Addition and Subtraction Problem Types

In the K-2 Classroom

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These Three Things…

25	**26**
31	**27**

Learning Objectives

* Take a deep look at the Learning Progressions for **Operations and Algebraic Thinking in the Washington State Learning Standards**

    * Explore students conceptual development of operations from concrete to abstract

    * Experience various problem types

* Explore activities to ensure a deep understanding of **Operations and Algebraic Thinking.**

Setting the Stage

Addition and Subtraction Problem Types in the K-2 Classroom

Why Math?

* "The National Council of Teachers of Mathematics (NCTM) and the National Association for the Education of Young Children (NAEYC) affirm that high-quality, challenging, and accessible mathematics education for 3-to 6- year- old children is a vital foundation for future mathematics learning. In every early childhood setting, children should experience effective, research-based curriculum and teaching practices."

Making the Case…
Focus on number sense!

* Research indicates that early number sense predicts school success more than other measures of cognition like verbal, spatial or memory skills or reading ability.

 Jordoan, Kaplan, Locuniak, and Ramineni, 2007

Why P-3?

- Achievement gaps exist early

- High quality "preschool" helps to prepare children

- Without sustained attention to high quality learning experiences, fade-out appears

- Achievement gaps are fairly stable from 3rd grade on

What do you see?

What does it mean?

What considerations might be made?

Percent of 2014 Entering Kindergartners, by Range of Demonstrated Skills
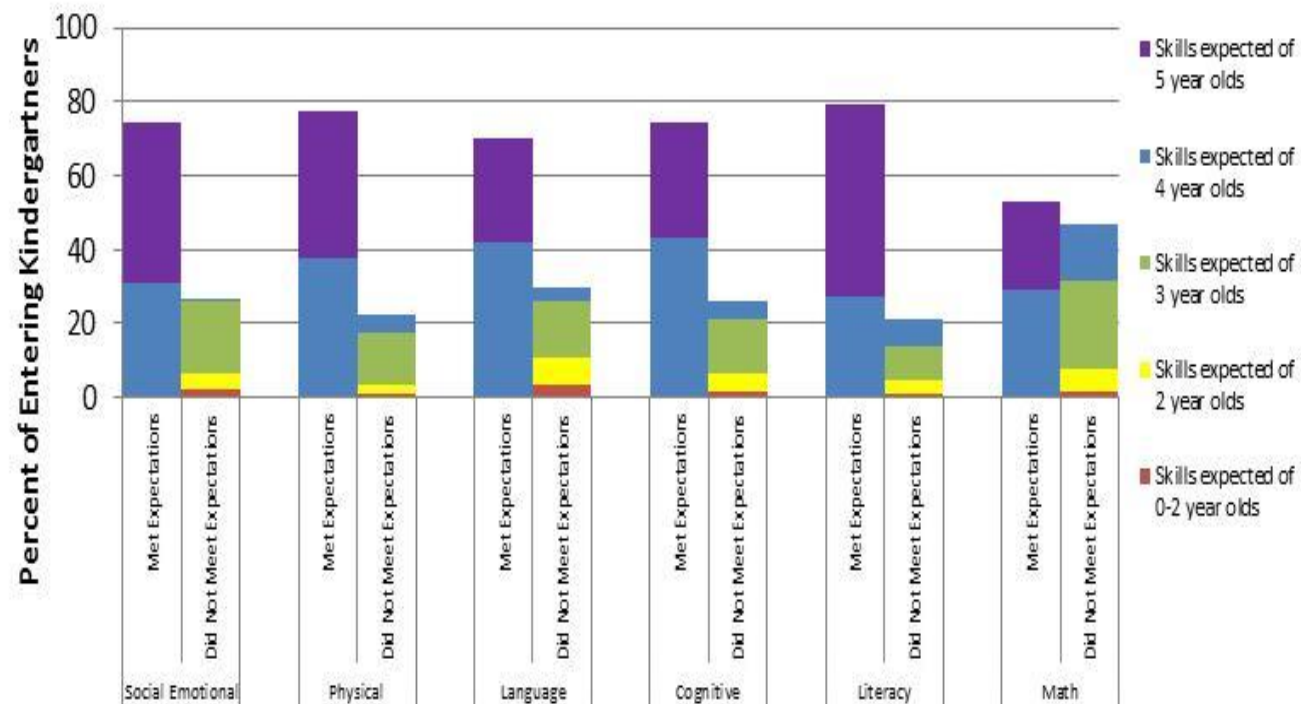
Standards

