



Subject/Course: Mathematics

Author Notes:

These are suggestions for how to introduce, support, and fade support while teaching schema-based problem solving in mathematics. These suggestions accompany the Teaching Tutorial, *Schema-based Problem Solving in Mathematics*, by Asha Jitendra. See the Teaching Tutorial section of TeachingLD.org.

DLD member teachers created this lesson plan, using evidence-based practices in their own classrooms. They have shared them with TeachingLD.org so that other teachers may benefit from their experience. If you try the plan out in your classroom, please send us an email with your reflections.

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Steps for Introducing a Schema-based Strategy

Example

“Today, you will learn a type of addition-subtraction problem called **change**. You will learn to organization information in **change** stories using diagrams. Later, you will learn to solve real word problems. Learning to solve word problems can help you use math in every day life.”

1. Provide an anticipatory set in which you present the goal of the lesson and use a focus statement to gain student’s attention as well as explain the relevance of the lesson and its link to previous learning.
2. Introduce the strategy steps on the poster, note card, or transparency. Model application of the steps using several examples. Initially (Phase 1), introduce only the first two steps in the context of story situations. Use examples that have no unknown information. For Step 1, the teacher reads the problem, retells it in his or her own words, and describes the features of the problem. “This is a **change** problem, because there is a change to the beginning amount that increases or decreases the ending amount.”
3. Next, using an overhead projector or other means of display, the teacher can show the diagram for the specific problem.
4. For Step 2, the teacher underlines important information and maps it onto the diagram. Present this step by asking questions and modeling by emphasizing key information. “What does this story talk about?” “Has 4 sweaters” tells that Jane started with 4 sweaters, “gave her 3 more” tells that there was a change to the beginning amount, and “now has 7 sweaters,” talks about the ending amount. Finally, summarize the key features of the story using the completed diagram.
5. Next, introduce the six strategy steps using word problems (Phase 2) in which the unknown may involve different information (e.g., beginning, change, ending, smaller group(s), larger group, compared, referent, or difference amounts) to be solved. Instruction to apply steps 1 and 2 are similar to Phase 1, with the exception that during Step 2, students learn to flag the unknown information using a question mark (?).
6. For Step 3, present the strategy to determine whether to add or subtract to solve the problem. For all three problem types, explain that you first need to determine the total amount in the problem. Using the instructions on the poster or note card, model finding the total in the problem and write T under the appropriate set (e.g., large group). Model application of the rule, “If the total is given, we subtract to find the part. If the total is not given, we add the parts to find it.
7. For Step 4, present the math sentence and carry out the operation (addition or subtraction).
8. For Step 5, write the complete answer. Finally, model checking the answer to see if it makes sense for Step 6.
9. Have students demonstrate the schema-based strategy when provided with several different examples.

Important Points to Remember

- Make sure that sufficient time is available to emphasize the key features of the diagram AND strategy and for students to process the information. Sessions can run anywhere from 25 minutes to 45 minutes.
- Although instruction should be explicit and overt modeling of correct story mapping by the teacher is important, it is equally necessary for the teacher to employ frequent student exchange to facilitate the identification of critical elements of the story. Check student understanding and provide appropriate feedback on use of each strategy as needed. Remember to keep the vocabulary and the process questions consistent.
- Present the problem-solving strategy using 2-4 modeled examples, 3-5 guided practice examples, and 5-10 independent practice examples. The number of examples will vary based on the learner.
- Make sure that the language for story situations is simple and straightforward; it is crucial that students can read and understand the stories. For word problems, create problems or select problems from students' texts and model the use of the strategy using a range of easy to difficult problems (indirect language, irrelevant information). Additionally, provide guided practice using a range of problems before students are to solve problems independently.

Steps for Reviewing a Schema-based Strategy

1. Once students have learned the steps for using schem-based strategies to solve each type of problem, present a review of the three different problem types. Ask students to read the problem with a partner or independently and to identify the problem type. Present worksheets that include all three problem diagrams, and ask students to select the appropriate diagram to map information from the story situation or word problem.
2. Check student worksheets at the end of each session and provide appropriate feedback on strategy usage as needed.

Important Points to Remember

- Provide feedback if students have difficulty discriminating between the different problem types or applying the strategy steps. For example, on the first day of review you may have to correct the student if he or she inaccurately identifies the problem type and may have to remind students to check the strategy steps and apply them in the correct sequence.
- Provide lots of practice solving word problems independently to aid maintenance of the strategy. Present a variety of problems to promote generalization of the problem solving skill.
- Cue students to use the strategy whenever they have to solve word problems.

Steps for Fading Support

1. Once students have learned the steps of a schema-based strategy to a level where they can independently verbalize them, remove the posters or note cards.
2. Once students meet criterion (e.g., 90% correct on 2 days) in solving word problems on daily worksheets, remove the diagrams from worksheets. Tell students that they have been doing a really good job solving problems using the diagrams and that it is now time to remove them. Encourage the students to generate their own diagram to represent the problem. Tell them that their diagram should not only help them illustrate the problem features, but should also be more efficient—simpler—than actually drawing the diagrams.

Important Points to Remember

- Make sure that students are proficient in verbalizing the strategy steps and solving problems using diagrams before removing the posters or note cards and diagrams.
- If a student has difficulty creating his or her own diagram, the teacher or another student in the classroom can share their diagram.
- Cue students to use the strategy and to use their diagrams whenever they have to solve word problems.