

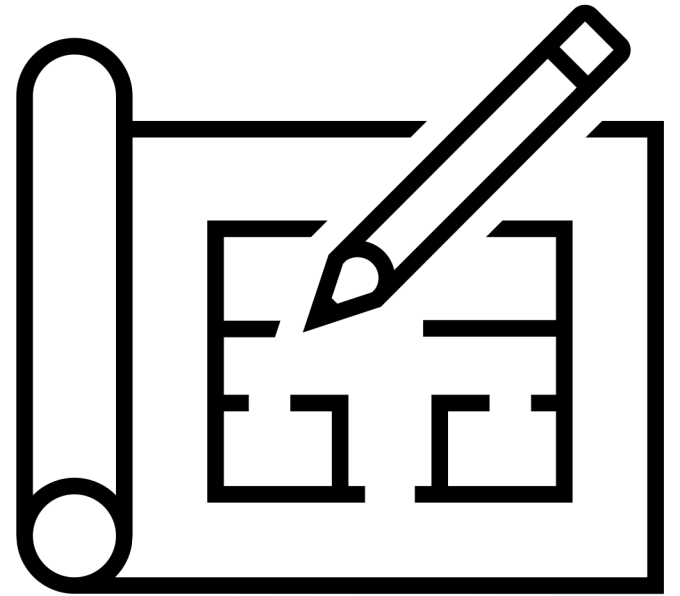


Using Additive Word Problem Structures to Improve Word Problem Solving



WRITE 2 ONE-STEP
WORDS PROBLEMS
REQUIRING
ADDITION/SUBTRACTION

SAVE THEM FOR LATER IN THE
SESSION



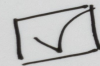
Agenda

- Skills required for successful word problem solving
- Strategy instruction on problem solving process
- Structures of word problems
- Schema instruction

To do:



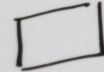
Wake up



Make coffee



Drink coffee



Make more coffee

Bamboo



An Amalgamation Skill

Word Problem Solving

On-Task Engagement

Self-Regulation

Reading Comprehension

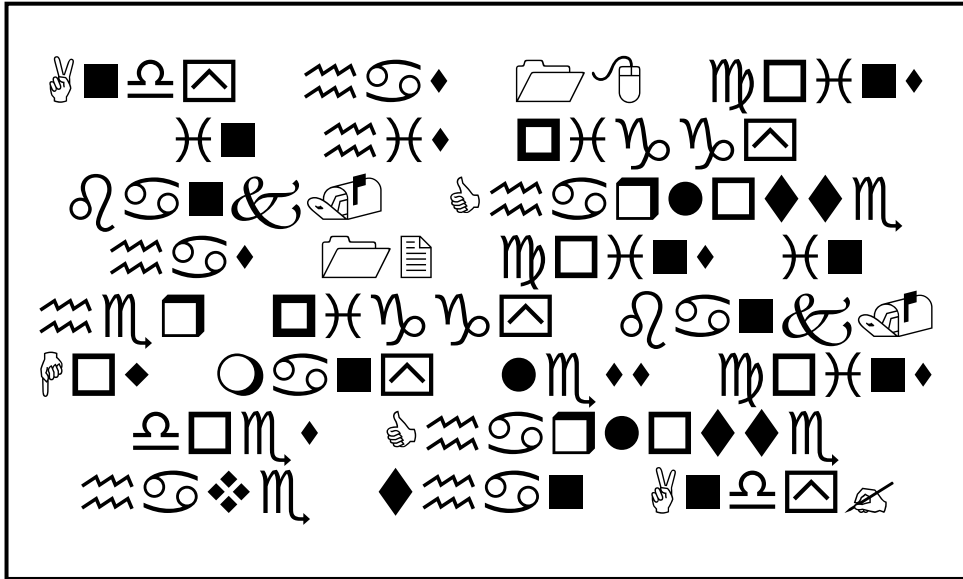
Decoding

Language
Comprehension

Computational
Proficiency

Conceptual Knowledge

Basic Fact Automaticity



Andy has 18 coins in his piggy bank.
Charlotte has 12 coins in her piggy bank. Coins are joined and different.
What is the answer?