- ❑ Washington Learning Standards
- ❑ Learning Pathways in Numeracy: Addressing Early Numeracy Skills
- ❑ Content Emphasis by Cluster Documents

Domains

Preschool	K	1	2	3	4	5	6	7	8	HS
Counting and Cardinality										
Operations and Algebraic Thinking							Ratio and Proportional Relationships		Functions	
	Numbers and Operations in Base Ten						Expressions and Equations		Algebra	
				Fractions			The Number System		Number and Quantity	
Measurement and Data							Probability and Statistics			Modeling
Geometry										
Standards for Mathematical Practice										

Structure of the Washington Learning Standards

Domain

Number and Operations in Base Ten   3.NBT

Use place value understanding and properties of operations to perform multi-digit arithmetic.

1. Use place value understanding to round whole numbers to the nearest 10 or 100.

2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

3. Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.

Standard

Cluster

Standards for Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Learning Pathways in Numeracy…

Learning Pathways in Numeracy Activity Using Case Studies

Work at your tables to put the math progression statements in order.

	Operations	Related Topics
0 - 36 months		
3 - 4 years		
4 - 5 years	There may be more than one statement in an age grouping.	Consider how Operations and Algebraic Thinking bridge to other domains.
5 and kindergarten		
Grade 1		
Grade 2		
Grade 3		

Case Studies…

* **You have a 2ⁿᵈ grade child who can add and subtract within 5**

    * Where are they on the numeracy pathway?
    * What stages would this student need to progress through to be at the appropriate age/grade level?
    * What kind of activity might you provide this student?

Case Studies…

* **You have a four year old child who can demonstrate fluency within 10.**

    * Where are they on the numeracy pathway?
    * What would be your next steps for this student?

CCSS-Math Content Emphasis by Cluster-Kindergarten

* **Counting and Cardinality**
    * Know number names and the count sequence.
    * Count to tell the number of objects.
    * Compare numbers.
* **Operations and Algebraic Thinking**
    * Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.
* **Number and Operations in Base Ten**
    * Work with numbers 11-19 to gain foundations for place value.
* **Measurement and Data**
    * Describe and compare measureable attributes.
    * Classify objects and count the number of objects in categories.
* **Geometry**
    * Identify and describe shapes.
    * Analyze, compare, create, and compose shapes.

* **Key:**

    * Major Clusters

    * Supporting Clusters

    * Additional Clusters

Learning Progressions

Addition and Subtraction Problem Types in the K-2 Classroom

Progression Jigsaw

Read Through your assigned subsection on page 4-5.

Groups 1

From saying the **counting** words to counting out objects

Groups 2

From **subitizing** to single-digit arithmetic fluency

Groups 3

From counting to **counting on**

Groups 4

From **comparison** by matching to comparison by numbers to comparison involving adding and subtracting

How Concepts Progress

Record the following on your notecard:

* In RED
    * A **Progression of the Big Ideas** from you section (summarized)   -->
    * What does this look like in the **Pathways?**
* In BLUE
    * **Ways to implement** these Big Ideas (lesson or activity ideas)

Be read to **Share**

Give One! Get One!

1. Silently brainstorm counting, addition or subtraction activities you have done in your classroom.

2. On the front of your card write down a FAVORITE activity you do in your classroom to practice counting, adding or subtracting? (one activity)

3. Number the back of your card 1-3

4. When I say go, find 3 others (not seated at your table) who can share a different activity with you. Give them yours; get there's. Record it on the back of your card.

Algebraic thinking does not develop in isolation…

Numeracy does not develop along a linear path.

