UNIT 4 IMPEDIMENTS TO PROBLEM SOLVING

Structure

4.0 INTRODUCTION

You might have come across many situations when your attempts at problem solving may have failed. This is largely because the problem space is not adequately searched or because it is not represented well in the first place. There are numerous factors that are influential impediments to problem solving.

Einstellung (or set or mental set) and functional fixedness are classic obstacles to both proper representation and search identified by the Gestalt psychologists. However, there are other impediments to problem solving also. In this chapter we will study some of these impediments to problem solving.

4.1 OBJECTIVES

After completing this unit, you will be able to :

- Define probles;
- Differentiate between problems and dilemmas;
- Define and describe Mental Set;
- Describe Luchin's Water Jar Problem;
- Explain impediments to problem solving;
- Define Functional Fixedness;
- Explain Incomplete or Incorrect Representations; and
- Analyse Lack of Problem Specific Knowledge or Expertise.

4.2 EFFECTIVE PROBLEM SOLVING

Depending on the kind of dilemma or problem, there are a number of models that can help people to think through their approaches to decision-making.

Haynes' model

This suggests a 3-step approach in the form of reflective questions, for dealing with ethical decision-making dilemmas and problems

When working out a solution to the problem, there are a few questions one should pose to oneself and these are for instance, "If this particular solution is considered what will be the consequences and would there be more benefits vis a vis harmful effects?"

Hall's model (2001)

Alan Hall (University of Waikato) offers a set of questions that educators can use to help consider all things before deciding what they ought to do when confronted with an ethical problem, and how they will do it:

What is the basic issue concerned with the problem?

What principle is at risk?

Who will benefit?

Will benefits be more than harm?

4.3 OTHER METHODS FOR PROBLEM SOLVING

4.3.1 Einstellung

It is the term used by the Gestaltists to describe the tendency to set the mind into a routine approach to problem solving. When we considered Wertheimer's laboratory problems, we noted that sometimes previous experience can blind a person to simple solutions. The experiments of Luchins (1942; Luchins & Luchins, 1950, 1994a, 1994b) are among the most interesting demonstrations of the way in which repeating a particular problemsolving method can make a person blind to alternative ways of solving the problem.

Luchins (1942) discovered set or Einstellung effects with the water jar problems. In this problem it is required to measure out a desired quantity of water using three jars with different capacities. Jars used have no gradations on them so they have to be filled up to the top to measure amounts that result in the desired quantity.

Luchin's Water Jar Problems

	Jar Sizes			
	A	**B**	**C**	**Goal**
Problem 1	21	127	3	100
Problem 2	14	163	25	99
Problem 3	18	43	10	5
Problem 4	9	42	6	21
Problem 5	20	59	4	31
Problem 6	23	49	3	20

For instance, suppose the desired quantity was 5 cups and Jar A held 10 cups, Jar B held 4 cups, and Jar C held 1 cup, the solution would be to fill A first. Next from A pour into B once, and then pour from B into C once (A-B-C). Try all six problems in above Table before proceeding.

Luchins found that problem solvers adopt a set in solving these problems. After solving the first two or three, they automatically try the solution B-A-2C without searching the problem space for an alternative solution. Take a look at problem 6 again. Although B-A-2C works fine, it entails much more effort than A-C. Yet because of Einstellung, people typically overlook the obvious, easy solution.

Langer (1989) saw that Einstellung effects are one type of mindlessness that characterises human behaviour, particularly in our dealings with other people. All too often we act from a single perspective or rule that has worked in the past. Instead of exploring our environment carefully to seek out alternative courses of action, we sample just enough features to recognise that our set approach seems to be on track.

Einstellung also constrains how we represent problems as well as how we search them.

Self Assessment Questions

1) Define problem solving.

.....

.....

.....

.....

.....

.....

2) Describe effective problem solving. What is required for effective problem solving.

.....

.....

.....

.....

.....

3) What are the various other methods of problem solving?

.....

.....

.....

.....

.....

4) What is Einstellung? Explain

.....

.....

.....

.....

.....

4.3.2 Understanding the Problem

1) **Interpretation**

Develop a relatively clearer understanding of the problem before attempting to solve it.

