Diagrams for Word Problems

Why Is This Strategy Useful?

Word problems in mathematics present particular difficulties for students with learning disabilities (LD). To solve word problems using internally represented information, students must apply knowledge strategically both to reduce cognitive effort and to enhance the probability of solution. The ability to identify the salient components of a word problem is necessary to generate an accurate equation. Direct instruction in identifying and applying appropriate strategies is necessary for LD students. Once the relationship between the components is understood, the problem solver can translate the problem from one words into numbers. Research shows that students who are taught to diagram relationships between word-problem components schematically and to develop an action schema perform much better in word problem solving than those who are taught with different strategies. Teaching students a technique for diagramming and translating the information into numerical equations improves their problem solving abilities. This strategy is best-suited for secondary math students and has been shown to be effective for students with learning disabilities.

Description of Strategy

Successful strategy instruction requires modeling of competent strategy use, sufficient and appropriate exemplar problems, ample opportunity to practice and receive correction on strategy use, and adequate opportunities for student to describe and evaluate how effectively they are employing newly learned strategies. To introduce the topic of diagramming word problems, the instructor explains the objectives of the lesson and defines different types of word problems. The instructor encourages students to ask questions and then distributes worksheets to practice identifying problems and labeling key statements.

Explicit diagramming instruction focuses on a schematic method for representing word problems containing relational statements. The key aspects of this instruction are for students to identify the separate features of each problem type and to organize and represent the relevant information in the story situation using schematic diagrams. The shorthand problem schemata identification and diagram strategy for word problems can be expressed as follows.

1. Find the problem pattern
   (a) Read the problem carefully
   (b) Ask whether the problem is a change, group, or compare problem type

2. Organize and represent the information in the problem using diagrams
   (a) Map the known information (object identity and object amount) onto the schema diagram
   (b) Flag the unknown information using a question mark

3. Plan to solve the problem
   (a) Find the object identity that represents the “whole” or total amount and write a “T” for total under the set
   (b) Select an arithmetic operation based on the known and unknown information (i.e., “When the total is not known, add to find the total; when the total is known, subtract to find the part.”)

4. Solve the problem
(a) Add or subtract
(b) Check if the answer makes sense
(c) Write the whole answer

Research Evidence

At least one randomized controlled trial supports the use of this strategy. This study investigated the effects of three intervention conditions (translation, diagram, and attention) on the solving of word problems. In the translation group, students learned to create and solve word problems by identification of three statement types (i.e., assignments, relations, questions). Instruction in the diagram group was similar to instruction used in the translation group, but differed on one key feature: students in the diagram group were also taught a technique for diagramming and translating the information into numerical equations. Students in the attention group informally discussed problem-solving approaches but did not receive specific math instruction. Thirty-eight students were randomly assigned to either a translation training group, a diagram training group, or an attention-control group. Results indicated that students in the diagram group made substantially fewer errors than students in the translation and attention groups. On some specific posttest measures, students in the diagram group improved to a point where their performance was comparable to that of their nondisabled peers.

Sample Studies Supporting this Strategy


This study examined effects of two types of instruction on the word-problem solving performance of postsecondary students with learning disabilities. We used an analysis of error patterns to determine the effects of explicit instructions when word-problem language did not directly correspond (i.e., was inconsistent) with required arithmetic operations. Thirty-eight students randomly participated in either a translation training group, a diagram training group, or an attention-control group. Analyses of variance revealed that the diagram group out-performed both the attention-control and the translation group. We interpret these findings as showing the importance of procedural as well as declarative forms of math word-problem solving knowledge.

Additional Resources