Children need to have a counting sequence and practice with subitizing and comparing *simultaneously* with operations.
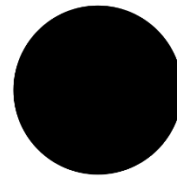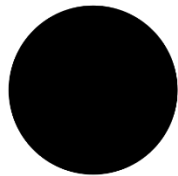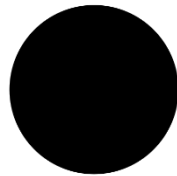
Subitizing

Addition and Subtraction Problem Types in the K-2 Classroom
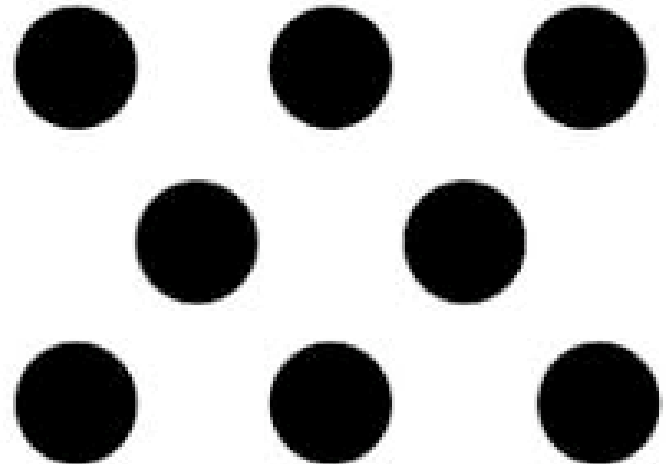
Consider the following number….
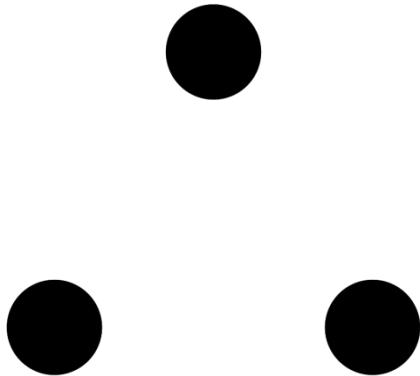
3

How many do you see?

How many do you see?

* How many dots do you see?
* How do you see the arrangement?
* How is this different from the image with three dots?

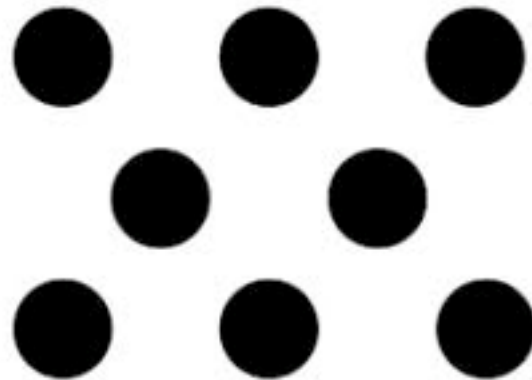# Building Vocabulary-Subitizing
Latin word meaning "to arrive suddenly"

Perceptual

Conceptual

Activity:
Dot Cards

* Dot Card Flash
* Near Numbers
  * One More
  * One Less
* More Less and the Same
* Doubles
* Anchors to Five and Ten
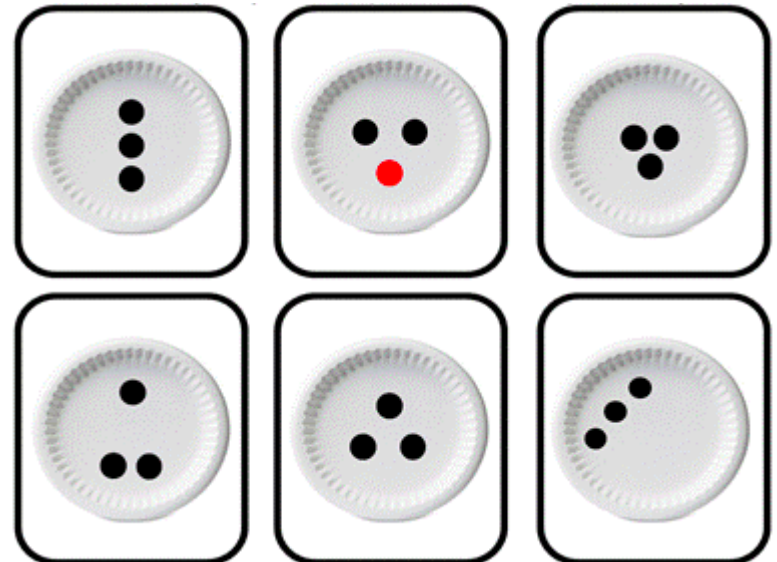
Subitizing Activity

