

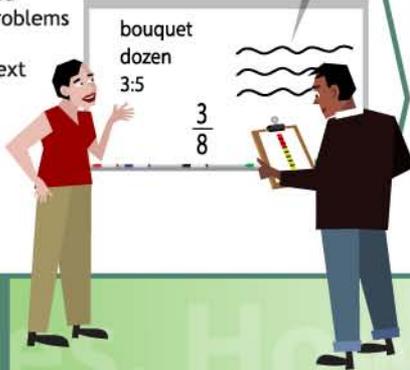
Improving Mathematical Problem Solving in Grades 4 Through 8

The IES Practice Guide *Improving Mathematical Problem Solving in Grades 4 Through 8* details the importance for teachers to incorporate problem solving into classroom instruction. The Guide has recommendations of effective instructional practices for improving students' problem-solving skills.

Monica bought a bouquet with two dozen red and yellow roses. She had 3 red roses for every 5 yellow roses. How many red roses are in Monica's bouquet?

Prepare Problems

- Use routine and non-routine problems
- Consider context and language
- Draw on students' experiences and interests



Problem-Solving Instruction

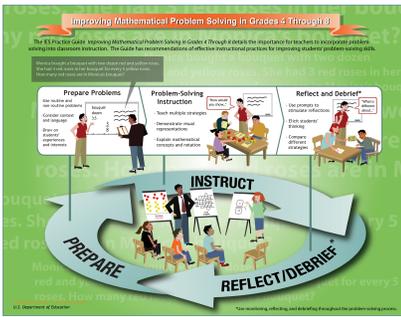
- Teach multiple strategies
- Demonstrate visual representations
- Explain mathematical concepts and notation



Reflect and Debrief

- Use prompts to stimulate reflections
- Elicit students' thinking
- Compare different strategies





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The IES Practice Guide *Improving Mathematical Problem Solving in Grades 4 Through 8* details the importance of teachers incorporating problem solving into their classroom instruction. The Guide has five recommendations of effective instructional practices for improving students' problem-solving skills. For purposes of this website, the five recommendations were combined into three practices for conducting a lesson.

This diagram illustrates how five recommendations in the Practice Guide *Improving Mathematical Problem Solving in Grades 4 Through 8* can be implemented in lessons. In the diagram, teachers are shown preparing a problem, providing appropriate problem solving instruction to students, and debriefing the problem solving process with students. It is important for teachers to consider all the practices when conducting a problem-solving lesson. Even though teachers may not use all elements of the practices in every problem-solving lesson, instruction and debriefing of one lesson will support preparation and planning for the next lesson.

Prepare Problems

Problem solving should be an integral part of all mathematics curricular units with time allocated for problem solving in whole-class instruction. Thoughtful preparation of problem-solving activities includes intentionally planning to use a variety of problems, ensuring that students have the language and mathematical experience necessary to solve the problems. Lessons should use routine problems when the goal is for students to understand a mathematical idea and use non-routine problems when the goal is for students to think strategically and apply what they learn in a new way.

Monitor and Reflect on the Problem-Solving Process*

Monitoring and reflecting during problem solving helps students evaluate the steps they are taking to solve a problem and connect new concepts to what they already know. While the ultimate goal is for students to monitor and reflect on their own while solving a problem, teachers can support students with prompts and can use a thinkaloud to model what they do while solving a problem. Teachers can use student thinking to develop students' ability to monitor and reflect by asking students to explain their reasoning or compare their strategy with other strategies.

* Use monitoring, reflecting, and debriefing throughout the problem-solving process.

Instruction

Visual Representations

Appropriate visual representations (e.g., table, graph, and/or diagram) help students solve problems by linking the relationships between quantities in a problem with the mathematical operations needed to solve the problem. Visual representations help students understand

the mathematics involved in a problem and translate information into symbolic notation. Teachers should select and teach visual representations appropriate for students and the problems they are solving.

Multiple Problem-Solving Strategies

Students who learn and use multiple strategies to solve problems may be more successful. Teachers should encourage students to use strategies that are efficient and make sense to them. Students who practice with multiple problem-solving strategies, sharing and comparing strategies with other students, are able to approach and solve mathematics problems with greater flexibility.

Mathematical Concepts and Notation

Mathematical concepts and notation provide students with structures for organizing information in a problem. Students develop new ways of reasoning when teachers explain relevant concepts and notation in the context of problem solving, prompt students to provide mathematically valid explanations, and help students make sense of algebraic notation.

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