

ACTIVE PROBLEM SOLVING

Futurists continue to stress that our future is going to undergo change at a rate even greater than present generations have experienced. This implies that today's and future problems will have a dynamic component. Such problems change or evolve as they are being studied. It is evident then that a fundamental skill for dealing with the future is active problem solving, i.e., the ability to solve problems that are undergoing change during the process of resolution.

Problem solving can be divided into two categories, Routine and Nonroutine. **Routine Problem Solving** stresses the use of sets of known or prescribed procedures (algorithms) to solve problems. The strength of this approach is that it is easily assessed by paper-pencil tests. Since today's computers and calculators can quickly and accurately perform the most complex arrangements of algorithms for multi-step routine problems, the typical workplace does not require a high level of proficiency in Routine Problem Solving. However, today's workplace does require many employees to be proficient in Nonroutine Problem Solving.



Nonroutine Problem Solving, stresses the use of heuristics and often requires little to no use of algorithms. Unlike algorithms, heuristics are procedures or strategies that do not guarantee a solution to a problem but provide a more highly probable method for discovering a solution. Building a model and drawing a picture of a problem are two basic problem-solving heuristics. Studying end-of-game situations provides students with experiences in using the heuristics of reducing the problem to a similar but simpler problem and working a problem backwards, i.e. from its resolution to its initial state. Other heuristics include describing the problem situation, classifying information, and finding irrelevant information.

There are two categories of Nonroutine Problem Solving: Static and Active.

1) Static-Nonroutine problems have a fixed, known goal and fixed, known elements that are used to resolve the problem. Solving a jigsaw puzzle is an example of a Static-Nonroutine problem. Given all pieces to a puzzle and a picture of the goal, learners are challenged to arrange the pieces to complete the picture. Various heuristics such as



classifying the pieces by color, connecting the pieces which form the border, or connecting the pieces which form a salient feature to the puzzle, such as a flag pole, are typical ways in which people attempt to resolve such problems.

2) Active-Nonroutine problems may have a fixed goal with changing elements, a changing goal or alternative goals with fixed elements, or changing or alternative goals with changing elements. The heuristics used in this form of problem solving are known as strategies. People who study such problems must learn to change or adapt their strategies as the problem unfolds.

The **Mathematics Pentathlon® Program** provides experiences in thought processes necessary for Active Problem Solving. The series of 20 Mathematics Pentathlon games provide students with experiences in

deductive and inductive reasoning through the repeated use of sequential thought as well as nonlinear, intuitive thinking. Exposure to such forms of thought helps students relate to real-life problem-solving situations and learn to “think on their feet.”

PROBLEM SOLVING

ROUTINE

algorithms

uses sets of prescribed or known procedures (rules) to solve problems

STRENGTH

easily assessed by paper-pencil tests

WEAKNESS

least relevant to human problem solving

NONROUTINE

heuristics

uses strategies that do not guarantee a solution to a problem but provide a more highly probable method for solving problems

STATIC or ACTIVE

- fixed, known goal and known elements
- fixed goal(s) with changing elements
- changing goal(s) with fixed elements
- changing goal(s) with changing elements

STRENGTH & WEAKNESS

most relevant to human problem solving

least able to be assessed by paper-pencil tests