



Using Schema-based Instruction to Solve Math Word Problems Lesson 2: Two-step Math Word Problems

Objective: To teach students the skills to distinguish between three different word problem types using the schema strategy and solve two-step math word problems using the schema strategy.

Setting and Materials:

Settings: Resource Classroom (Special education classroom: 45 minute middle school math class)

Materials:

- Strategy diagram worksheets
- Practice problems
- Worksheets with story situations
- Note sheets with strategy rules for identifying the total and the operation to use when solving word problems

Content Taught

Teach the skills needed to solve two-step math word problems including the following operations (a) addition, (b) subtraction, (c) multiplication, and (d) division, as well as, how to distinguish between three different word problem types.

Teaching Procedures

1. Introduce the lesson
2. Provide direct instruction to explain the rules:
 - a) To assist students with memorizing the rules, use a self-instructional sheet with written rules to help them identify the total and operation.
 - b) Until students can memorize the rules independently, let them use a notes sheet as a scaffold while completing problems during guided practice.
 - c) Explain the three features of each problem type (change, group, and compare) in story situations that do not contain any unknown information.

Example:

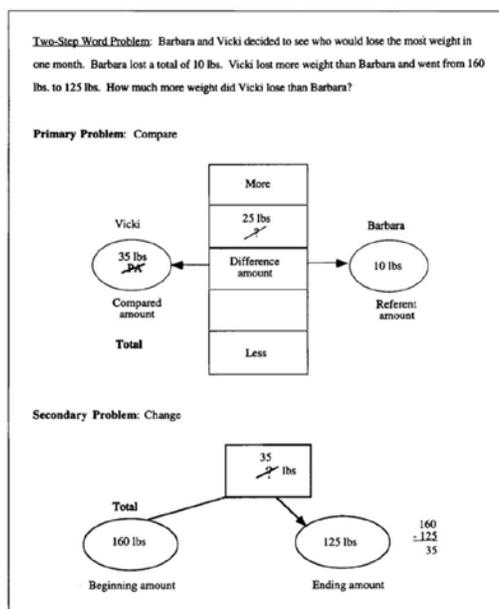


FIGURE 3. Sample procedure for solving two-step word problems. *Note.* From (1) *Schemas in Problem Solving*, by S. P. Marshall, 1995, New York: Cambridge University Press. Copyright 1995 by Cambridge University Press; and (2) *Story Problem Solver: A Schema-Based System of Instruction*, by S. P. Marshall, K. E. Barthali, M. A. Brewer, and F. E. Rose, 1989, San Diego: Center for Research in Mathematics and Science Education. Copyright 1989 by Center for Research in Mathematics and Science Education. Adapted with permission.

3. Model the strategy
 - a) Give students schemata diagrams to follow along with you.
 - b) Model for the students how to solve the problem using the schemata diagrams.
 - c) For two-step word problems begin with explaining backward chaining where students actively search for what is “unknown” and develop a solution plan from the unknown variable to the given information.
4. Guided Practice
 - a) Provide students schemata diagrams to allow students to map features of the story situation into the diagrams.
 - b) Help students solve the problem using the correct story mapping procedures
 - c) Make sure each student applies the strategy steps.
 - d) Once students demonstrate knowledge of problem schemata, begin to give them word problems instead of story problems.
 - e) For the word problems, teach students to identify the missing element in the problem with a question mark.
 - f) Teach students to find the key words in the text that tell them the operation. Example: In a change problem, understanding whether the problem ended up with more or less than the beginning amount was important. Students were taught that when the problem ended up with

more, the ending amount represented the total. However, if the problem ended up with less, the beginning amount was the total. In a group problem, the larger group object always represented the total because the smaller groups combined to form the larger group. In the compare problem, the quantity represented by the higher value was deemed to be the total. It was critical for students to determine whether the referent or the compared object represented the higher value in the problem by examining the comparison or difference statement (e.g., Larry delivered 18 more newspapers than Jim).

- g) Next, teach student a rule based on the part-whole concept for determining the correct operation by examining the part of the situation that was unknown and whether or not it represented the total amount. For example: “when the total is not known, we add to find the total; when the total is known, we subtract to find the other amount.”
- h) Next, show students how to identify the secondary problem, which should be solved to answer the primary problem. Since solving another problem with a secondary schema can involve the answer to one of the missing elements in the primary schema, teach students to write “PA” or partial answer until they solve the missing portion.