Andy has $\log_2(3)$ coins in his piggy bank. Charlotte has $\log_5(14)$ in her piggy bank. How many more coins does Charlotte have than Andy?



Other Considerations

What is Key Word Technique?

- Teach students to tie key word to an operation

The Key Word in Word Problems	
 Add Sum Total All together Plus In all	 Multiply Product Times Twice Total Multiplied by
 Subtract Remain Difference Less than Fewer How many more Minus	 Divide Quotient Goes into Split Equally Each

AN INVESTIGATION OF USING KEYWORDS TO SOLVE WORD PROBLEMS

ABSTRACT

In mathematics, the keyword strategy involves identifying a keyword and using that keyword to determine the operation needed to find a word problem's solution. We analyzed 747 high-stakes released items across grades 3, 4, 5, 6, 7, and 8. Of these, 57 items did not involve written text. Of the 690 text-based items, we classified 69% as directive word problems and 31% as routineword problems. For all 690 items, we identified any keywords appearing in the text of the word problem. We categorized the 214 routine word problems by schema. We identified keywords within these problems and determined whether a keyword and its implied operation matched the correct problem solution. For single-step routine word problems, we determined that keywords featured within the problem led to a correct problem solution with less than a 50% match rate. For multistep routine word problems, the match rate was less than 10%.

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Kasey made \$42 and Mandi made \$37. How much money did they make **altogether**?

Kasey and Mandi made \$79 **altogether**. If Kasey made \$42, how much money did Mandi make?

Ineffective Practice Routines

- Practice all addition
- Practice all subtraction

 Double Digit Addition	NAME: _____	
$\begin{array}{r} 22 \\ + 16 \\ \hline \end{array}$	$\begin{array}{r} 52 \\ + 24 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ + 11 \\ \hline \end{array}$
$\begin{array}{r} 77 \\ + 22 \\ \hline \end{array}$	$\begin{array}{r} 34 \\ + 65 \\ \hline \end{array}$	$\begin{array}{r} 52 \\ + 34 \\ \hline \end{array}$
$\begin{array}{r} 16 \\ + 23 \\ \hline \end{array}$	$\begin{array}{r} 32 \\ + 16 \\ \hline \end{array}$	$\begin{array}{r} 61 \\ + 21 \\ \hline \end{array}$

Mrs. Jones has 22 students in her class. Mr. Bond has 17 students in his class. How many students do they have altogether?

My mom brought 35 cupcakes and 24 cookies to the school. How many treats did she have in all?

There were 42 crickets jumping around the playground. If 16 more crickets joined, how many crickets are there now?

I jumped with the jump rope 43 times in a row. My friend jumped 32 times. How many times did we jump in all?

