

## Learning Strategies and Mathematics

### What Are Learning Strategies?

Learning strategies are an individual's approach to a task. They are how a student organizes and uses a set of skills to learn content or to accomplish a particular task more effectively and efficiently either in or out of school (Schumaker & Deshler, 1984). According to NICHCY (1997, p. 3), learning strategies "include what we think about (e.g., planning before writing, realizing when we are not understanding something we are reading, remembering what we have learned previously on the topic under study) and what we physically do (e.g., taking notes, rereading to clear up confusion, making a chart, table, or story map to capture the most important information)."

Teachers who teach students learning strategies teach students how to learn and how to be successful in and out of the academic setting. Learning strategies give students a way to think through and plan the solution to a problem. Students who use learning strategies become more effective and independent learners.

### **Direct Instruction, Strategy Instruction, and Learning Strategies: What's the Difference?**

Direct instruction is teacher centered and focused on helping students learn basic skills and information. Strategy instruction is student centered and teaches students how to learn information and then retrieve that information when it is needed. Learning strategies are taught during strategy instruction as ways of organizing information so that it can be retrieved. All three could and should be found in the same lesson because they complement one another, and strategy and direct instruction are very similar.

Students with mathematics disabilities often do not learn these strategies naturally (Montague, 1998). They switch from strategy to strategy because they do not know how to use them effectively. However, they can be taught to use the two types of learning strategies: cognitive and metacognitive. Cognitive strategies, include how to read, visualize, estimate, and compute. They can easily be taught as the teacher (1) repeatedly models the strategies, (2) monitors the students' use of the strategies, and (3) provides feedback to students. Metacognitive strategies are more difficult to teach because they involve self-questioning and self-checking techniques. Students with disabilities often have less developed strategy banks and do not have access to these important problem-solving strategies unless the strategies are taught to them. However, learning to use the metacognitive strategies will enable learners to be successful throughout the learning opportunities in their lives.

### What Do Learning Strategies Look Like for Mathematics?

Many types of learning strategies are available for mathematics. Cognitive learning strategies range from the simple to the complex and may include

- adding by counting on from the first addend or the larger addend;

- using mnemonics, such as the mnemonic for remembering computational order: **Please Excuse My Dear Aunt Sally** – Parentheses, Exponents, Multiplication, Division, Addition, and Subtraction);
- understanding that two times any number will be even or that five times any number will always end in a zero or a 5; or
- using a finger strategy for multiplying numbers less than 10 by 9.

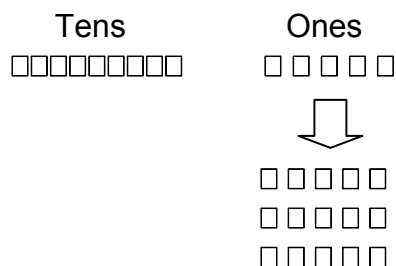
Manipulatives are an excellent way for students to develop self-verbalizing learning strategies. As they use the senses of sight, touch, and hearing, students should be encouraged to talk their way through each problem, either with peers or to themselves. They gain an understanding of the “why” of basic facts. The more time that teachers give students to use the manipulates and to talk through mathematics problems, the easier it is for students to retrieve that knowledge. Using manipulatives makes way for more abstract thinking. For more information about manipulatives, see the brief that focuses on the Concrete-Representational-Abstract (CRA) instructional strategy.

### Multiplying Numbers Under 10 by 9

Example:  $9 \times 4 =$

1. Spread your 10 fingers in front of you, palm down.
2. Count your fingers from the left pinkie to the number you are multiplying by 9 (in this case, the number is 4, so you count to the left index finger).
3. The number of fingers to the left of that finger (3) is the number of 10s (30), and the number of fingers to the right of that finger (6) is the number of ones.
4. In this example, the answer is 3 tens and 6 ones, or 36.

An important way to teach students learning strategies is for teachers to model the strategy. Teachers must show students the thinking process that they use to analyze and solve problems and then the way they check the reasonableness of the answer. The example below demonstrates this process. The teacher demonstrates the process of subtracting 8 from 15 by using manipulatives. As students hear the teacher talking her way through each problem, they imitate the teacher’s dialogue as they approach similar problems. If students spend time talking their way through problems, they develop a better understanding of the process of problem solving. When the teacher has solved the problem, she discusses aloud her check for the reasonableness of her answer.



### Teacher Self-Dialogue

Let’s see. I have five 1s in the ones column and one 10 in the tens column. I need to take away eight 1s from the ones column, but I don’t have enough. So now what do I do? I can’t do it with the ones, so now what? What do I know about the tens column? That one 10 is the same as ten 1s. So, if I take the one 10 and break it into its ten 1s and put them into the ones column, then I can take away eight. [The teacher does this; breaks the tens unit into ten 1s, puts them into the ones column with the five 1s, and then takes away eight of the 1s. She has seven 1s left, and she verbalizes this as she completes the problem.] Now, is my answer reasonable? I will check it by adding the eight I took away and the seven that were left.  $7 + 8 = 15!$  It is reasonable and correct.

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As students learn these strategies through practice, the teacher models less and students gradually take over the responsibility of determining which strategy to use. Students become more independent learners. The goal is for students to generalize these strategies into other learning situations.

Many learning strategies are discussed in educational literature—far too many to list here. One of the most famous and possibly most effective learning strategies for problem solving in mathematics is George Pólya’s 4-step problem-solving process (Van de Walle, 1998):

- Understanding the problem
- Developing a plan to solve the problem
- Carrying out the plan
- Looking back to be sure the answer solves the problem

These steps apply not only to mathematics and other academic areas but also to life skills.

### **How Are Learning Strategies Implemented?**

After the strategies have been taught, students may work independently in the class as the teacher moves around the room, observing and monitoring that students are using the strategy appropriately. Students may work in small groups and check each other’s use of the strategy.

#### **How to Implement Learning Strategies in the Classroom**

Administrators should—

- provide professional development about learning strategies and
- monitor teachers to be sure that learning strategies are taught.

Teachers should—

- have a range of strategies from which to choose;
- practice new strategies until they are comfortable with them;
- explain why learning strategies are important as they teach them, which motivates students;
- match strategies with the material;
- model a variety of strategies in each class—different students may be more successful with different strategies;
- consistently encourage students to use learning strategies in learning situations;
- monitor students’ use of learning strategies to ensure they are using them correctly; and
- encourage generalization to other subject areas.

Learning strategies should be part of every lesson, but they are more than the lesson. As teachers model these problem-solving strategies daily, monitor the students’ use of them, and encourage students to use the strategies in a variety of ways, students learn to generalize these strategies into other areas to become independent learners for life.

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## **References and Resources**

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