- Where does this activity fall on the Pathway?
- What components or domains are addressed (WA Learning Standards)?
- How can this activity be adapted to meet the needs of your students? (interventions and extensions)
- What can be assessed from this activity?

Choose a Number to Make this Easy to Solve

$$16 + \underline{} + 23$$

Considering the Equal Sign

Researchers indicate to *avoid* using:

* the equal sign to list objects and numbers (John = 8).
* to give a number in a collection (||| = 3)
* to represent strings of calculations
   (2 + 3 = 5 + 7 = 12 x 2 = 24)

Use it:

* in the context of finding all the decompositions for a number
* place total number (6 = 5 + 1)
* Not as a "the answer is coming" context

Strategy Development for Solving Single-Digit Addition and Subtraction Problems

Level 1: Direct Modeling (Kindergarten)

* All quantities are physically represented used to "act out" the situation

Level 2: Counting On (Grade 1)

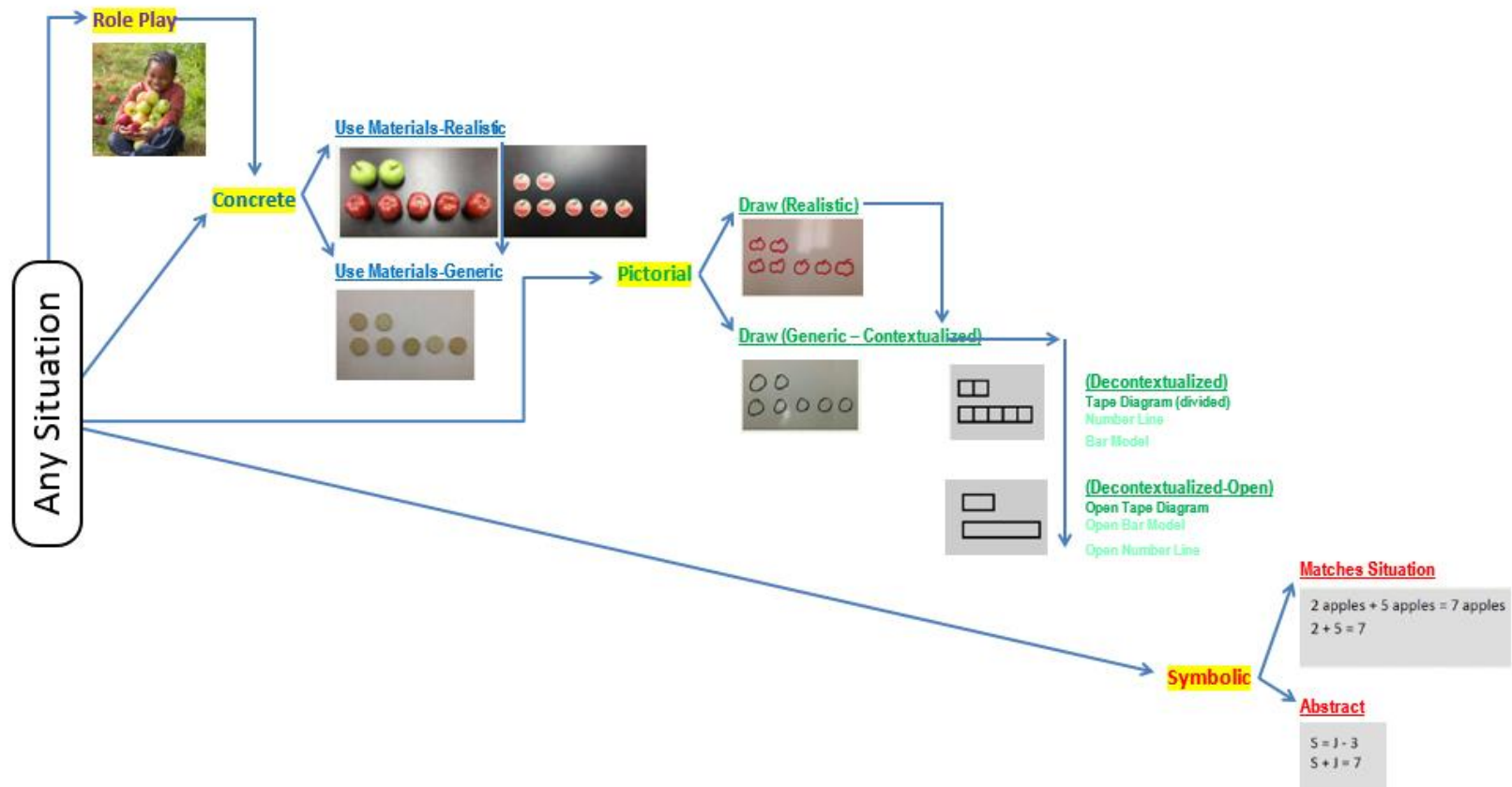* Involves "abstracting" one quantity and using it as a starting point.