Devote more time and effort to the initial formulation of ill structured problems.

Look at the immediate problem in its relation to the broader mission and problems of the organisation.

2) **Goals**

Adopt a broader range of goals for problem solving

When solving problems in groups, have less personal stake in any preconceived solution. Because their aim is to arrive at the best solution the group can produce.

4.4 OVERCOMING THE CONSTRAINTS

The problem solver must adequately anticipate many of the constraints likely to arise during problem solving.

They must show a greater tendency to plan, in advance, for how to address anticipated constraints.

They must respond more adaptively and flexibly to constraints that arise unexpectedly.

They should not view the constraints as major impediments to problem solving.

4.4.1 Typical Processes in Solving a Problem

- Think through their solution processes in considerable detail
- Develop an explicit plan for solving the problem, which often includes many steps.
- Collect comprehensive amounts of relevant information from reliable sources as part of developing and implementing their solution plan.
- Monitor progress with the plan and refine it when outcomes are not satisfactory.
- Consult, often extensively, with others in developing their solution plan.
- Plan for follow-up.

4.5 IMPEDIMENTS IN PROBLEM SOLVING

Solving problems is a complex process and each of us is better at the skills required at some stages than others.

A problem exists when an obstacle prevents the person from reaching an objective.

In order to achieve effective problem solving , this problem solving itself can be divided into stages, which must be followed methodically.

Solving problems effectively requires a controlled mixture of analytical and creative thinking.

The following are the list of some of the reasons why people fail to find effective solutions include:

- Not being methodical
- Lack of commitment to solving the problem
- Misinterpreting the problem
- Lack of knowledge of the techniques and processes involved in problem solving
- Inability to use the techniques effectively.
- Using a method inappropriate to the particular problem
- Insufficient or inaccurate information
- Inability to combine analytical and creative thinking
- Failure to ensure effective implementation.

Self Assessment Questions

1) What are the two important aspects involved in problem solving?

.....

.....

.....

.....

.....

2) What are the ways in which the constraints in regard to problem solving could be overcome?

.....

.....

.....

.....

.....

3) What are the various impediments in problem solving?

.....

.....

.....

.....

.....

4) Why do people fail to find effective solutions to problems?

.....

.....

.....

.....

.....

4.6 PRODUCTIVE PROBLEM SOLVING AND IMPEDIMENTS THEREOF

Let us first consider what is required for productive problem solving. The following provides the requirements

A clear description of the problem.

A description of the limiting (or negative) factors involved in the problem.

A description of the constructive (or positive) factors involved in the problem.

A clear delineation of the "ownership'' of the problem. Whose problem is it: mine, yours, the other guy's, my boss', my spouse's, my child's, my parents', my teacher's?

A clear description of the scope of the problem: How extensive a problem is it? How long has this problem existed? How many people are affected? What else is affected by this problem?

A clear description of the consequences if the problem were not solved: What is the possible impact on my family, job, marriage, school performance, life in this community, etc., if this problem isn't solved? What is the worst possible thing that could happen if this problem isn't solved?

A list of brainstormed solutions to the problem, with each alternative analysed as to its reality, its benefits and the consequences for following each one.

A system of ranking each solution to finalise the decision-making process. A rating system for analysing each solution is developed, e.g., 100 percent chance of success, 75 percent chance of success, 50 percent chance of success.

It is always ideal to brainstorm the problem and to do this one should follow the rules given below:

1) Express all ideas.
2) Deem no idea too wild to be considered.
3) Quantity is important; every idea that comes to mind should be included.
4) Getting together with others to brainstorm is desirable.
5) Criticism or negative evaluation regarding any idea is forbidden until brainstorming is completed.

Some of the questions one should ask of oneself in order to achieve effective problem solving are:

- Am I procrastinating?
- Am I avoiding the problem?
- Am I in denial?
- Am I shutting down or blocking my creativity on this problem?
- Am I ignoring it, hoping it will go away?
- Am I using magical and/or fantasy thinking in addressing the problem?

4.6.1 Impediments to Productive Problem Solving

- A "Yes, but'' attitude.
- Intellectual defensiveness closed to new ideas.
- Fear of being perceived as being incompetent.
- Fear of one's ideas being unaccepted.
- Inability to be objective about the problem.
- Fear of being wrong.
- Inability to be creative, imaginative or "off the wall'' in developing alternative solutions.

