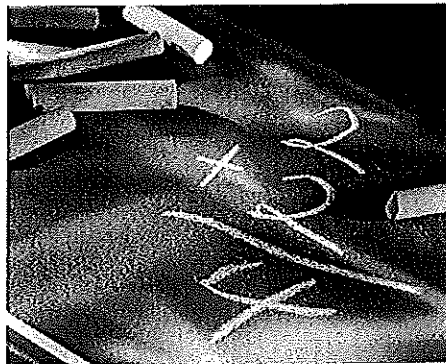


MATH PROBLEM SOLVING INTERVENTIONS



Tier 2 – Tier 3 Seven-Step Strategy For Math Word Problems

Math word problems are often difficult for many children. Word problems are much easier when a student knows and uses effective strategies to solve them. Students who approach math word problems without a strategy often make procedural and computational errors. Interventions for math word problems should target both basic math skills and use of strategies “to enable students to be thoughtful problem solvers” (Scheid, 1993,p.9). In addition, academic instruction must be tailored to the cognitive needs of individual students. Giving students some strategies or plans for doing word problems can be very helpful to them.

A Plan for Working on Math Word Problems

Math problems especially require a careful and systematic approach, a plan that includes developing ways to do the problem as well as checking that the solution is reasonable and correct. Strategy use, or good planning, is critical for coming up with an effective way of approaching the problem and monitoring the effectiveness of the strategy. Children who have poor planning skills will find these problems especially hard to solve, and therefore they should be instructed to use a plan.

How to Teach the Plan for Doing Word Problems

The teacher instructs the student on the following 7 step plan for completing word problems:

1. Read (for understanding and getting information)
 - Read the problem. If you do not understand, read it again.
 - Ask “Have I read and understood the problem?”
 - Check for understanding as you need the problem.
2. Paraphrase (use your own words to restate the problem)
 - Underline the important information. Put the problem in your own words.
 - Ask “Have I found the important facts? What is the question I am looking for?”
 - Check that the information goes with the question
3. Visualize (a picture or a diagram of the problem)
 - Make a drawing or a diagram.
 - Ask “Does the picture fit the problem?”
 - Check that the information goes with the question.
4. Hypothesize (make a plan to solve the problem)
 - Decide how many steps and operations are needed. Write the symbols (+, -, x, /)
 - Ask “If I do it this way, what will I get? If I do this, then what do I need to do next? How many steps are needed.
 - Check that the plan makes sense.
5. Estimate (predict the answer)
 - Round the numbers, do the problem, and write the estimate.

- Ask “Did I round up and down? Did I write the estimate?”
 - Check that you used the important information.
6. Compute (do the arithmetic)
 - Do the operations in the right order.
 - Ask, “How does my answer compare with my estimate? Does my answer make sense? Are the decimals or money signs in the right place?”
 - Check that all the operations were done in the right order.
 7. Check (make sure everything is right)
 - Check the computation.
 - Ask, “Have I checked every step and calculation, and is my answer right?”
 - Check that everything is right. If not, go back. Then, ask for help if you need it.

Who Should Learn the Plan for Word Problems?

All students are likely to find using this plan helpful for doing word problems. Math word problems involve all the Pass processes. Successive processing is involved when a child has to remember the ordering of relevant information. Attention is involved when the child must separate relevant from irrelevant details in the word problem. Simultaneous processing is very important so the child can see how all the information in the problem is related. However, students who score low in planning are likely to benefit from using this plan as a structure to help them work through math word problems (Naglieri, 1999).

Progress Monitoring Tool

Use AIMSweb "MCAP" to monitor student progress on this intervention. Also, in Tier 3 the Intervention Documentation Worksheet located in the SST/Tier 3 Procedural Manual must be used to document when the intervention is implemented.

Source:

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Resources:

Two excellent starting points for both students and teachers are available at: forum.wwarthmore.edu/dr.math/dr-math.html/ and www.mathgoodies.com/.

References:

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- Schied, K. (1993). *Helping students become strategic learners*. Cambridge, MA: Brookline Books.

Tier 2 – Tier 3 Solving Word Problems Using Structured Organizers

Brief Description:

This intervention gives students better understanding of reading, interpreting, and solving word problems in mathematics. The use of structure organizers is first modeled by the teacher and students use the organizers on their own. As students become more proficient, the structured organizer is phased out.

Materials Needed:

Structured Organizers for solving math word problems
Transparency of structured organizer

Procedure:**Phase 1: Modeling the use of Structured Organizers**

- a. Display a word problem and a structured organizer to the entire class on the overhead projector. Hand out copies to the students. Have students complete their own copies as you call on individual students for responses and fill in the transparency.
- b. Have students hand in their structured organizers and answer the word problem.

Phase 2: Checking student use of Structured Organizers

- a. Have the students independently fill out the organizer for a new word problem
- b. Come back together as a whole class and fill out the organizer together, calling on students to answer the questions. Record responses on the organizer transparency and have students make any necessary corrections on their papers.

Phase 3: Independent Use of Structured Organizers

- a. Give students new word problems and have the student complete structured organizers while solving them. Do not have them respond as a group.

