The Problem Solver 3

Activities for Learning Problem-Solving Strategies

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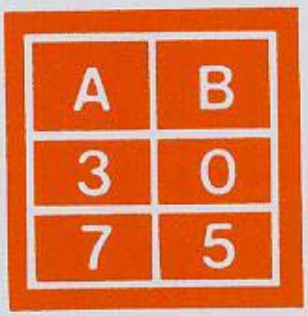
Creative Publications



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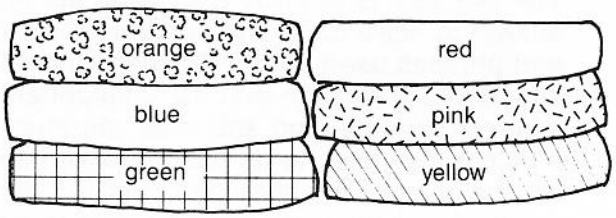
What Are the Ten Solution Strategies?

ACT OUT OR USE OBJECTS

Some students may find it helpful to act out a problem or to move objects around while they are trying to solve a problem. It allows them to develop visual images of both the data in the problem and the solution process. By taking an active role in finding the solution, students are more likely to remember the process they used and be able to use it again for solving similar problems. The dramatizations and objects need not be elaborate: small scraps of paper and colored chips or counters will usually work quite well. This strategy is especially helpful when the problem solver wants to visualize relationships. For example:

Problem 15: Mandy folded her T-shirts and put them in two stacks in her drawer. She put three T-shirts in each stack. She put the green shirt under the blue shirt. She put the yellow shirt on the right side of the green shirt. She put the orange shirt on top of the blue shirt. Finally Mandy put the pink shirt between the yellow shirt and the red shirt. Where did Mandy put each T-shirt in her drawer?

Solution:

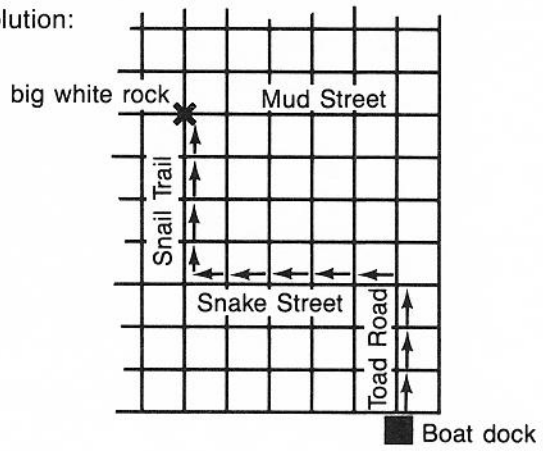


MAKE A PICTURE OR DIAGRAM

It may be helpful to use an available picture or make one when trying to solve certain problems. The pictures or diagrams need not be beautiful or well drawn. It is most important that they help the problem solver understand and manipulate the data in the problem. Using pictures is almost a necessity for some problems, particularly those which involve mapping. For example:

Problem 17: Juanita and Cole discovered a note in a bottle. It said, "Start at the Boat Dock on Toad Road. Go forward 3 blocks on Toad Road to Snake Street. Turn left and go forward 5 blocks to Snail Trail. Turn right and go forward 4 blocks to Mud Street. Stay there. Use your eyes. Look for a secret message under a big white rock." Can you show the path from the Boat Dock to the secret message?

Solution:



USE OR MAKE A TABLE

A table is an orderly arrangement of data, such as numbers. Problem solvers find that making tables helps them keep track of data, spot missing data, and identify data that is asked for in the problem. Because patterns often become obvious when data is organized in a table, this strategy is often used in conjunction with other strategies. In the example below, the table is used to keep track of data and could also be used for identifying a number pattern.

Problem 27: The guards of Clock Castle open the two gates at the same time every hour to let visitors go into the castle. The guards keep track of how many people they let in through their gates. This is what they wrote today:

Time	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00
Visitors through King's Gate	1	5	9	13	17			
Visitors through Queen's Gate	1	4	9	12	17			

The guards kept letting visitors go into the castle in the same ways all day. How many visitors went through Queen's Gate at the time that 33 visitors went through King's Gate?