- Being inflexible or too serious to have fun while problem solving.
- Not tuning into one's "inner child''.
- Being so chronically immersed or emotionally "stuck'' in problems that no feelings or emotions can be elicited.
- Believing that one's emotions and feelings about a problem are "wrong'' and should be discounted in problem solving.
- Resentment about having to solve the problem and blaming others for causing the Problem.
- No desire to own up to the problem yourself.
- Believing that problems are the concerns of others, why waste time in trying to solving them.
- Mental and/or physical fatigue from trying to cope with problems and finding no fruitful solutions.
- Burnout, feeling so stressed, anxious or tense in the face of a problem that your body systems shut down.
- Getting so angry about the problem that all energy and attention is drawn to the anger rather than to the problem.
- Feeling sorry for oneself so much that the "self-pity'' overwhelms and obstructs all creative thinking on the matter.
- Getting so down or depressed about the problem that it is impossible to come up long enough to deal with the problem.
- Denial that the problem exists.
- Bargaining in dealing with the problem; e.g., agreeing to perform certain steps only as long as the solution to the problem benefits you.

Self Assessment Questions

1) What is meant by Productive problem solving?

.....

.....

.....

.....

.....

2) What are the essential pre requisites for productive problem solving?

.....

.....

.....

.....

.....

.....

3) What are the impediments to productive problem solving?

.....

.....

.....

.....

.....

4) How can you overcome these impediments to productive problem solving?

.....

.....

.....

.....

.....

4.7 PROBLEM SOLVING IN TEAMS AND SMALL GROUPS

There are many things that make a group or team fail to solve a problem. Some of the barriers in this regard include the following:

1) Lack of structure.

   When there is no structure group members lose focus and direction.

2) Poor communication.

   This is a barrier that can wreak havoc for every group member that is involved. Poor communication can lead to misunderstanding of the problem. Further poor communication itself can be caused by inattentiveness and dominance that can be made by one or more group members. Ineffective communication will definitely be a negative against any discussion or meeting.

3) No communication

   This would be a problem solving killer.

4) Negative attitude

   This is a barrier to problem solving in small groups. If members are not flexible and open minded during a discussion or meeting, then a balanced opinion can not be produced.

5) No goal or agenda

   When having a team or small group meet for problem solving, it is very important to have a goal or agenda. This in turn will help to avoid most barriers and keep the group focused and organised.

6) Lack of participation

   It is important in a small group or team every member should participate in the problem solving process. They must all have clear idea as to what the

group is trying to achieve and give all members time to participate and give their views and feelings. This path, in the end, will help to keep focus, structure, and communication open for all members.

In addition to the above other problems that may affect the problem solving processes are:

- Emotions
- Learning styles
- Gender
- Cognitive barriers
- The lack of transfer of structure between problems.

4.8 CRITICAL THINKING IN PROBLEM SOLVING AND IMPEDIMENTS

Critical thinking consists of three steps:

1) Becoming aware that assumptions exist
2) Making assumptions explicit
3) Assessing their accuracy

Misconceptions about Critical Thinking

- It is a wholly negative process – it tears down ideas and puts nothing in their place
- It will lead to relativistic freeze – the inability to make commitments to people, ideas, and structures.
- It seems to involve traumative change – one is expected to abandon old assumptions continually.

Other fallacies in regard to problem solving are :

- Irrelevant reason.
- The person's character attached to discredit arguer rather than argument
- Generalisation – one event which follows was cause by first
- Slippery slope with an either or approach which leads to non resolving a problem.
- Appeal to emotion – emotional appeals rather than logical reasons to persuade.

Self Assessment Questions

1) How do problems get resolved in teams and groups?

.....

.....

.....

.....

.....

2) What makes solution to the problem a failure in teams and groups?

.....

.....

.....

.....

.....

3) What is meant by critical thinking in problem solving?

.....

.....

.....

.....

.....

4) What are the impediments to problems solving through critical thinking?

.....

.....

.....

.....

.....