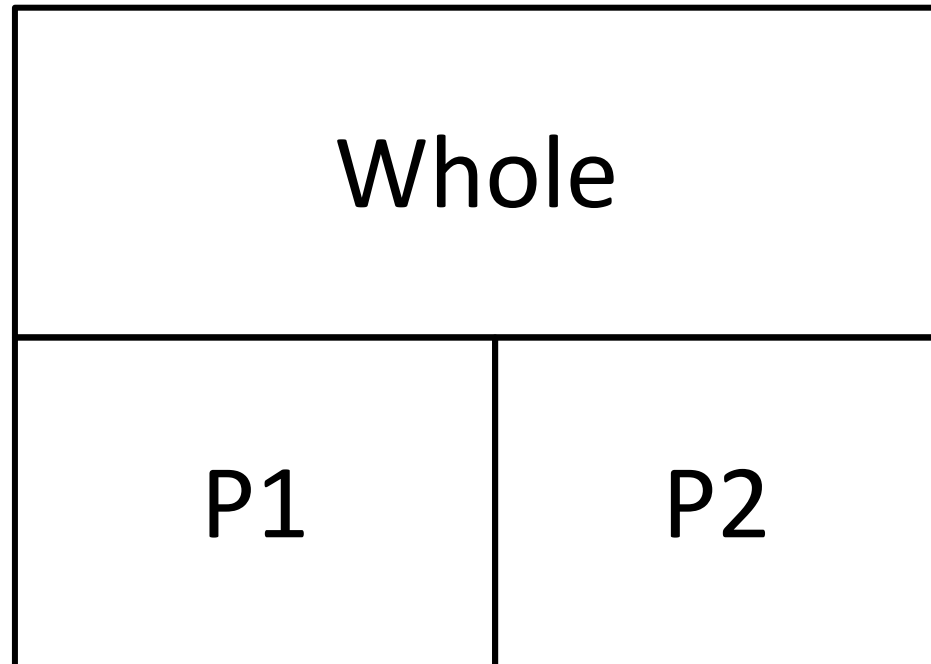


Word Problem Structures

Addition and Subtraction Schemas

- Total

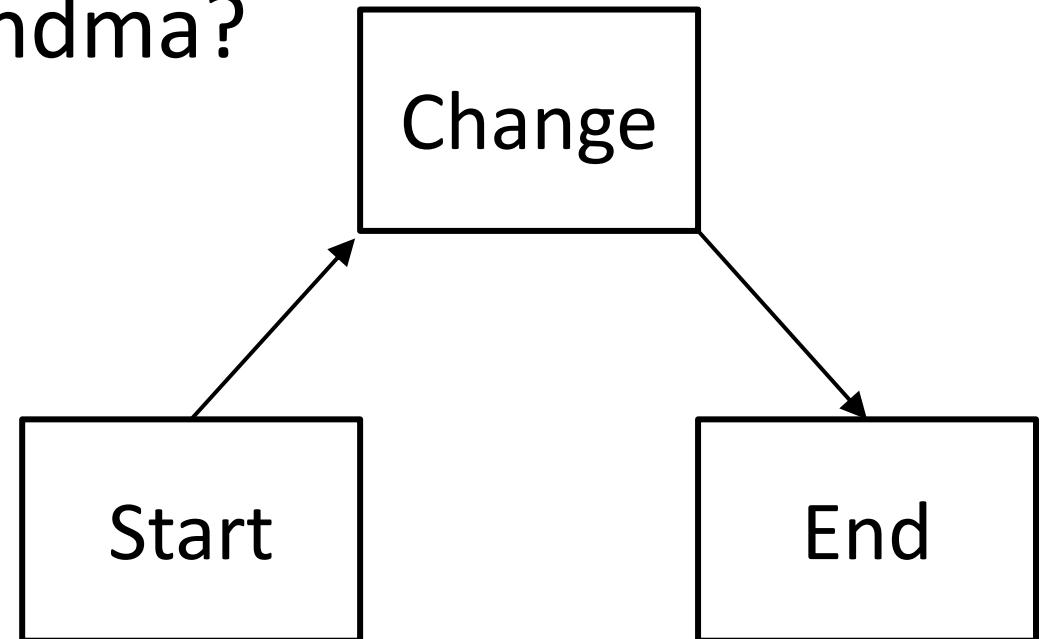
Jimmy has 2 red apples and some green apples. He has 6 apples in all. How many apples are green?



