

What is a problem?

A problem is a situation for which the following conditions exist.

- It involves a question that represents a challenge for the individual.
- The question cannot be answered immediately by some routine procedures known to the individual.
- The individual accepts the challenge.

- What is problem solving?

Description of Problem Solving

- Problem solving is a process by which an individual uses previously learned concepts, facts, and relationships, along with various reasoning skills and strategies, to answer a question or questions about a situation.

- George Polya developed a framework for problem solving that breaks down problem solving into four distinguishable steps. In 1945, he outlined these steps in a now-classic book called *How to Solve It*. Listed below are Polya's four steps with suggestions for carrying out these steps. These suggestions are meant to serve as starting points. The number of strategies that help the problem solving process are almost endless and vary according to each person's strengths and preferences.

George Polya's Problem Solving Model

- Understand the problem
- Make a plan
- Carry out the plan
- Look back

Understanding the problem

- Questions that can be useful to ask:
 1. Do you understand what the problem is asking for?
 2. Can you state the problem in your own words, this is, paraphrase the problem?
 3. Have you used all the given information?
 4. Is there known information that is not stated in the problem?
 5. Can you solve a part of the problem?
- Actions that can be helpful:
 1. Reread the problem carefully. (Often it helps to reread a problem several times.)
 2. Try to use the given information to deduce more information.
 3. Plug in some numbers to make the problem more concrete, more real.

- What are some plans or strategies that can be used to solve problems?

Devising a Plan

- Some common strategies are offered below:
 1. Model the problem by acting it out or using objects.
 2. Represent the problem with a diagram (carefully drawn and labeled). Check to see if you used (the relevant) given information. Does the diagram "fit" the problem?
 3. Guess→check→revise (vs. "grope and hope"). Keep track of "guesses" with a table.
 4. Look for patterns—in the problem or from your guesses.
 5. Reason logically and systematically.
 6. Work backwards.
 7. Use or make a table (sometimes the key comes from adding a new column).
 8. Make an organized list.
 9. Work a simpler problem. It is often helpful to break the problem down into a sequence of simpler "bite-size" problems. Also, if the problem has "ugly" numbers, you may "see" the problem better by substituting "nice" numbers and then thinking about the problem.

Strategies for Solving Problems

- Act out the problem or use objects
- Make a picture or diagram
- Use or look for a pattern
- Guess and check
- Use logical reasoning
- Work backwards
- Use or make a table
- Make an organized list
- Work a simpler problem

Carrying out the Plan

- 1. Are you keeping the problem meaningful or are you just "groping and hoping"? At each step, ask yourself what the numbers mean. Label your work.
- 2. Are you bogged down? Do you need to try another strategy?

Looking Back

- 1. Does your answer make sense? Is the answer reasonable? Is the answer close to your estimate if you made one?
- 2. Does your answer work when you check it with the given information? (Note that checking the procedure checks the computation but not the solution.)
- 3. Can you use a different method to solve the problem?