Level 3: Convert to an Easier Problem (begin in Grade 1 and continue in Grade 2)

* Example: "9 + 4 = 10 + 3 so 9 + 4 = 13"

Strategy Development for Solving Single-Digit Addition and Subtraction Problems

Concrete-Pictorial-Abstract (CPA)

Addition and Subtraction Situations

Addition and Subtraction Problem Types in the K-2 Classroom

Addition and Subtraction

* Addition is used to name the whole when the parts of the whole are known.

* Subtraction is used to name a part when the whole and the remaining part are known.

Addition & Subtraction Situations

	Result Unknown	Change Unknown	Start Unknown
Add to (Join)	K	1st	2nd
Take From (Separate)	K	1st	2nd

	Total Unknown	Both Addends Unknown	Addend Unknown
Put Together/Take Apart (Part-Part-Whole)	K	K	1st

	Difference Unknown	Bigger Unknown	Smaller Unknown
Compare	*"How many more?"* 1st	*"more"* 1st	*"fewer"* 1st
	"How many fewer?" 1st	*"fewer"* 2nd	*"more"* 2nd

Keywords Can Be Misleading

"Children must understand the language, including the semantics and the syntax and be familiar with the situations the language represents."

Children need to make sense of the situation…

If there is no sense, children use unproductive coping strategies…

The Zoo Problem

* Rose saw **14** monkeys at the zoo. She saw **5** *fewer* monkeys than foxes. How many foxes did Rose see?

14 - 5 = 9

The Zoo Problem

* Rose saw 14 monkeys at the zoo. She saw 5 fewer monkeys than foxes. How many foxes did Rose see?   14 + 5 = 19

The Candy Shop Problem

* The candy shop has **8** pounds of fudge on display. The owner added candy to the display until there was **13** pounds of candy on display. How much candy did the owner *add to* the display?

$$8 + 13 = 21$$

The Candy Shop Problem

* The candy shop has 8 pounds of fudge on display. The owner added candy to the display until there was 13 pounds of candy on display. How much candy did the owner add to the display?

$$8 + ? = 13$$

Your Turn…

How would you represent this situation?

Frank gave away 3 cookies and still has 7 left. How many did he have to start with?

Three parts of problem…

*

Start	Change
Result	

Add to / Take From

Addition and Subtraction Problem Types
in the K-2 Classroom

Add To ~ Problems

Start	Change	
Result		

The candy shop has 8 pounds of fudge on display. The owner added another 5 pounds to the display. How much candy is on display?

Add To ~ Problems

Start 8	Change 5
Result ?	

The candy shop has 8 pounds of fudge on display. The owner added another 5 pounds to the display. How much candy is on display?