Addition and Subtraction Schemas

- Total
- Change

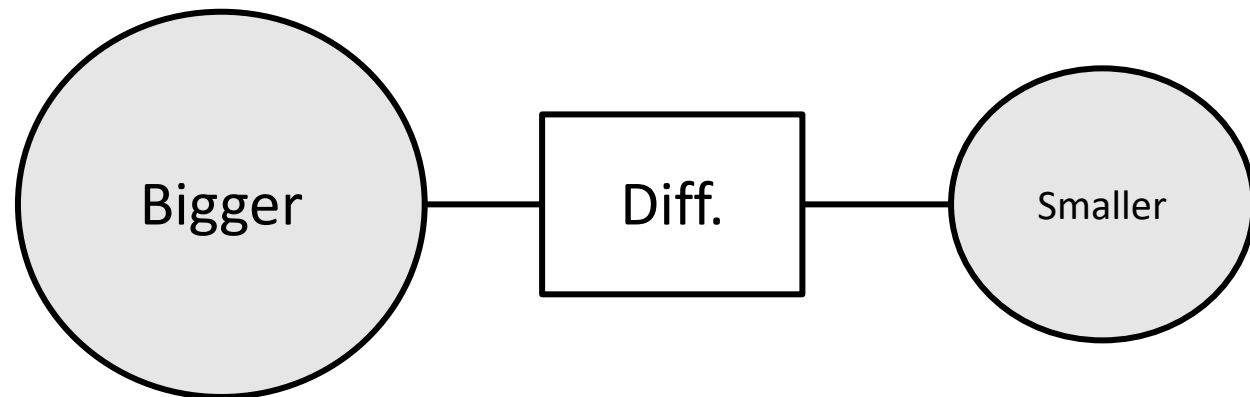
Jimmy has 5 apples. He gives some apples to his Grandma. He has 2 left. How many apples did he give to his Grandma?



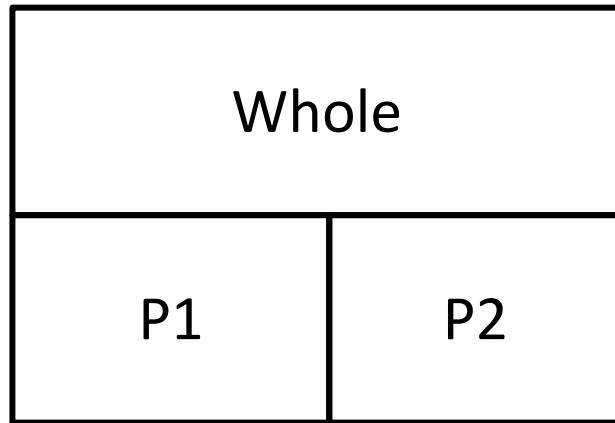
Addition and Subtraction Schemas

- Total
- Change
- Difference

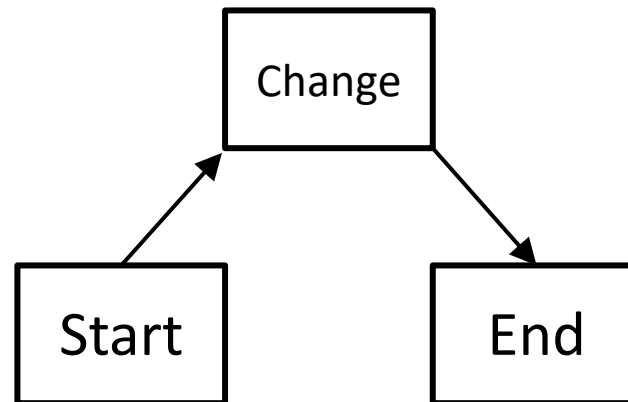
Jimmy has 5 red apples and some green apples. He has 2 more red apples than green apples. How many green apples does he have?