Phase 4: Maintenance

- a. Have students complete word problems without giving them structured organizers to complete.

Comments/Tips:

- This intervention uses elements of the Group Story Mapping intervention for reading comprehension. Structured Organizers can be found in Lerner (2003) and Bos & Vaughn (2002), referenced below.

Progress Monitoring Tool

Use AIMSweb "MCAP" to monitor student progress on this intervention. Also, in Tier 3 the Intervention Documentation Worksheet located in the SST/Tier 3 Procedural Manual must be used to document when the intervention is implemented.

References:

Bos, C.S., & Vaughn, S. (2002). *Strategies for Teaching Students with Learning and Behavior Problems*, 5th Edition. Boston: Allyn and Bacon.

Lerner, J. (2003). *Learning Disabilities*, 9th Edition. Boston: Houghton Mifflin Company.

Rathovan, Natalie (1999). *Effective School Interventions*. Guilford Press: New York, NY.

Tier 2 Reciprocal Peer Tutoring to Improve Math Achievement

Brief Description:

The purpose of this intervention is to improve math performance and behavior during math instruction by means of peer tutoring, group rewards, and self-management procedures.

Students monitor their academic progress in a group context, acting as instructional partners for each other, setting team goals, and managing their own group reward contingencies. Reciprocal peer tutoring has been demonstrated to improve not only math performance but also students' perceptions of their own academic competence and self-control, and earns high satisfaction ratings from both teachers and students. The intervention takes approximately 20 minutes – 30 minutes for peer tutoring and 10 minutes for individual class drills and checking.

Materials Needed:

- Reinforcement Menus with activity rewards, one per student pair
- "Team Score Cards," consisting of 3" by 5" index cards or sheets of paper, one per student pair per week
- Stickers for team score cards
- Flash cards with math problems printed on the front and the problem plus computational steps and answers printed on the back, one problem per card, one set of cards per student pair
- Sheets of paper divided into four sections: "try 1," "try 2," "help," "try 3"
- Instructional prompt cards or sheets with specific instructions related to common mistakes in solving math problems, one per student pair
- Problem drill sheets with 10 or more problems, one per student per session
- Answer sheets for problem drill sheets, one per student per session (optional)

Procedure:

1. Assess students' current level of math performance by calculating percent-correct scores on daily math drill sheets or weekly quizzes, administering Curriculum-Based Math Probes, and/or observing students' behavior during math work periods.
2. Tell the students that they will be learning to work in teams to help each other do well in math.
3. Divide the class into pairs. Provide each pair with a Reinforcement Menu listing activity rewards. Help each pair select a reward for the day.
4. Meet weekly with each team to help the students select their team goal.
5. After each pair has chosen a team goal, have the pairs record their expected individual contribution to the team (individual goals), the sum of the individual goals (team goal), and their choice of a reward on the team score card.
6. Give a set of flash cards to each pair, and tell the students to choose who will act as "teacher" first.
7. Have the "teachers" hold up the flash cards for the students, and tell the students to work the problem on their worksheets in the section marked "try 1" while their teachers observe their work.

8. If the problem is solved correctly, the teachers praise the students and present the next problem. If the solution is incorrect, the teachers give students instructional prompts read from a prompt card and tell them to try again in the worksheet section marked "try 2."
9. If the students do not solve the problem correctly on the second try, teachers help them by computing the problem in the "help" section of the worksheet. As teachers work the problem, they explain what they are doing at each step and answer students' questions. Then the teachers tell the students to work the problem again in the "try 3" section. If teachers have trouble answering students' questions, they can ask the classroom teacher for help.
10. After 10 minutes, signal the pairs to switch roles for a second 10-minute tutoring session.
11. During tutoring sessions, walk around the room supervising and identifying strategies "teachers" can use to help their students.
12. After the second tutoring session, give each student a problem drill sheet and have students work on their own for a fixed period of time, such as 7 to 10 minutes.
13. Have students switch papers with their team partner. Have them use an answer sheet to correct their partner's work or provide the correct answers yourself as students check papers.
14. Have the pairs first determine their team's total score by counting the number correct, and then have them compare their team score with their team goal to see if they have "won" (met their goal).
15. If a team wins, give the students a sticker to put on their score card for that day. After five wins, schedule a time when the team can engage in the previously selected reward activity.
16. Evaluate the intervention by repeating the first step and comparing results.

Comments/Tips:

- ↔ Rewards can also be provided on a weekly classwide basis rather than on a daily team basis when a pre-determined percentage of teams meet their goals 4 out of 5 days during the week.
- ↔ Deliver the rewards to the entire class on Friday.

Progress Monitoring Tool

Use AIMSweb "MCAP" to monitor student progress on this intervention.

Source:

Rathovan, Natalie (1999). *Effective School Interventions*. Guilford Press: New York, NY.

References:

Fantuzzo, J.W., King, J.A., & Heller, L.R. (1992). Effects of reciprocal peer tutoring on

mathematics and school adjustment: A component analysis. *Journal of Educational Psychology*,
84, 331-339.

Fantuzzo, J.W., & Rohrbeck, C.A. (1992). Self-managed groups: Fitting self-management approaches into classroom systems. *School Psychology Review*, 21, 255-263.