Heuristic Problem Solving and the Microcomputer

by
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The microcomputer is an exciting new educational tool with which mathematics and heuristic problem solving can be taught. Programming should not be taught for its own sake. Rather, it should be taught as required to enhance students' problem-solving skills.

I have been making a collection of problems suitable for Grades 4, 5, and 6 which can be solved using the microcomputer. Each problem consists of a number pattern which must be understood before a program can be written.

The teaching lessons developed to accompany each problem are based on Polya's problem-solving steps:

1) Understand the problem

> Some of the strategies which may be appropriate include:
>
> - making a table
> - conducting an experiment
> - making an organized list
> - separating the parts
> - recognizing the pattern
> - thinking of a simpler problem

2) Make a plan

> This is the first step at which we consider using the microcomputer to continue the number pattern we have discovered.
> Make a flowchart and/or plan the output you expect to see on the screen or printer.

3) Carry out the plan

> Translate your plan into a computer program and run it. Only a few commands in BASIC are required to write programs for any of the problems since programming is not the main objective. Most require

knowledge of variables, PRINT, IF_THEN, FOR...NEXT. Some require INPUT and GOSUB.

4) Looking back.

Can you improve your program?
What did you learn by solving this problem?
Could you have solved it differently?
Can you extend the problem?

The students have used Polya's four steps to organize their write-ups too.

Some of the problems in the set follow.

1) Write a program that will continue this number pattern:

3, 9, 27, 81, 243, . . .

2) How many telephone numbers can there be that start with the same first three digits as yours?
Write a computer program to do the work for you.

3) If you start saving money with one cent on the first day, two cents on the second day, four cents on the third day, eight cents on the fourth day, and so on for 30 days, how much money will you have saved?

4) If each of four people shakes hands once with each of the other three, how many handshakes will there be? How many if there are five people? Write a program that will ask the user how many people there are and tell him how many handshakes there will be.

5) How long would it take to spread a rumor in a town of 80,000 people if each person who hears the rumor tells it to three new people within 15 minutes?

6) Write a program that will continue this number pattern:

$$1 \times 8 + 1 = \text{xxx}$$
$$12 \times 8 + 2 = \text{xxx}$$
$$123 \times 8 + 3 = \text{xxx}$$
$$\cdot$$
$$\cdot$$
$$\cdot$$
$$123456789 \times 8 + 9 = \text{xxx}$$

Your program should let the user predict some numbers in the pattern. The computer should check the answer and give the user an appropriate message.

7) In the song "The Twelve Days of Christmas," gifts are given to the singer in a definite pattern. Write a program to figure out how many gifts there were altogether.