

Helping Students With Word Problems Schema-Based Instruction: Additive Schemas

What is schema-based instruction? Schema-based instruction teaches students to categorize word problems by the word problem’s underlying mathematical structure and then use an appropriate solution strategy. One category of schema is additive.

How is it different from common instructional practice? Typical word problem instruction often asks students to find keywords or identify word problems by an operation. Both approaches can mislead students because words can represent more than one operation. Identifying word problems by a single math operation is problematic because word problems may be solved by more than one operation. Furthermore, multistep word problems may require multiple operations.

Why should I teach schemas? Schemas support solving single- and multi-step word problems because students begin to recognize separate and distinct mathematical structures.

What are students expected to learn? Students will be able to recognize schemas of word problems, translate the information into a visual representation or equation, and correctly solve for the missing information.

What should I avoid when teaching schemas? Don’t tell students to look for key words. Don’t tell students “This is an [addition] word problem.” Avoid only showing end unknown problems, particularly with subtraction, which tend to be the most commonly found ones in textbooks.

What students can this help? Schema-based instruction can support typical learners, students with disabilities, and multilingual/English learners.

There are three kinds of additive schemas. Additive schemas involve addition or subtraction procedures. One additive schema is the **change** problem. Change problems also may be called *join* or *separate problems*.

Change problems are when an amount increases or decreases because something changes the starting amount. Students must solve for an unknown start, change, or end amount.

 Student knowledge: Students need to know if the amount is increasing or decreasing, and if they are solving for the starting amount, the ending amount, or the amount of change.



Increase; end unknown:

- Carly has 3 ribbons. Shay gives her 2 ribbons. How many ribbons does Carly have now?



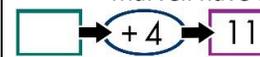
Increase; change unknown:

- Misha has 9 candies. Kaheen gave her some more candies. Now she has 12 candies. How many did Kaheen give her?



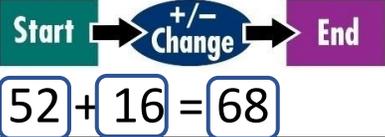
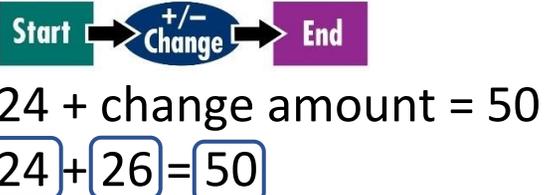
Increase; start unknown:

- Marveli has some stickers. Maverick gave her 4 stickers. Now Marveli has 11 stickers. How many stickers did Marveli have to begin with?



<p><u>Decrease; end unknown:</u></p> <ul style="list-style-type: none"> Carly has 3 ribbons. She gave Shay 1 ribbon. How many ribbons does Carly have now? 	<p><u>Decrease; change unknown:</u></p> <ul style="list-style-type: none"> Misha has 9 candies. Misha gives Kaheen some candies. Now she has 2 candies. How many did she give Kaheen? 	<p><u>Decrease; start unknown:</u></p> <ul style="list-style-type: none"> Maverick has some stickers. He gives 4 stickers to Marveli. Now Marveli has 11 stickers. How many stickers did Maverick have to begin with? 
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How do I teach this?

<i>What should I do?</i>	<i>What does this look like?</i>
Choose a schema to introduce to students.	"This is a type of problem called a change problem. Let me show you why."
Start with stories that contain all the information.	"Jorge had some money and earned \$16 for babysitting. His starting amount was \$52. Now, he has \$68. There was a change, and it increased by 16, from 52 to 68."
Show students how to translate the information for each schema into a visual representation or equation. Teach students to use language in the full context of the schema, not to rely on key words.	
Teach students how to solve a word problem with an unknown quantity. <i>Start by teaching the end unknown, the change unknown, and, last, the start unknown.</i>	"Isabella had some money and earned \$24 for fixing the motorcycle. Now, she has \$50. How much money did she have to start with?"
<p>Students need to:</p> <ol style="list-style-type: none"> 1. Read the word problem. 2. Identify the schema. 3. Translate the information into a visual representation or equation. 4. Solve the problem. 	<p>"What kind of problem is this?" <i>Change problem.</i> "How do you know?" <i>Isabella's amount of money changed when she got paid. She had more money at the end.</i></p> 

Watch Dr. Sarah Powell introduce this additive schema.



<https://youtu.be/N7sx354AoGU>

