

The 4-Step Problem Identification Strategy

Why Is This Strategy Useful?

Many students – both elementary and middle school students – consider mathematical word problems to be difficult. A major cause of the difficulty appears to be students' inability to understand the problem structure that is embedded in the problem text. The Four-Step Problem Identification Strategy plan helps math students to employ sound reasoning and to develop mathematical language while they complete a four-step problem-solving process. This problem-solving plan consists of four steps which lead students to gaining information about the details, main idea, strategy, and how the problem was solved. Experts agree that repeated experience doing this pattern of steps allows the learner to internalize the problem-solving framework and apply it to a variety of situations, ultimately resulting in the ability to achieve higher levels of mathematics. The 4-Step Problem Identification Strategy is generally taught in elementary and middle schools to students struggling with word problems.

Description of Strategy

The 4-Step Problem Identification Strategy:

- 1. Understand the Problem.** In this step, the student is a reader, thinker and analyzer. They ask themselves several questions and summarize the problem to generate the main idea or question being asked.
- 2. Devising a Plan.** Here, the student may re-read the problem sentence by sentence, searching for all context details and extra information. Also in this step, students may use “graphic representations” to organize their ideas, to provide evidence of their mathematical thinking, and to show their strategy for arriving at a solution. In this second step, students will determine what mathematical signs and strategies to use (addition, subtraction, multiplication, division, etc.)
- 3. Carrying Out the Plan** The plan devised in Step 2 will be carried out in this step. Students will compute numbers using their defined mathematic plan and end with an answer to the given problem. After organizing the ideas and details, this step will become easier.
- 4. Looking Back.** In this step, students must explain the solution strategy they have selected. They must provide reasons for and offer proof of the soundness of their strategy.

The 4-Step strategy is a problem-solving process which is defined as series of steps for finding a problem's solution or a question's answer. Instead of working from memory or using intuition, the student progresses through phases of analysis that require logic and thinking about each part. Teachers who teach students learning strategies teach students how to learn and how to be successful in and out of the academic setting. Easy ways to implement the 4-Step strategy would be to compile a reference worksheet for students and model the use of this technique when solving mathematic word problems.

Research Evidence

At least one randomized controlled trial provides an example of the application of the 4-Step strategy and its' impact on students solving mathematic word problems. This study investigated the effects of personalized computer-based instruction on the achievement of students.

Participants were 104 middle school students who were randomly assigned to either a personalized computer-based group or a non-personalized group. Separation between the two groups was the implementation of the 4-Step strategy which personalizes word problems for students. Although results did not indicate a significant difference in students using the 4-Step strategy, many experts agree that this strategy is helpful to both general and special education students struggling with mathematics.

Sample Studies Supporting this Strategy

Harter, C. Liu, P., Yang, L., Yu, H. and Cheng, Y.C. (2004). *The Effects of Using Personalized Computer-Based Instruction in Mathematics Learning*. University of Northern Colorado.

This randomized controlled trial investigated the effects of personalized computer-based instruction on the achievement and attitudes regarding arithmetic problems and two-step mathematics word problems of 104 middle school American students from a predominately Hispanic population. Students were randomly blocked by ability level based on pretest scores to a personalized or non-personalized version of the computer-based instruction. Students in the personalized group used the 4-Step Strategy to better identify with their word problems. Students made significant pretest-to posttest gains across treatments and scored significantly higher on arithmetic than on two-step word problems on the posttest. However, the personalized treatment did not produce a significant achievement difference over the non-personalized one. A significant three-way interaction reflected that personalized lower-ability students improved more from pretest to posttest than personalized higher-ability students, non-personalized higher-ability students, and non-personalized lower-ability students. Personalized subjects had significantly more positive attitudes toward the computer-based instruction on mathematics learning than their non- personalized counterparts.

Additional Resources

Helping Students with Learning Disabilities Make Sense of Word Problems. Gallagher Landi, Mary Anne. *Intervention in School & Clinic*, Sep2001, Vol. 37 Issue 1, p13, 6p,

Learning Strategies and Mathematics

http://www.k8accesscenter.org/training_resources/LearningStrategies_Mathematics.asp

Elementary Math and 4-Step <http://www.cfishd.net/dept2/curricu/elmath/4step.htm>