Add To ~ Problems

Start	Change
Result	

The candy shop has 8 pounds of fudge on display. The owner added candy to the display until there was 13 pounds of candy on display. How much candy did the owner add to the display?

Add To ~ Problems

Start 8	Change ?
Result 13	

The candy shop has 8 pounds of fudge on display. The owner added candy to the display until there was 13 pounds of candy on display. How much candy did the owner add to the display?

Add To ~ Problems

Start	Change
Result	

The candy shop had some fudge in the display case. The owner added 5 pounds of fudge to the display. Now 13 pounds of fudge is on display, how much fudge was in the display before the fudge was added?

Add To ~ Problems

Start ?	Change 5
Result 13	

The candy shop had some fudge in the display case. The owner added 5 pounds of fudge to the display. Now 13 pounds of fudge is on display, how much fudge was in the display before the fudge was added?

Writing Problems

Start	Change	Result
9	+6	?
9	+?	15
?	+6	15

* **With a partner decide who will do addition and who will do subtraction (add to/take from).**

* **Write a word problem for each situation using the same set of numbers.**

* **Share your problems with your partner and act out a few of your problems.**

* **Be prepared to share with the whole group.**

Start	Change	Result
12	- 8	?
12	- ?	4
?	- 8	4

Put Together / Take Apart~ Problems

Part	Part
Whole	

Marci has 24 red stickers and 18 blue stickers.
How many stickers does Marci have?

Put Together / Take Apart~ Problems

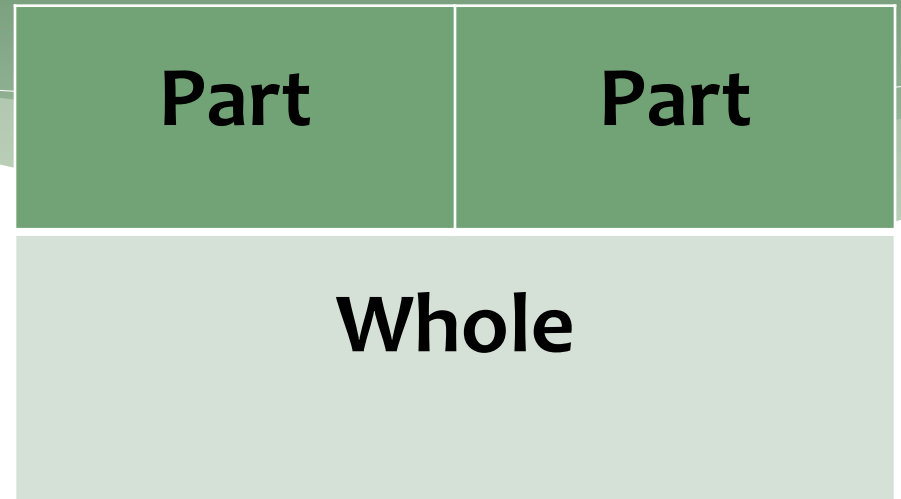| Part 24	Part 18
Whole ?	

Marci has 24 red stickers and 18 blue stickers. How many stickers does Marci have altogether?

Put Together / Take Apart~ Problems

Part	Part
Whole	

Marci has some red stickers and 18 blue stickers. Marci has a collection of 42 stickers. How many red stickers does Marci have?

