

## Helping Students With Word Problems

### Schema-Based Instruction: Multiplicative 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 the multiplicative schema.

#### How is it different from other common instructional practices?

Typical word problem instruction asks students to find keywords or identify word problems by an operation. Both approaches can mislead students because key words can represent more than one operation. Identifying word problems by a single math operation is problematic because word problems can usually be solved by more than one operation. Furthermore, multistep word problems usually 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 will students 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 a multiplication word problem."

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

There are three kinds of multiplicative schemas. Multiplicative schemas involve multiplication or division procedures. One multiplicative schema is the **comparison** problem.

**Comparison** problems are when a set is multiplied a number of times for a product.



Student knowledge: Students need to recognize that a set is being repeated for a product. Students need to know if the product, the set, or the number of times is unknown.



#### Product unknown:

- Mai has 6 pieces of candy. Kyla has 2 times as many pieces of candy. How many pieces of candy does Kyla have?

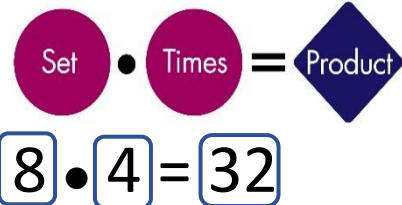
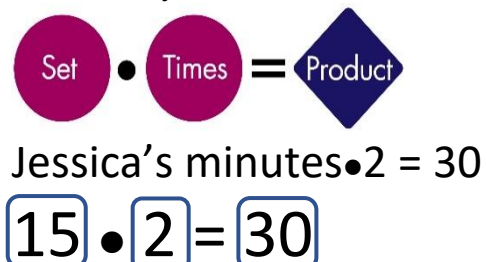
$$6 \cdot 2 = \diamond$$

#### Set/Number of times unknown:

- Pedro has 7 video games. Bronwynn has 21 video games. How many times as many video games does Bronwynn have than Pedro?

$$7 \cdot \circ = \diamond 21$$

### 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 comparison problem. Let me show you why.”
Start with stories that contain all the information.	“Luis baked 32 brownies. Luis baked 4 times as many brownies as Micah. If Luis baked 4 times the amount of Micah’s brownies, Micah must have baked 8 brownies.”
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.	“Yasmine ran 2 times as long as Jessica. Yasmine ran for 30 minutes. How many minutes did Jessica run?”
Students need to: <ol style="list-style-type: none"> <li>1. Read the word problem.</li> <li>2. Identify the schema.</li> <li>3. Translate the information into a visual representation or equation.</li> <li>4. Solve the problem.</li> </ol>	What kind of problem is this? <i>Comparison problem.</i> How do you know? <i>They’re comparing the minutes that each girl ran. We know the total that Yasmine ran, and we know she ran longer than Jessica—2 times as long. We’re missing the amount of Jessica’s time.</i> 

Watch Dr. Sarah Powell introduce this multiplicative schema.  <https://youtu.be/2WNQMH1qZNE>

