

PROBLEM SOLVING

Prepared by

Appu Aravind
Asst. Professor
DBSH

Problem

- Has its origin in the Greek word, *problema*
- An unwelcome situation which must be dealt with and 'solved' or overcome
- In academic context- a question starting from a given set of conditions in order to investigate or demonstrate a fact, result, or law

Problem Solving

- Any activity or group of activities that seek to resolve problems or find a solution to them by proceeding in an orderly fashion.
- Kinds of problems vary from one domain to another. Hence we use different problem solving strategies.

Different Domains of Problem Solving

- Psychology and Cognitive Science
 - Ability to move from a given state to desired state
 - Makes use of a number of fundamental skills
- Computer Science
 - Replicate the problem solving strategy of human brain and express it in an algorithm
- Engineering
 - Concerned with products and processes – to prevent actual or anticipated failures

Types of Problem Solving

- Problems can be classified based on..
 - Types of unknown
 - Levels of difficulty
 - Open-endedness

Type of unknown

- Known problem, known solution
- Known problem, solution requires additional expertise
- Known problem, solution requires new approaches
- Unidentified problems

Based on Level of Difficulty

Problems that require progressively advanced intellectual abilities..

Knowledge

When.. Where.. What formula

Comprehension

Relate.. Show.. Distinguish

Application

Apply.. Demonstrate.. Determine

Analysis

Organize.. Arrange..

Synthesis

Speculate.. Devise.. Design

Evaluation

Open-endedness

- Open-ended problems
 - No single correct answer for the problem
 - Subjective, at times even, opinion based
 - Divergent thinking is suited
- Close-ended problems
 - A single correct answer for the problem
 - Convergent thinking is suited

The Problem Solving Process

- The general structure of an effective problem solving is process or *problem solving cycle* has been identified by Bransford & Stein as the IDEAL model

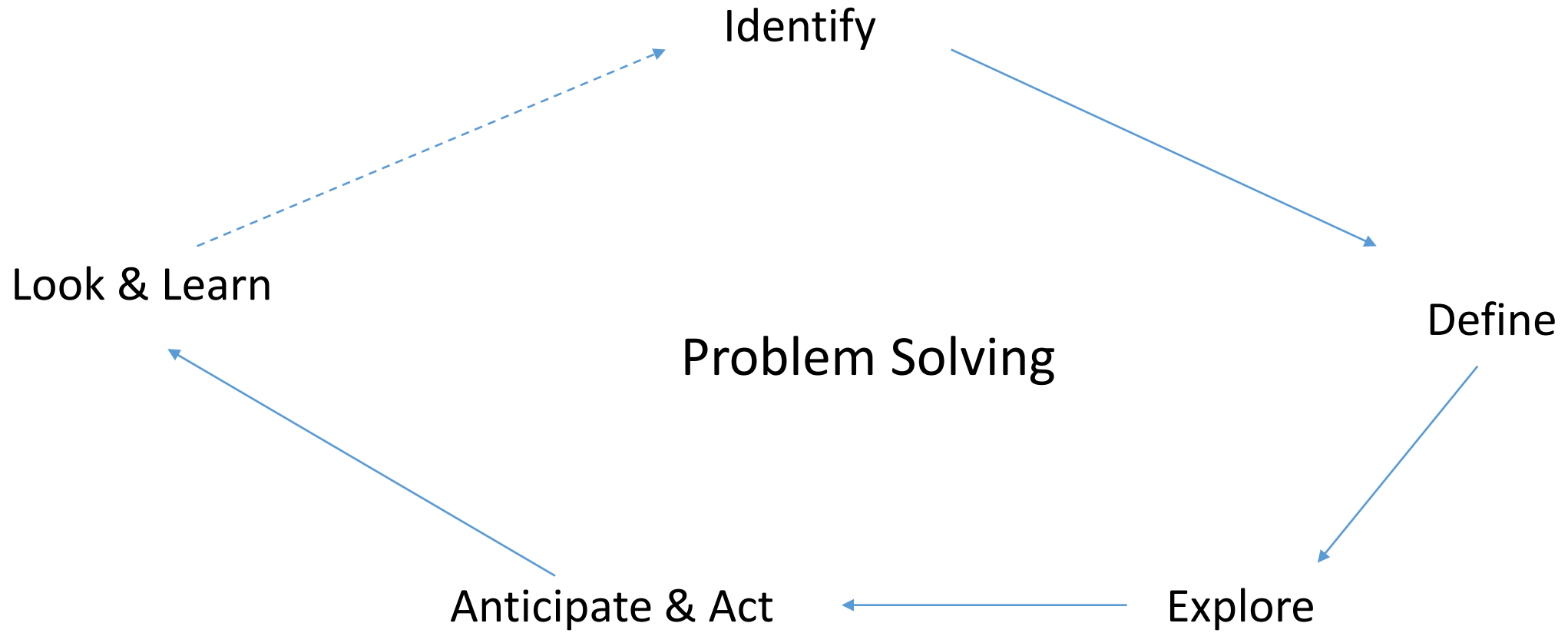
I identification of problem

D definition of goals

E exploration of possible strategies

A anticipation of outcome and action

L learning through retrospection



The IDEAL Problem Solving Cycle

Types of Problem Solving Activities

- Can be divided into five categories. For solving a problem, one may need to move back and forth among these categories.

- Routine

Follows a fixed series of actions. Solver does not have to make any decisions and need only perform the actions one after the other.

- Diagnosis

Solver must decide which routine is suitable for the problem at hand. Problem is examined with a view to understanding which routine is apt.

- Strategy

Finding out the most usable routine to solve the problem.

- Interpretation

Information must be extracted from real world situations.

- Generation

Development of new routine.

Problem Solving Strategies

- A series of steps that a problem solver adopts to get his/her goals.
- What set an expert apart from a novice is his robust problem solving strategy.
- Novices use trail-and-error while experts consistently use particular strategies.
- It has been suggested that effective strategies have between four and fifteen steps.

Polya's 4 Step Method

- George Polya, a Hungarian mathematician
- Theorizes that there are four essential principles of problem solving which are characterized by different questions to be asked at each step.

Understand the Problem

- Do you understand all the words in the problem?
- Can you re-state the question in your own words?
- What do you need to find out?
- Is there a picture/sketch you can draw?
- Is the given information sufficient for the solution?
- If not, what other information is required?

Devise a Plan

- The best strategy out of so many possibilities.

Look for patterns

Guess an answer and check

Draw a diagram

Write down equation

Make a table

Consider special cases

Break into subproblems

Work backward

Do a similar, simpler problem

Be ingenious

Execute the Plan

- Act according to the strategy planned out in the earlier stage.
- Substitute numbers and check answers at each stage.
- Make an accurate record of the work you did.

Look Back

- Re-examine the answers that you have obtained
- Are they within reasonable limits?
- How do they compare with the answers to the original problem?
- Can the solution be generalized?
- Is there another method of solving this?

Common Problem Solving Strategies

- *Abstraction*
- *Analogy*
- *Brainstorming*
- *Divide and conquer*
- *Hypothesis testing*
- *Lateral thinking*
- *Means-ends analysis*
- *Method of focal objects*

Morphological analysis

Reduction

Research

Root cause analysis

Trial-and-error