Solution: 33

Time	8:00	9:00	10:00	11:00	noon	1:00	2:00	3:00	4:00
Visitors through King's Gate	1	5	9	13	17	21	25	29	33
Visitors through Queen's Gate	1	4	9	12	17	20	25	28	33

MAKE AN ORGANIZED LIST

Making an organized list helps problem solvers organize their thinking about a problem. Recording work in an organized list makes it easy to review what has been done and to identify important steps that must yet be completed. It also provides a systematic way of recording computations made with given data or recording combinations of given items. For example:

Problem 35:
WANTED: Warty Toads and Smooth Frogs. I will pay 3¢ for each toad, and 5¢ for each frog.

Bert and Bruno saw the professor's ad, so they are bringing a sack of 10 toads and frogs to her. The professor looks at the animals and then gives the boys 38¢. How many of the animals were toads and how many were frogs?

Solution: 6 toads and 4 frogs

$6 + 4 = 10$

$18¢ + 20¢ = 38¢$

Toads	Money	Frogs	Money
1	3¢	1	5¢
2	6¢	2	10¢
3	9¢	3	15¢
4	12¢	4	20¢
5	15¢	5	25¢
6	18¢	6	30¢

GUESS AND CHECK

Guessing and checking is helpful when a problem presents large numbers or many pieces of data, or when the problem asks the solver to find one solution but not all possible solutions to a problem. When problem solvers use this strategy, they guess the answer, test to see if it is correct, and make another guess if the previous one was incorrect. In this way, they gradually come closer and closer to a solution by making increasingly more reasonable guesses. Problem solvers can also use this strategy to get started, and may then find another strategy which can be used. Guessing and checking is particularly helpful when a problem presents so many pieces of data that making an organized list becomes a major task. For example:

Problem 42: Zoobee has two kinds of flowers in his garden: dandelions and tiger lilies. Zoobee planted only tiger lilies, but dandelions came up too. There are 51 flowers in Zoobee's garden, and there are 15 more dandelions than tiger lilies. How many of the flowers are tiger lilies and how many are dandelions?

Solution: 18 tiger lilies and 33 dandelions

USE OR LOOK FOR A PATTERN

A pattern is a regular, systematic repetition. A pattern may be numerical, visual, or behavioral. By identifying the pattern, the problem solver can predict what will "come next"and what will happen again and again in the same way. Looking for patterns is a very important strategy for problem solving, and is used to solve many different kinds of problems. Sometimes students can solve a problem just by recognizing a pattern, but often they will have to extend a pattern to find a solution. Making a number table often reveals patterns, and for this reason is frequently used in conjunction with the "look for a pattern" strategy. For example:

Problem 25: Mona is wearing her magic cape again. The first time she wore it, she found 5 pennies in a crack of the sidewalk. The next time she wore it, she discovered 9 pennies under an old barrel. The third time she wore it, she found 13 pennies in some sand. The fourth time she wore it, she discovered 17 pennies under the bleachers in a ball park. If Mona keeps finding pennies in this way, how many will she find when she wears her cape the eighth time?

Solution: 33

Time	1st	2nd	3rd	4th	5th	6th	7th	8th
Pennies Mona finds	5	9	13	17	21	25	29	33

WORK BACKWARDS

To solve certain problems, the solver must make a series of computations, starting with data presented at the end of the problem and ending with data presented at the beginning of the problem. For example:

Problem 44: The Kingdom of Ketchupia is famous for its tomato sauce. One day the recipe for the sauce disappeared. The king ordered some of his Red Knights to search throughout the kingdom for the recipe. They did not return. On the second day, the king sent out 4 more knights than he had sent out the first day. Each day the king kept sending out 4 more knights than he had sent out the day before. Nineteen knights left the castle on the fifth day. How many knights in all did the king send out into his kingdom?

Solution: 55 $3 + 7 + 11 + 15 + 19 = 55$

Day	1st	2nd	3rd	4th	5th
Number of knights sent out	3	7	11	15	19

USE LOGICAL REASONING

Logical reasoning is really used for all problem solving. However, there are types of problems that include or imply various conditional statements such as: "if. . .then," or "if. . .then. . .else," or "if something is true, then. . ." or "if something is not true, then. . . ." The data given in the problems can often be displayed in a chart or matrix. This kind of problem requires formal logical reasoning as the problem solver steps his or her way through the statements given in the problem. For example:

Problem 39: An old sneaker, a cup, a bottle, and a can fell off Drew's Dock and dropped to the bottom of the water. Along came a fish, a snail, a crab, and a snake who were looking for homes. The snake slithered into the bottle. The crab crawled into the sneaker. The fish wouldn't go near the can. What did each sea animal choose as its home?

