Operations of Addition and Subtraction

Student Probe

1. Will had 7 toy cars. He bought 5 toy cards. How many toy cars does Will have now?

2. Molly has 14 beads. On the way to school, she lost 8 beads. How many beads does Molly have now?

If the student is successful with these problems with action then use these problems with no action as student probes.

1. Will had 3 red cars and 4 blue cars. How many cars does Will have?

2. Molly has 14 beads. 8 of the beads are silver. The other beads are gold. How many gold beads does she have?

If the student is successful with all of these problems go to the lesson Solving Open Sentences with Addition and Subtraction.

At a Glance

What: Understanding the meaning of the operations of addition and subtraction
Standard:
AR.Math.Content.2.OA.A.1

- Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.
- Represent a strategy with a related equation including a symbol for the unknown number.

Mathematical Practices:
SMP1: Make sense of problems and persevere in solving them.
SMP4: Model with mathematics
Who: Students who have difficulty solving problems in context.
Grade Level: 2
Prerequisite Vocabulary: None
Prerequisite Skills: None
Delivery Format: Individual or small group
Lesson Length: 30 minutes
Materials, Resources, Technology: counters
Student Worksheets: None

Lesson Description

This lesson is intended to develop students' conceptual understanding of addition and subtraction. Students will develop an understanding that addition is joining two or more sets of objects into one set and finding the number of objects in the "joined set."
Also, in this lesson the student will develop an understanding that subtraction is separating one set of objects into two parts. The student knows one part, but must find the other part. The student needs to be exposed to addition and subtraction problems with result unknown, start unknown, and change unknown.
Important note: Students may or may not need the cubes to find the answer to the question. However, using manipulatives initially with all students develops the conceptual understanding of addition and subtraction.

Rationale

In real life, students will be expected to solve contextual problems. Problems with actions are easier for children to solve than problems with no action. Initially, expose children to problems with action. As students gain understanding and expertise, consider problems with no action. Most children solve *all joining* problems using addition. Children will see three types of joining problems. The type of joining problem is determined by what is unknown—start unknown, change unknown, and result unknown. The easiest for children to solve is result unknown. The most difficult for children to solve is the start unknown.

In real life, adults are expected to solve problems using mathematics. The most difficult part is determining what operation or operations will be used to solve the problem. To be able to identify the operations to use to solve the problem students must understand the meaning of the operations, namely addition and subtraction.

Preparation

Prepare printed problems for students to view as they solve each problem and/or answer questions.

Lesson

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
1. Present students with the following problem: Michael has 6 football cards. His grandmother gave him 3 football cards for his birthday. How many football cards does Michael have now? Restate the problem in your own words.	Answers may vary.	The problem involves what objects? *football cards* What is happening (the action) in the problem? *Grandmother gave Michael some football cards.*

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
2. Ask the student to model the problem using cubes (or some other counter). Represent the football cards Michael had to start. Represent the football cards Michael's grandmother gave him on the mat. (Ensure that the student keeps the two sets of cubes separated.)	Student should place 6 cubes on the mat. Student should place 3 cubes on the mat.	How many football cards did Michael have to start with? How many did Michael's grandmother give him?
3. What does the problem ask us to find? What word in the problem describes the action? Is this action "joining to" or "taking away"?	The number of football cards Gave Joining to	Will Michael have more cards or fewer cards?
4. What do you need to do to the two sets to find the number of football cards Michael has now?	Join the 6 football cards and 3 football cards into one set.	
5. How many cubes are in the one set now that the two (or more) sets are joined? How many football cards does Michael have now?	9 9	
6. Let's write the number sentence for the problem. (Note: Use manipulatives initially with all students to develop the concept that addition means to "join sets of objects".)	6 + 3 = 9 or 6 + 3 9	

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
7. Continue to provide students problems that require addition to find the answer but with the unknown at different locations: result, change, start.		
8. Present students with the following problem: Lisa has 9 hair bows for her hair. She gave a friend 2 hair bows. How many hair bows does Lisa have now? Restate the problem in your own words.	 Answers vary.	The problem involves what objects? *hair bows* What is happening (the action) in the problem? *She gave a friend 2 hair bows.*
9. What word in the problem describes the action? Is this action "joining to" or "taking away"? What does "taking away" mean?	Gave Taking away Subtracting	Will Lisa have more bows or fewer bows?
10. What numbers are in the problem? *9, 2* How many hair bows did Lisa have to start with?	9 and 2 9	
11. Ask the student to model the problem using cubes (or some other counter). Represent the hair bows that Lisa started with. How many did she give her best friend?	 11 2	