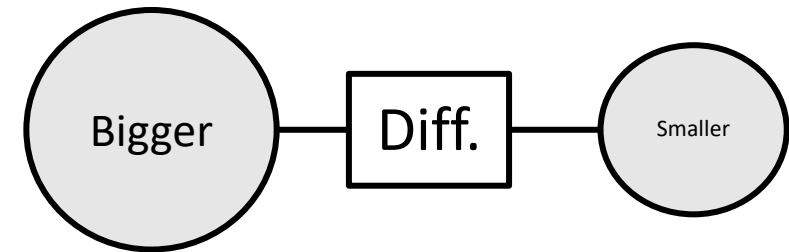
Total



Change

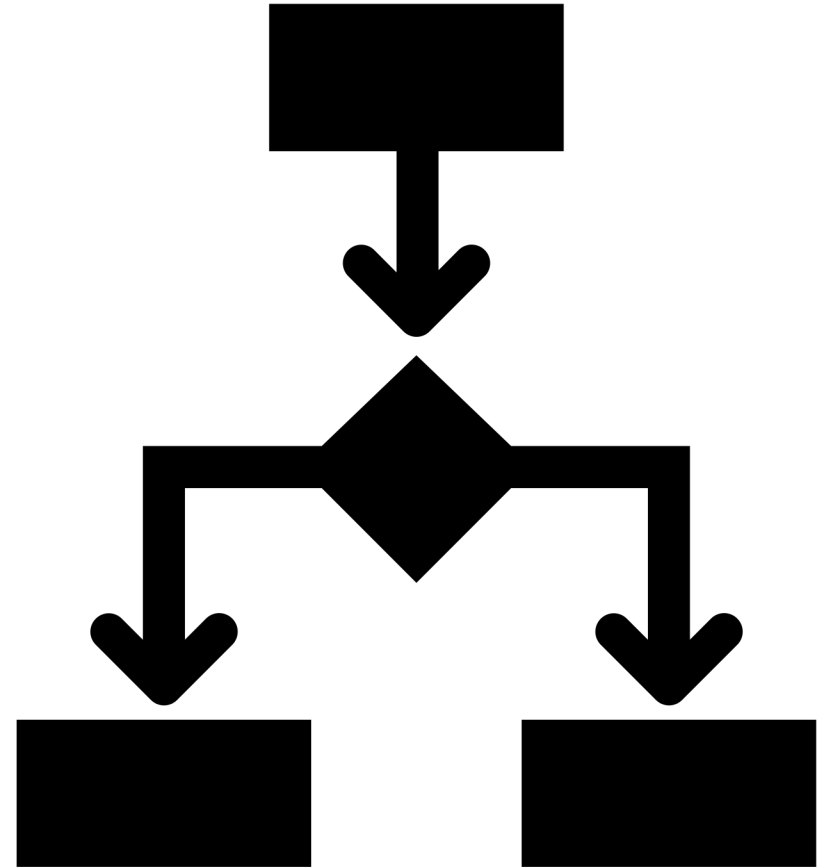


Difference



1. How many "mini structures" for each?
2. What would generalized versions look like?
3. What would combined version look like?
4. Generate word problems representing each

Practice Sorting



I played video games for 16 hours last week and 23 hours this week! My mom wants to know how many hours total hours I spent playing video games these past two weeks. Can you help me?

For breakfast, Sarah's puppy eats $\frac{4}{5}$ of a cup of food. For lunch, her puppy eats $\frac{2}{5}$ of a cup of food. How much less food does the puppy eat at lunch than breakfast?

Lindsey ran $\frac{3}{5}$ of the marathon and walked $\frac{1}{5}$ of the marathon. How much of the marathon has she completed?

Charlie walked $\frac{2}{5}$ of a mile, biked for $\frac{4}{5}$ of a mile, and jogged for $\frac{2}{5}$ of a mile. How far did Charlie travel?

Andy has 11 nickels and 12 dimes in his car.
Andrea has 11 more coins in her car than Andy.
How many coins does Andrea have?

My new car started with 44 miles on it. I drove 11 miles to OKC and an additional 11 miles to Edmond. How many miles are on my car now?

Ms. Henson has 12 boys and 14 girls in her classroom. Mr. Jackson has 12 students. How many more students does Ms. Henson have than Mr. Jackson?

OK Released Items

Seth wants to visit all 50 states. He has visited 14 states. The number sentence shows, , the number of states Seth has left to visit.

$$\boxed{\text{ } + 14 = 50}$$

How many states does Seth have left to visit?

Use this information to answer the following two questions.



At the beginning of the week, Gabriela had \$12 and Henry had \$9. During the week, they both earned money collecting cans that they recycled. At the end of the week, Gabriela and Henry each had \$20.

Gabriela took the money she earned to the movie theater. She bought a ticket and a drink for a total of \$14. How much money did she have left?

Hide All

Released items from STAAR

7 The lengths of two insects are given below.

- Ladybug: 10 millimeters
- Walking stick: 30 centimeters

What is the difference in length of these two insects in millimeters?