5. Independent Practice

- a) Give the students problems for all types of two-step word problems for independent practice with a diagram sheet.
- b) Next give the students problems for all types of two-step word problems to solve and do not give them a diagram sheet, encourage them to draw their own.

Evaluation

After giving feedback on independent practice, give student a 10-item word problem test immediately following instruction.

Lesson Plan Based on:

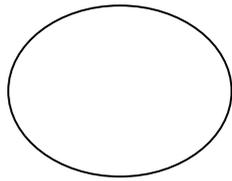
Jitendra, A. K., Hoff, K., & Beck, M. M. (1999). Teaching middle school students with learning disabilities to solve word problems using a schema-based approach. *Remedial and Special Education, 20*, 50-64.

Worksheet

Two-Step Word Problems

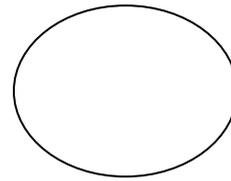
1. Jim and Mark decided to see who could run the most miles in the month of September. Jim ran a total of 60 miles. Mark ran more miles than Jim. He ran an average of 2.5 miles each day for 30 days. How many more miles did Mark run than Jim?

Primary Problem: Compare



Compared Amount

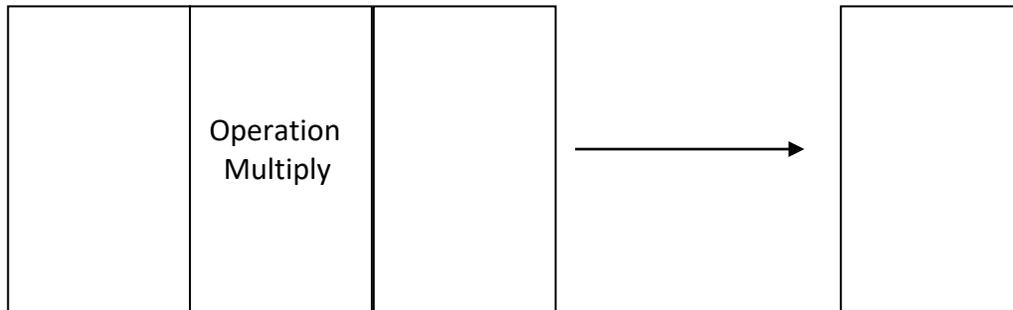
More
Difference Amount
Less



Referent Amount

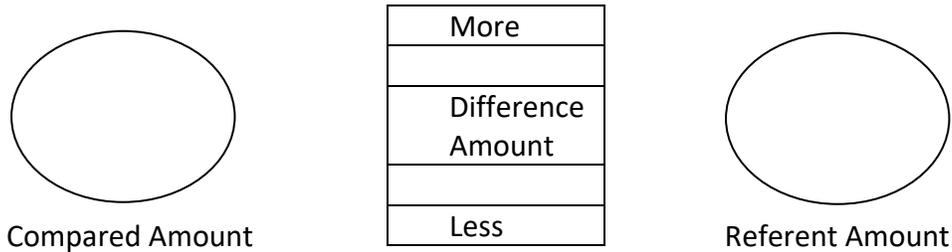
Secondary Problem: Group Problem

How many miles did Mark run?

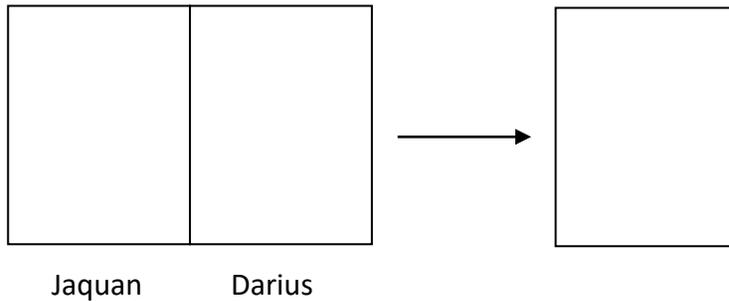


2. Jaquan and Darius decided to see if they could earn enough money to buy two bicycles. The bicycles costs \$300.00. Jaquan made \$171.00. Darius made less than Jaquan and earned \$126.88. How much more money do they need?

Primary Problem: Compare



Secondary Problem: Group



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