Put Together / Take Apart~ Problems

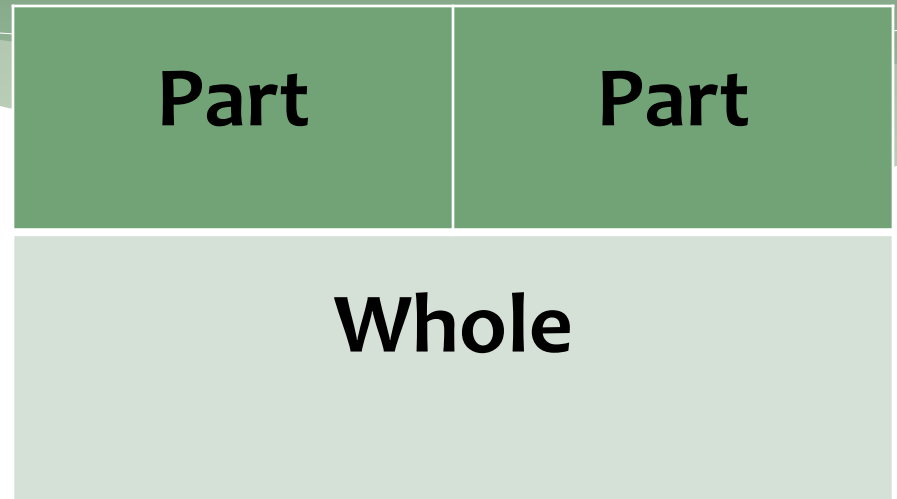| Part ?	Part 18
Whole 42	

Marci has some red stickers and 18 blue stickers. Marci has a collection of 42 stickers. How many red stickers does Marci have?

Put Together / Take Apart~ Problems

Part	Part
Whole	

Marci has some red stickers and some blue stickers. Marci has a collection of 42 stickers. How many red stickers and blue stickers might Marci have in her collection?

Put Together / Take Apart~ Problems

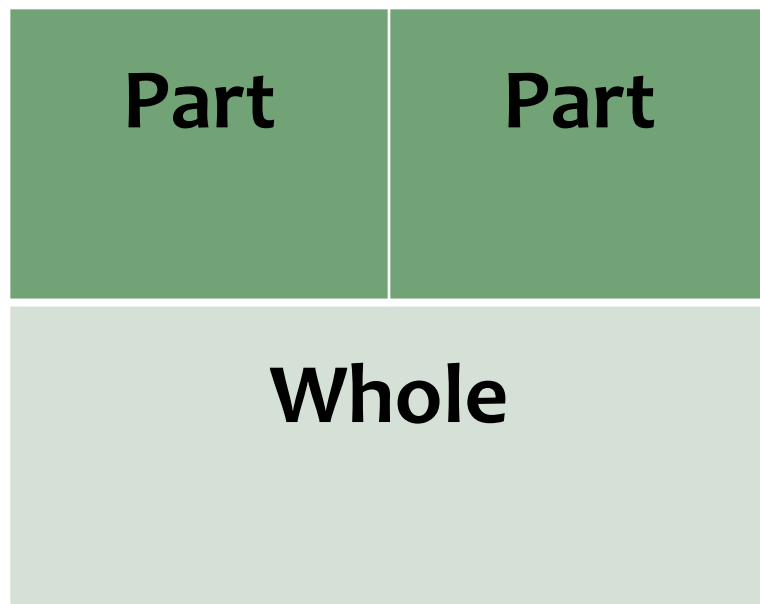| Part ?	Part ?
Whole 42	

Marci has some red stickers and some blue stickers. Marci has a collection of 42 stickers. How many red stickers and blue stickers might Marci have in her collection?

Write Three Problems…

Part	Part
Whole	

* Write a word problem for each situation.
* Share your problems with your partner and act out a few of your problems.
* Be prepared to share with the whole group.

Comparison

Addition and Subtraction Problem Types in the K-2 Classroom

Final Type-Comparisons

Smaller Quantity

Comparison

Larger Quantity

Children were asked what kind of ice cream they liked. Of the children asked 20 liked chocolate and 15 liked vanilla. How many more liked chocolate? How many fewer liked vanilla?

Final Type-Comparisons

Smaller Quantity

Comparison

Larger Quantity

Fifteen children liked vanilla ice cream. There are five more children that like chocolate. How many children like chocolate ice cream?

Final Type-Comparisons

Smaller Quantity

Comparison

Larger Quantity

Twenty children like chocolate ice cream. Five fewer like vanilla. How many like vanilla?

IF WE TEACH TODAY'S STUDENTS AS WE TAUGHT YESTERDAY'S, WE ROB THEM OF TOMORROW.

John Dewey

Final Thoughts

Addition and Subtraction Problem Types in the K-2 Classroom

Take Aways for the Day

I have a deeper understanding of…	Activities I could implement in my classroom…

Evaluation

Your feedback is appreciated!

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