

## Teaching Problem Solving

To develop into expert problem solvers, students must first encounter problems that engage them and give them opportunities to develop the skills they need to learn. Through project-based learning, students gain direct experience solving problems.

The types of problems that benefit students the most are the ones that perplex them. For a problem to have the greatest benefit for students, it must be challenging enough to require the regulation of cognitive and metacognitive strategies.

One way in which teachers can improve students' problem solving skills is by having them focus on processes rather than outcomes. Dr. Ellen Langer, psychology professor, points out that thinking of outcomes often inhibits students in problem solving. A process orientation—thinking "How do I do it?" instead of "Can I do it?"—helps students think actively of different ways in which a problem might be solved instead of focusing on the many possibilities for failure (Langer, 1989, p. 34).

A group of researchers in math education emphasize the importance of reflection during problem solving activities. "It is what you learn after you have solved the problem that really counts," they explain (Wilson, Fernandez, & Hadaway, 1993). However, they warn that developing students' desire to look back is very difficult. This is due, in part, to the specific culture of many mathematics classrooms in which the purpose of solving a problem is just to find the answer, not to learn problem solving skills.

Reflection can occur in classrooms in both formal and informal ways. Providing time just for writing or talking about the processes they used to solve problems can help students refine their own processes. Considerable research also supports the notion that students improve their problem solving skills by working in groups (Wegerif, 2002). These social situations provide natural ways to discuss how work on a project is progressing.

Educators are often tempted to provide students with a heuristic, or a rule of thumb, when solving problems. For many teachers and students alike, a left-brain process like following a series of steps when confronting a challenge seems like a logical way to approach a problem. Teachers must bear in mind, however, the many ways in which students' thinking and learning styles differ. Considerable evidence shows that the right brain plays a significant role in solving problems by imagining alternatives, viewing the whole picture, and assigning value to alternative solutions.

Huitt (1998) suggests that, along with the critical and evaluative processes that are so important in problem solving, a second group of skills "tended to be more holistic and parallel, more emotional and intuitive, more creative, more visual, and more tactual/kinesthetic." He argues that successful problem solvers are creative as well as logical. Both ways of thinking are critical to success. In fact, creativity is often thought to be a special kind of problem solving process.

Few skills are as important for students to learn as problem solving skills. Young people who can identify problems that can be solved, explore options for solutions, use appropriate thinking strategies, and manage the whole process metacognitively, are equipped for success in school, in the workplace, and in life.

## References

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