- A** 70 mm
- B** 20 mm
- C** 290 mm
- D** 2,990 mm

- 18** Last month Jim drove his car 2,718.3 miles. That brought the car's total mileage to 87,416 miles. What was the car's total mileage before last month?
- F** 84,697.7 mi
 - G** 85,302.7 mi
 - H** 89,124.3 mi
 - J** 90,134.3 mi

22 So far this month Nancy has the expenses and income shown in the chart.

Nancy's Current Budget

<u>Expenses</u>		<u>Income</u>	
Clothes	\$40	Lawn mowing	\$30
Food	\$60	Babysitting	\$50
Movie tickets	\$30	Car washing	\$25
		Garage sale	\$35

Nancy wants to buy some music online but also have a balanced budget. Based on Nancy's current budget, what is the greatest amount of money she can spend on music?

F \$10

G \$35

H \$140

J \$5

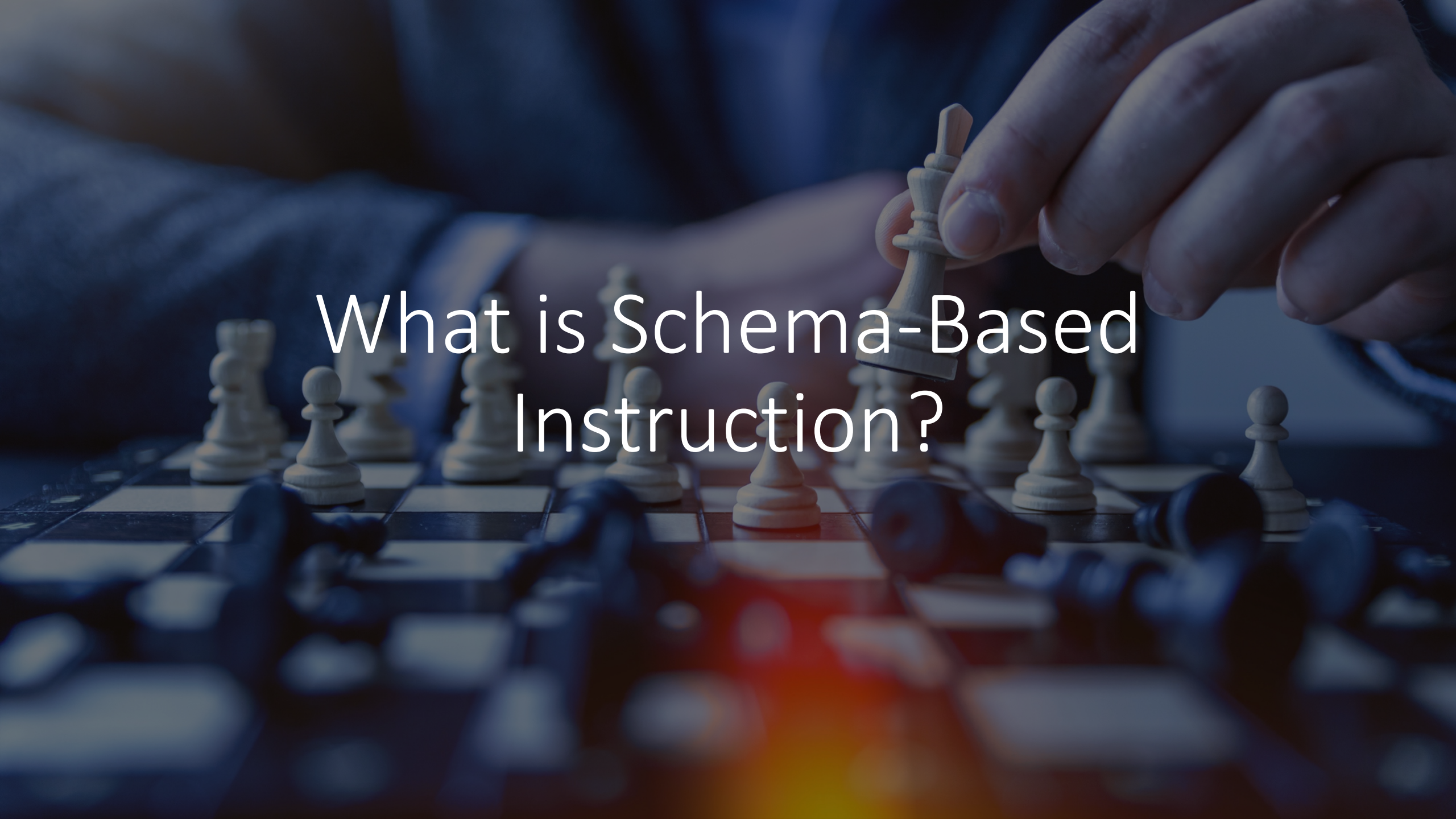
- 24** The table shows the population of three Texas counties. The population of Gray County is missing.