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
12. What will you do on your work mat to show that Lisa gave 2 hair bows to her best friend?	Take two cubes away from the group and place at another place on the work mat.	
13. How many hair bows does Lisa have now?	7	Where are the hair bows that Lisa gave her best friend? Where are the hair bows (cubes) that Lisa has now? What does the question ask us to find?
14. Let's write the number sentence for the problem. (Note: Use manipulatives initially with all students to develop the concept that subtraction means to "take away objects from a set".)	9 — 2 = 7 or 9 — 2 7	
15. Continue to provide students problems that require subtraction to find the answer but with the unknown at different locations: result, change, start.		
16. Present students with the following problem: Debbie has 15 beads. Her sister gave her some more beads. Debbie now has 21 beads. How many beads did Debbie give her?	Expect students to think: 15 plus "what number" is 21? Expect students to write: 15 + ? = 21 or 15, 16, 17, 18, 19, 20, 21 15 + 6 = 21 Debbie's sister gave her 6 hair bows.	The problem involves what objects? What is happening (the action) in the problem? *W*hat word in the problem describes the action? Is this action "joining to" or "taking away"? What numbers are in the problem? How many beads did Debbie have to start with?

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
17. Use cubes on the work mat to represent the beads Debbie had to start. Let's place a cup on the work mat to represent that we don't know how many beads Debbie's sister gave her.	Debbie had 15 beads to start.	
18. How many beads does Debbie have now? What can we do on the work mat to show that now Debbie has 21 cubes? (Note: The student may start at 13 and count on as each cube is dropped into the cup. This is the <u>counting on method</u>. OR The student may drop some cubes into the cup and then count all of the cubes to see if Debbie has 21 cubes. <u>This is trial and error method</u>.)	21 Add cubes to the container until we have 21 cubes on the work mat.	Observe and prompt the student as necessary.
19. What does the question ask us to find? Where on your work mat are the cubes that Debbie's sister gave Debbie? How many beads did Debbie's sister give her?	The number of beads that Debbie's sister gave Debbie. The cubes in the cup. 6	 Count the cubes in the cup.
20. What happened in this problem? What was the action in this problem?	Debbie had 15 beads. Debbie's sister gave her 6 cubes. Now, Debbie has 21 beads.	

	Joined two sets of beads.	
The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
21. Present students with the following problem: Michael baked 12 cookies. He and his friends ate some cookies. He now has 7 cookies. How many cookies did Michael and his friends eat?	Expect students to think: 12 minus "what number" is 7? Expect students to write: 12 - ? = 7 or 12, 11, 10, 9, 8, 7 12 - 5 = 7 Michael and his friends ate 5 cookies.	The problem involves what objects? What is happening (the action) in the problem? *W*hat word in the problem describes the action? Is this action "joining to" or "taking away"? What does "taking away" mean? What numbers are in the problem?
22. Use cubes on the work mat to represent the cookies Michael had to start. How many cookies did Michael have to start with?	12	
23. How many cookies did Michael and his friends eat?	We don't know. That is what we are asked to find.	
24. How many cookies does Michael have now?	7	

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
25. What can we do with the cubes on the work mat to show Michael and his friends ate some cookies? (Note: The student may start at 12 and count backwards as each cube is picked up unti he counts to 7. This is the <u>counting backward method</u>. OR The student may pick up some cubes, then count all of the cubes left on the work mat to see if Michael still has 7 cookies. This is a <u>trial and error method</u> and if 7 cookies are not left on the work mat, then the student will probably put all the cubes back on the work mat and try another "handful". OR The student may pick up one cube, then count all of the cookies left on the work mat to see if Michael still has 7 cookies. Then, the student will pick up another cube and see how many cookies Michael has left. The student will continue to pick up one cube at a time and checking to see the number of cookies that Michael still has until he has 7 left.)	Take some cookies away until Michael has 7 cookies left.	

