob, Harry's brother, woke up sleepily. He forgot that he had some carrots in his pocket. On the way to the meadow, Bob found 4 carrots and put them in his pocket. Later he counted all the carrots in his pocket. He had 7 in all.* Ask students to describe the mystery/problem in the story. Expect something like; "We do not know how many carrots Bob had to begin with." Draw a box and counters diagram of the problem situation (see diagram). Ask students to provide a number sentence for the problem situation, using the agreed upon symbol for the mystery number (for example: '? + 4 = 7'). Discuss the relationship between the number sentence and the diagram. Ask students to solve the problem by using counters and counting strategies. Discuss their solutions.



- Repeat the activity about three times, using different stories that pose a problem. Restrict the numbers involved to less than 20.

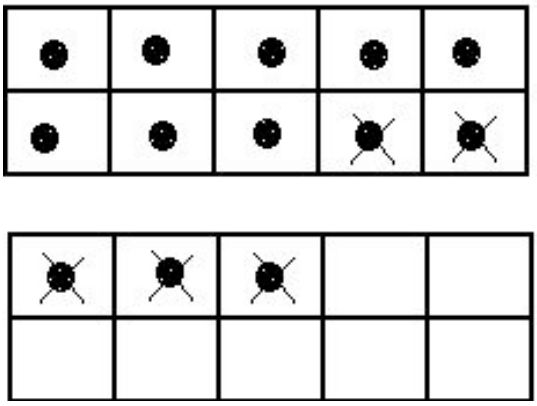
Activity 12: Addresses achievement indicators 1, 2, 3, and 5, and practice on ? + b = c.

- Select one of the story problems and discuss how ten frames can show and be used to solve the problem. (See below for an example for ? + 5 = 13). Ask students to use ten frames to solve two other story problems.

Students place 13 markers in the ten frames.

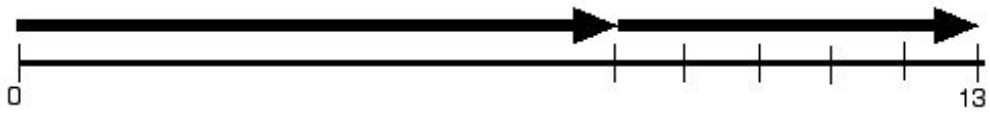
Students put an X over each of the last 5 markers.

Students then count how many markers do not have an X over them.



Activity 13: Addresses achievement indicators 1, 2, 3, and 5, and practice on ? + b = c.

- Select one of the story problems and discuss how a number line can show and be used to solve the problem. (See here for an example for ? + 5 = 13). Ask students to use a number line to solve two other story problems.



Note:

The number line does not show the marks from 0 to 8. That would give the mystery number away.

Activity 14: Revisits SET SCENE & addresses achievement indicators 1, 2, 3, and 5.

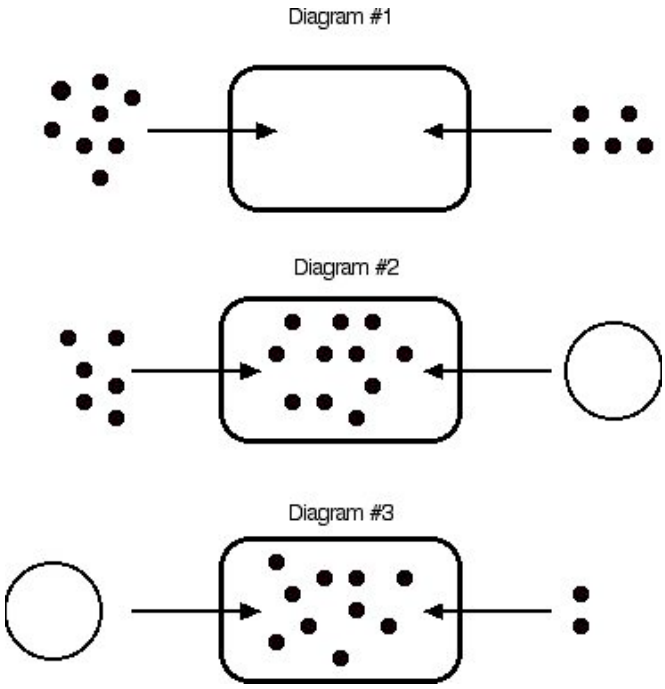
- Retell the SET SCENE problem. Ask students to write the number sentence of it (expect: 3 + 5 + 2 = ?).
- Ask students to solve it using ten frames and using a number line. Discuss solutions.

Activity 15: Addresses achievement indicators 1, 2, 3, and 5, and practice on ? + b = c

- Organize students into groups. Ask each group to create a story problem (orally only) for the number sentence ? + 6 = 13. Ask three groups to tell their story problem. Ask the other children to solve the problem, obtaining answers by using counters and counting strategies.

Activity 16: Assessment of teaching.

Provide students with a worksheet containing 3 diagrams; one for 'a + b = ?', one for 'a + ? = c', and one for '? + b = c' (see example). Ask students to write a number sentence for each diagram and to find the value of the mystery number by using counters and counting strategies.



If all is well with the assessment of teaching, engage students in PRACTICE (the conclusion to the lesson plan).

Two examples of partially well-designed worksheets follow.

Each worksheet contains a sampling of question types. More questions of each type are needed for a well-designed worksheet.

The MAINTAIN stage follows the sample worksheets.

Question 1.

Figure out the missing number in each number sentence by using counters and a counting strategy.

a) 6 + 3 = ?

b) ? + 8 = 13

c) 4 + ? = 9

Question 2.

Figure out the missing number in each number sentence by using ten frames.

a) 6 + 3 = ?

b) ? + 8 = 13

c) 4 + ? = 9

Question 3.

Figure out the missing number in each number sentence by using a number line.

a) 6 + 3 = ?

b) ? + 8 = 13

c) 4 + ? = 9

Question 4.

Draw a picture for each number sentence. The picture should tell a story about the number sentence.

a) 6 + 3 = ?

b) ? + 8 = 13

c) 4 + ? = 9

MAINTAIN stage

Mini-task example

During the morning routine, every so often:

- Present a story problem of one of the three forms: a + b = ?, a + ? = c, ? + b = c. Ask students to write the number sentence for it and to solve the problem.

Rich-task example

Solving complex problems is one way to maintain this outcome. The examples below reflect this.

Sample problems (They would be orally presented.)

An ant carrying a larva was trying to get out of a sloped ant tunnel. The tunnel is 30 ant steps long. The ant moved 10 steps forward but then slipped back 4 steps. It tried again. It moved 8 steps forward but slipped back 6 steps. Then the ant ate some sugar. Wow! It moved forward all the way to the end without slipping. How many steps did it move forward after eating the sugar?

Sam and Mary want to know how many toys that had in their toy boxes. Mary had 15 toys in her toy box. Sam had two toy boxes. The red toy box had 17 toys. The blue toy box had 24 toys. How many toys do Mary and Sam have altogether?

How many books do the students in the classroom read in a month? Check your estimate by obtaining the needed data and then doing the necessary arithmetic.