Population

County	Population
Anderson	58,308
Dallas	2,416,014
Brazos	197,632
Gray	

The population of Gray County is 35,553 less than the population of Anderson County. What is the combined population of these four counties?

- F** 2,694,709
- G** 2,707,507
- H** 2,695,209
- J** 2,765,815

A close-up photograph of a hand moving a white chess king piece on a chessboard. The board is partially visible with other pieces in the background. The lighting is soft and focused on the hand and the piece being moved. The text "What is Schema-Based Instruction?" is overlaid in white on the image.

What is Schema-Based Instruction?



Steps for Teaching Schemas

Steps for Teaching Schemas

1. Mnemonic for the Process
2. Total
3. Change
4. Interleave Total, Change
5. Difference
6. Interleave Total, Change, Difference
7. Plan for generalization

USING A MNEMONIC



STEPS NEEDED IN A MNEMONIC



Understand the problem



Devise a plan



Carry out the plan



Look back

ONE
MNEMONIC FOR
MATH PROBLEM
SOLVING

R=Read the problem

I=Identify the problem type

F=Fill in information

S=Solve and check

C = Circle the information

U = Underline the question

B = Box the keywords

E = Eliminate irrelevant information

S = Solve

U = Understand the problem

P = Plan to solve

S = Solve

Total

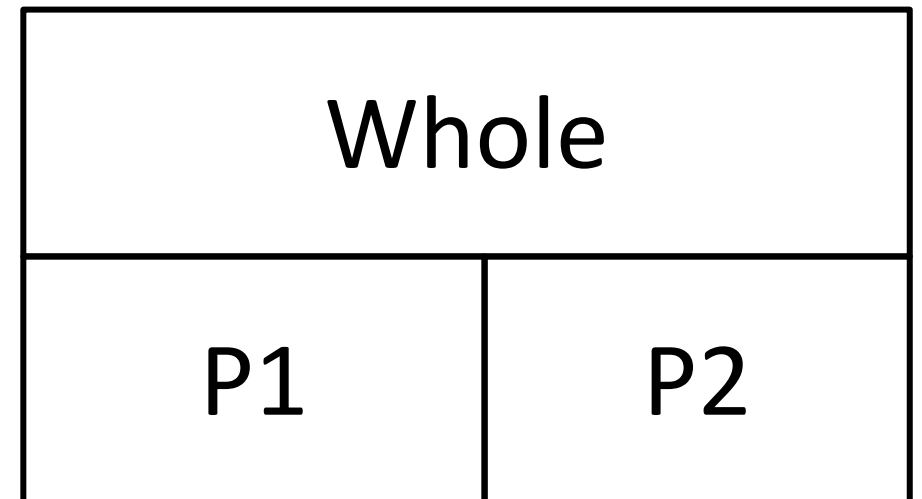
1. Define Total

“In a total problem, there are some parts, or groups, and one total amount. The 2 parts make up the total. In this diagram, it shows the two parts the same length as the total, because they make up the total.”

“For example, let’s read this problem [read]. There are two groups of apples Jimmy has; red & green. Then, there is the total amount of all the apples.”

PPW problems might be asking for one part, or group, or it might be asking you to figure out the total amount.”

Jimmy has 2 red apples and some green apples. He has 6 apples in all.
How many apples are green?