Solution: Fish—cup; snail—can;
crab—sneaker; worm—bottle

	Sneaker	Cup	Bottle	Can
Fish	No	Yes	No	No
Snail	No	No	No	Yes
Crab	Yes	No	No	No
Worm	No	No	Yes	No

MAKE IT SIMPLER

Students will find it helpful to be able to make problems simpler, especially when they begin to solve complex problems. Making a problem simpler may mean reducing large numbers to small numbers, or reducing the number of items given in a problem. The simpler representation of the problem, then, may suggest what operation or process can be used to solve the more complex problem. The simpler representation may even reveal a pattern which can be used to solve the problem. For example:

Problem 45: Ron and Rebecca Robot work in a factory. Ron pushes 6 blocks together in a row on a table, and Rebecca sprays paint on the blocks. Every block has 6 sides. The sides that touch the table or sides of other blocks don't get painted. How many sides of the blocks in a row get painted?

Solution: 20

Number of blocks in the row	Number of sides that get painted
1	5
2	8
3	11
4	14
5	17
6	20

BRAINSTORM

This strategy is often used when all else fails. When the problem solver cannot think of a similar problem that he or she has solved before, and cannot think of another strategy to use, brainstorming is a good strategy to try. Brainstorming means looking at a problem in new and inventive ways. There are always problems that stretch people beyond their experience and expertise. When students encounter problems that they cannot solve, they must be encouraged to open up, stretch, allow for inspiration, be creative, be flexible, and keep on trying until a light goes on! For example:

Problem 47: "Here's a puzzle for you," said Jan to Peggy. "Why is a robot's ear never only 12 inches long?" Peggy had to think about it for a while, but she figured it out. What was Peggy's answer?

Solution: Because then the ear would be a foot.

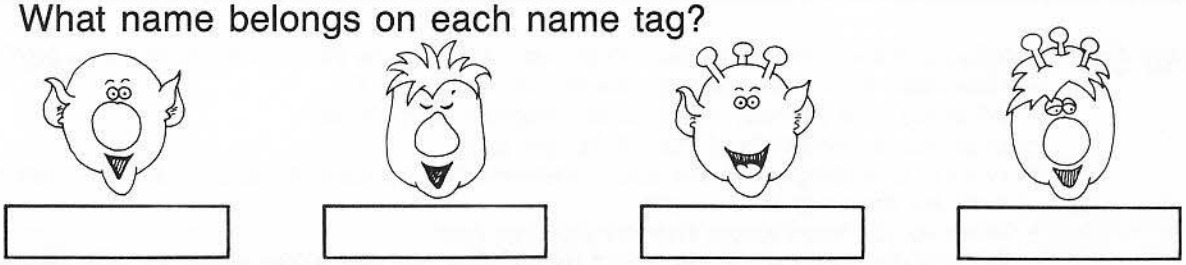
USE LOGICAL REASONING

Name

1 The Heebie-Jeebies are playing music in the lunchroom. Harry, Helen, Herman, and Harriet are in the band.

- Harry and Herman have ears.
- Herman does not have a nose.
- Harriet and Helen have hair.
- Helen has knobs on the top of her head.

What name belongs on each name tag?



FIND OUT

- What is the question you have to answer?
- How many Heebie-Jeebies are playing in the band?
- What are their names?
- What do you know about Harry?
- What is one thing you know about Herman? What else do you know about him?
- What do you know about Harriet?
- What is one thing you know about Helen? What else do you know about her?

CHOOSE A STRATEGY

- Circle to show what you choose.

SOLVE IT

- What does the first clue tell you? Look at the pictures on your paper. Which players could be Harry and Herman?
- What does the second clue tell you? Which of the two players is Herman? Write Herman's name on his name tag. Then who is the other player? Write his name on his name tag.
- What does the third clue tell you? How many players have hair? Who are those players?
- What does the fourth clue tell you? Which one of those two players is Helen? Write Helen's name on her name tag. Then who is the other one? Write her name on her name tag.

LOOK BACK

- Look back to see if your answer fits with what the problem tells you and asks you to find. Read the problem again. Look back over your work. Does your answer fit?