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
26. Where are the cookies that Michael still has? Where are the cookies that the Michael had to start with? How many cookies did Michael and his friends eat? (Note: Use manipulatives initially with all students to develop the concept that subtraction means to "take away objects".)	Part of the cookies are on the mat and part of the cookies are in the student's hand or at a different location on the work mat. 5	
27. Continue to provide students problems that require addition to find the answer but with the unknown at different locations: result, change, start.		
28. Present students with the following problem: Bill has some baseball cards. He receives 8 more baseball cards for his birthday. He now has 14 baseball cards. How many baseball cards did Bill have start with?	Expect students to think: What number plus 8 is 14? Expect students to write: $\underline{?} + 8 = 14$ or 8, 9, 10, 11, 12, 13, 14 Student uses trial and error. Example: Tries 5, which doesn't work. Tries 4, which doesn't work. Tries 6, which work. Bill had 6 baseball cards to start with.	The problem involves what objects? What is happening (the action) in the problem? *W*hat word in the problem describes the action? Is this action "joining to" or "taking away"? What does "joining to" mean? What numbers are in the problem? *8, 14*

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
28. How many baseball cards did Bill have to start with? How many cards did he receive?	We do not know. That is what we are asked to find. 8	
29. Use cubes on the work mat to represent the cards that Bill received. Let's place a cup on the work mat to represent that we don't know how many cards Bill had to start with.	Students place 8 cubes on the mat.	
30. How many cards (cubes) will you place in the cup?	The student places cards in the cup until Bill has his 14 cards on the work mat. OR The student may put some cards out and then count all of the cubes. The student continues to use trial and error until he has 14 cards.	
31. How many cards did Bill have to start with? (Note: Use manipulatives initially with all students to develop the concept that subtraction means to "take away objects".)	6	

Teacher Notes

Problem 1: Many adults solve this problem using subtraction. However, most children do not see this problem as a subtraction problem. Children see this problem as an addition problem. It is acceptable, if children solve this problem naturally using subtraction. As the teacher, do not teach children that this problem should be solved using subtraction. It may not make sense to the child to use subtraction.

Problem 2: Many adults solve this problem using addition. However, most children do not see this problem as an addition problem. Children see this problem as a subtraction (take away) problem. It is acceptable, if children solve this problem naturally using addition. As the

teacher, do not teach children that this problem should be solved using addition. It may not make sense to the child to use addition.

Variations

Problems to use with students for guided practice and/or independent practice:

Teacher Note: These problems should not be used during any one session. These are problems to use as the skill is revisited from time to time.

Join Result Unknown:

1. Jose had 7 marbles. His mother gave him 2 more marbles. How many marbles does Jose have now? What operation will you use to answer this question? Solve the problem.

2. Sally has 4 stickers. Her friend gave her 7 more stickers. How many stickers does Sally have now? What operation will you use to answer this question? Solve the problem.

3. Lance had 12 toy cars. His mother bought him 8 more toy cars. How many toy cars does Lance have now? What operation will you use to answer this question? Solve the problem.

4. Ann baked 12 cookies for the party. Then, she baked 6 more cookies for the party. How many cookies did Ann bake for the party? What operation will you use to answer this question? Solve the problem.

Taking Away Result Unknown:

1. 13 ducks were swimming in the pond. 5 ducks flew away. How many ducks were swimming in the pond now? What operation will you use to answer this question? Solve the problem.

2. Noah had 18 pieces of gum. He gave 5 pieces to his friends. How many pieces of gum did Noah have now? What operation will you use to answer this question? Solve the problem.

3. The baker made 14 cakes. He sold 8 cakes to his customers. How many cakes did the baker have now? What operation will you use to answer this question? Solve the problem

4. 9 birds are sitting in a tree. 3 birds flew away. How many birds are in the tree now? What operation will you use to answer this question? Solve the problem

5. Roderick has 19 pennies in his pocket. He used 6 pennies to buy a piece of gum. How many pennies does Roderick have now? What operation will you use to answer this question? Solve the problem

Join Change Unknown:

1. Savannah has 13 rings. Her sister gave her some more rings. Savannah now has 21 rings. How many rings did Savannah give her? What operation will you use to answer this question? Solve the problem

2. Jimmy has 14 baseball cards. He received some more baseball cards for his birthday from his grandfather. He now has 23 baseball cards. How many baseball cards did James receive from his grandfather? What operation will you use to answer this question? Solve the problem