Guided and Independent Practice

Total

Change

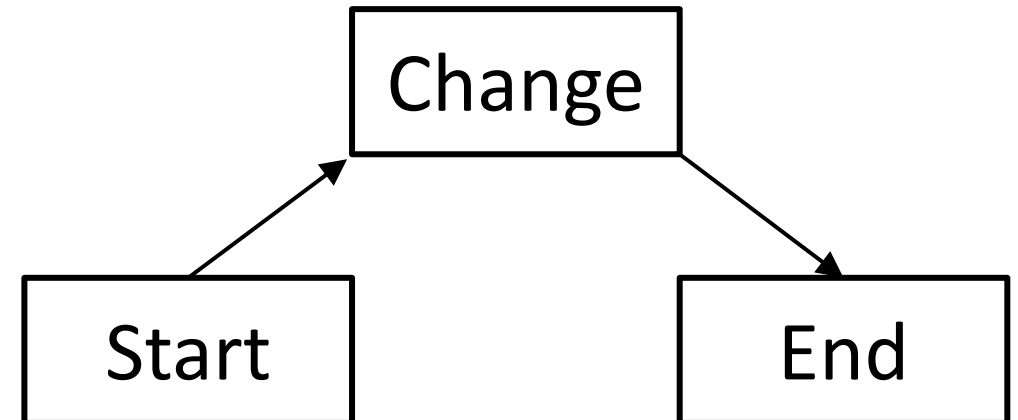
1. Define Change

“In a Change problem, there is a starting amount, a change amount, and an end amount. In this diagram, it shows the starting amount being “changed” resulting in an end amount.”

“For example, let’s read this problem [read]. There is the start amount (the number of apples Jimmy has), the change amount (the number of apples Jimmy gives to his Grandma), and the end amount (the number of apples Jimmy has left).”

Change problems might be asking for the start amount, change amount, or it might be asking you to figure out the end amount.”

Jimmy has 5 apples. He gives some apples to his Grandma. He has 2 left. How many apples did he give to his Grandma?



Guided and Independent Practice

Change

Interleave Total and Change

Distinguishing between Total/Difference

- Sort
- Solve

Difference

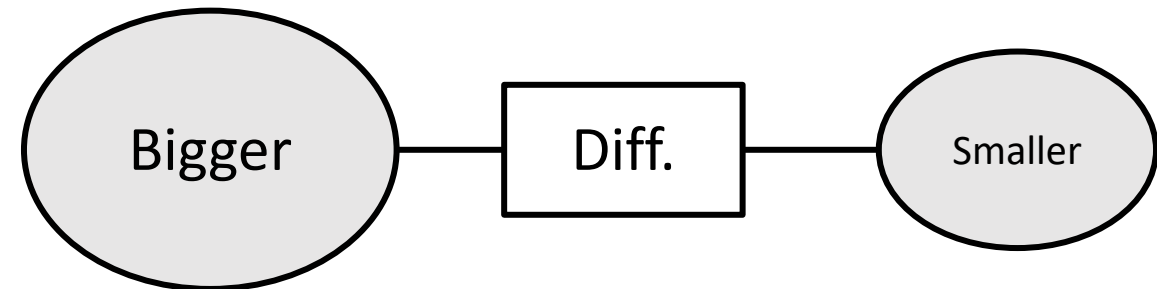
1. Define Difference

“In a difference problem, there is a larger quantity, smaller quantity, and the difference between the two quantities. In this diagram, it shows the larger quantity in the larger circle, the smaller quantity in the smaller circle, and the difference between the two quantities in the box.”

“For example, let’s read this problem [read]. There are two quantities being compared; red & green apples. Then, there is the total difference in the number of red and green apples.”

Compare problems might be asking for the larger quantity, smaller quantity, or it might be asking you to figure out the difference between the two quantities.”

Jimmy has 5 red apples and some green apples.
He has 2 more red apples than green apples.
How many green apples does he have?



Interleave Total, Change, Difference

Distinguishing between Total/Difference/Change

- Sort
- Solve

Push for Generalizing

- Total with 3+ parts
- Change with 2+ change values
- Include irrelevant information
- Present information via different ways (e.g., graphs, tables)
- Combined structures



tinyurl.com/mathwordproblems22