4.9 OTHER BARRIERS TO PROBLEM SOLVING

These are Perceptual blocks, Emotional blocks, Intellectual blocks, Environmental blocks, Culture blocks.

4..9.1 Perceptual Blocks

Perceptual blocks exist when we are unable to clearly perceive a problem or the information needed to solve it effectively .

They include:

a) Seeing *only what you* expect to see

Obscures the "true nature of a problem, either because we exclude relevant information or include information simply because we assume it is there.

b) *Stereotyping*

Often we don't look beyond the obvious and tend to label. For example, if someone isn't working as hard as we would like and we apply the label 'lazy' to that person, we might overlook the possibility that boredom with monotonous work is the problem, and not laziness

c) *Not recognising problems*

Problems go unnoticed until the effects have become severe and emergency action is required.

d) *Not seeing the problem in perspective*

This results from taking too narrow a view of the situation, so that we recognise only part of the problem or the information required to solve it. Sometimes people fail to recognise how different parts of the problem are related, rather they look at the problem more superficially and hence the solution alsom becomes inadequate.

e) *Mistaking cause and effect*

If cause and effect are confused then we are unlikely to find an effective solution. For example, if goods do not arrive and we assume that the supplier is late in despatching them when in fact our ordering department has failed to send out the order, then our search for solutions will be misdirected. In this situation the late despatch of the goods is an effect of the problem and not a cause.

4.9.2 Emotional Blocks

Emotional blocks exist when we perceive a threat to our emotional needs. These needs differ in type and strength from person to person but include needs for achievement, recognition, order, belonging and self-esteem. The emotional blocks include:

a) *Fear* of *making mistakes* or *looking foolish*

This is the most significant emotional block because it affects most of us and is difficult to overcome. As a result of traditional schooling, the expected reaction when we make a mistake or suggest radically different ideas is laughter and ridicule. No one likes being laughed at and as a result we learn to fear making mistakes and to avoid suggesting ideas which are different. This block becomes more severe in the presence of colleagues of a different rank to our own. With those who are more senior we imagine that we will be thought inexperienced or immature. With those more junior we want to protect our image as being knowledgeable and experienced.

b) *Impatience*

Being impatient to solve a problem may be due either to a desire to succeed quickly or to end the discomfort or loss caused by the problem. This has two major consequences. We tend to grab the first solution which comes along, without adequate analysis of the problem, and we evaluate ideas. too fast, almost instinctively rejecting unusual ideas. Either way, our solution is unlikely to be the most effective available.

c) *Avoiding anxiety*

This is another common block. Some of- us are more susceptible to anxiety and also find it more unpleasant than others. Many factors can cause anxiety, including high risk, disorder and ambiguity, long-term stress, and fear for our security. The effects on problem solving include avoiding risks, indecision in situations which are not ‘black and white’, excessive reliance on others’ judgement, and avoiding challenging the status quo. .

d) *Fear of taking risks*

This leads to the avoidance of situations where the outcome is uncertain or could be unpleasant. A major cause is our desire for security. The consequences include setting objectives within easy reach, so that there is no risk of failure, and accepting known solutions in preference to the unusual because their value is certain. A liking for taking risks and over-confidence in being able to avoid unpleasant, consequences are more dangerous blocks.

e) *Need for order*

This is related to avoiding anxiety. It can lead to an inability to cope with the frustration of situations which are not clear cut or where ambiguities exist.

f) *Lack* of *challenge*

This may arise when the problem is routine or the benefits/losses are not significant to us. The result is that either we don't tackle the problem or we take the easiest, quickest route to solution.

4.9.3 Intellectual Blocks

Intellectual blocks exist when we don't have the necessary thinking skills to find a successful solution, or are unable to use them effectively. They include:

a) *Lack of knowledge or skill in the problem solving process*

This is one of the most common blocks. It includes: inadequate skills in analytical and creative thinking; an inflexible strategy, using one approach for every type of problem; the inability to use the various problem solving techniques. They can all lead to ineffective solutions.

b) *Lack of creative thinking*

This is always caused by an inability to use the skills rather than their absence, resulting from the dominance of analytical thinking in our day-to-day lives and a lack of practice.

c) *Inflexible thinking*

This is a difficulty in switching from one type of thinking skill to another, such as from analysis to idea generation or from verbal to visual thinking.

