

The time needed before students consistently use mental strategies to solve problems varies, but for some students it can take a number of years. Mathematical tasks that highlight part-whole relationships in general and that focus on doubling and numbers summing to ten in particular provide a foundation on which students can build. Likewise, instruction that highlights the relationship between addition and subtraction and enables students to reflect on properties also contributes to children's number and operation sense.

Activity



Observing How Students Solve Problems

Objective: use knowledge of problem types and solution strategies to understand students' thinking.

Write one or two problems that fit the classification scheme described in Section 1 and are appropriate for the students you teach. (You may want to begin with join problems in which the result is unknown and separate problems in which the amount of change is unknown.) In individual five-minute interviews, ask students to solve the problems. Record each student's solution strategy for each problem. When you have all your data, group students' solution strategies by type. How many students are using modeling, counting, or number sense strategies? How might you use this information to further students' understanding?

Things to Think About

When watching students solve problems, it isn't always easy to determine what strategy they are using, since they may be unable to articulate their thinking. You may have to ask probing questions or watch for overt behavior in order to hypothesize about students' thought processes. Furthermore, when a child uses his fingers, is he using a modeling strategy or a counting strategy? It's a modeling strategy if the fingers are used to show the quantities in the problem; it's a counting strategy if the fingers are used to keep track of how many numbers are in a counting sequence.

You may find that students use different strategies for join problems in which the result is unknown than they do for separate problems in which the amount of change is unknown. This may be partly because they haven't had much experience with the latter type of problem.

If students are using modeling strategies, you may wish to include mathematical tasks and sequences in your instruction that support the development of counting strategies. Providing students with many opportunities to practice counting forward and backward (especially starting in the middle of a sequence), identify patterns when counting (e.g., when we count by 100s, what changes with each increase? what doesn't change with each increase?), and connect a modeling strategy with a counting strategy will help. If students are using any of the counting strategies, you can focus on instruction that supports the use of more sophisticated methods. Activities that enable students to grapple with part-whole relationships; that emphasize number combination strategies such as doubles, doubles plus one, and doubles minus one (e.g., $5 + 6$ can be thought of as $5 + 5 + 1$ or as $6 + 6 - 1$); and that have students exploring the relationship between addition and subtraction will all contribute to your goal. ▲