3. Quinton has 13 cars in his collection. He bought some more toy cars. He now has 21 toy cars. How many toy cars did Quinton buy? What operation will you use to answer this question? Solve the problem

4. Billie had 16 stickers in her collection. Her grandmother gave her some more stickers. Laura now has 28 stickers. How many stickers did Laura's grandmother give her? What operation will you use to answer this question? Solve the problem

5. Jacoby had 11 marbles. He received some more marbles for his birthday. He now has 18 marbles. How many marbles did Jacoby receive for his birthday? What operation will you use to answer this question? Solve the problem .

Taking Away Change Unknown:

1. Sixteen children were playing on the swings. Some children go inside. Now there are 12 children playing on the swings. How many children went inside? What operation will you use to answer this question? Solve the problem

2. Terry baked 18 cookies. She and her friends ate some cookies. She now has 7 cookies. How many cookies did Terry and her friends eat? What operation will you use to answer this question? Solve the problem

3. Kayla has 17 beads. She lost some beads. She now has 9 beads. How many beads did Kayla lose? What operation will you use to answer this question? Solve the problem

4. Fifteen ducks were swimming around in the lake. Some ducks flew away. Now there are 12 ducks swimming around in the lake. . How many ducks flew away? What operation will you use to answer this question? Solve the problem

5. Peyton had 16 comic books. He gave his best friend some comic books. Peyton now has 6 comic books. How many comic books did Ashton give his best friend? What operation will you use to answer this question? Solve the problem

Join Start Unknown:

1. Savannah has some rings. Her sister gave her 4 more rings. Savannah now has 9 rings. How many rings did Savannah have to start with? What operation will you use to answer this question? Solve the problem

2. Justin has some baseball cards. He receives 7 more baseball cards for his birthday from his grandfather. He now has 13 baseball cards. How many baseball cards did he have start with? What operation will you use to answer this question? Solve the problem

3. Jarius has some toy cars in his collection. He bought 6 more toy cars. He now has 11 toy cars. How many toy cars did Marius have to start with? What operation will you use to answer this question? Solve the problem

4. Laura had some stickers in her collection. Her grandmother gave her 12 more stickers. Laura now has 23 stickers. How many stickers did Laura have to start with? What operation will you use to answer this question? Solve the problem

Taking Away Start Unknown:

1. Ashton had some comic books. He gave his best friend 6 comic books. Ashton now has 15 comic books. How many comic books did Ashton have to start with? What operation will you use to answer this question? Solve the problem

2. Some children were playing on the swings. Seven children go inside. Now there are 4 children playing on the swings. How many children were on the swings to start with? What operation will you use to answer this question? Solve the problem

3. Erykah baked some cookies. She ate 5 cookies. She now has 7 cookies. How many cookies did she have to start with? What operation will you use to answer this question? Solve the problem

4. Maylah has some beads. She lost 5 beads. She now has 12 beads. How many beads did Maylah have to start with? What operation will you use to answer this question? Solve the problem.

5. Some ducks were swimming around in the lake. 8 ducks flew away. Now 25 ducks are swimming around in the lake. . How many ducks were swimming in the lake to start with? What operation will you use to answer this question? Solve the problem

Formative Assessment

1. Llanaria had 15 beads on her necklace. Then, she put 7 more beads on her necklace. How many beads did Llanaria have on her necklace then? What operation will you use to answer this question? Solve the problem.
2. Jacoby had some marbles. He received 9 more marbles for his birthday. He now has 23 marbles. How many marbles did Jacoby have to start with? What operation will you use to answer this question? Solve the problem.

References

Marjorie Montague, P. (2005, 4 19). *Math Problem Solving for Primary Elementary Students With Disabilities*. Retrieved 2 24, 2011, from The Iris Center: http://iris.peabody.vanderbilt.edu/resource_infoBrief/k8accesscenter_org_training_resources_documents_Math_Primary_Problem_Solving_pdf.html

Russell Gersten, P. (n.d.). *RTI and Mathematics IES Practice Guide - Response to Intervention in Mathematics*. Retrieved 2 25, 2011, from rti4sucess: http://www.rti4success.org/images/stories/webinar/rti_and_mathematics_webinar_presentation.pd