d) *Not being methodical*

This is perhaps the most common block. A step-by-step approach is essential to solving problems effectively.

e) *Lack of knowledge or skill in using the 'Language' of the problem*

If a problem involves a language that we cannot understand or cannot use, such as specialist jargon or statistical analysis, we will not be able to tackle the problem effectively. Similarly, we may use an inappropriate language, such as trying to find an error in accounts by describing the situation verbally rather than analysing it mathematically.

f) *Using inadequate information*

This happens when we do not make sufficient effort to collect the relevant information, or do not understand what information is relevant, where to find it,

or how it relates to the problem. Similarly, using inaccurate information can lead us to the wrong conclusions.

4.9.4 Expressive Blocks

Expressive blocks arise when we are unable to communicate in the way required to produce an effective solution, e.g. not being able to express our ideas effectively to those who have to implement the solution. .

Expressive blocks exist when we do not have the knowledge or skills necessary to communicate or record ideas in the ways required. They are caused by an inability to use 'languages' effectively, such as words, drawings, mathematics, scientific symbols, and so on. They include:

a) *Using the wrong language*

Some problems are more effectively solved or communicated using one language rather than another. For example, we are unlikely to get very far if we record data only verbally when the problem requires quantitative analysis. Similarly, people may find it hard to grasp our meaning if we try to explain our feelings about a situation using mathematics instead of words.

b) *Unfamiliarity with* a *particular application* of a *language*

The most obvious example is the difficulty many people have making a speech, even though they can write their ideas effectively on paper.

Inadequate explanations

These can result from a real lack of information about what you are trying to convey, or from assuming that your audience already has some of the information when, they don't.

c) *A passive management style*

A situation where we are reluctant to or find it difficult to exert influence may prevent us communicating our ideas effectively. This is particularly important when people need to be convinced of the validity of ideas.

d) *A dominant management style*

This is when we exert oppressive control, either deliberately or unconsciously, and can make those we are communicating with automatically reluctant to accept what we say or hostile to our ideas.

4.9.5 Environmental Blocks

Environmental blocks are caused by external obstacles in the social or physical environment, which prevent us from solving a problem effectively, e.g. distractions from the task.

Environmental blocks, which exist when the social or physical environment hinders our problem solving, include:

i) *Management style*

The way in which we are managed can influence both our attitude to problem solving and the freedom we have to create and implement ideas. For example, if

our ideas are dismissed constantly with comments such as 'No, it wouldn't work because ...', or 'No, we've tried it before and it didn't work', we soon give up trying.

ii) *Distractions*

Due to excessive noise and interruptions, these affect some people more than others, but in general they have a detrimental effect on problem solving.

iii) *Physical discomfort*

This can create a distraction as well as resulting in stress or lethargy depending on the circumstances. For example, poorly designed chairs may create a distraction by giving us backache which, in turn, can make us irritable and less interested in any type of work.

iv) *Lack* of *support*

This comes in many forms. For example, we may need specialist information, advice, skills or other resources, or authority to take action. A more pervasive aspect of this block is a lack of encouragement and the necessary organisational structure to support and exploit people's ideas.

v) *Stress*

Stress due to pressure of work and deadlines, affects people differently. For those who are susceptible to stress it can be a powerful block, hindering creative thinking in particular.

vi) *Lack* of *communication*

This has a number of effects, including inability to get the information you require and a lack of encouragement.

vii) *Monotonous work*

This can dull enthusiasm for solving problems and put us onto 'automatic pilot', making us blind to problems when they occur.

viii) *Expectations* of *others*

These can influence both our general performance in problem solving and the objectives we set ourselves. For example, if our peers and superiors are happy with a regular solution to a problem we may feel that it's a waste of time looking for a new; more effective solution. On the other hand, if we are expected to find an innovative solution we are likely to make a greater effort.

4.9.6 Cultural Blocks

Cultural blocks result from our conditioning to accept what is expected or 'normal' in a given situation, e.g. when the work ethic says that we must be serious-minded, but finding an effective solution requires some playful fantasy.

Cultural blocks exist when our problem solving is hindrance by accepting that some things are good or right and are done, while others are bad or wrong and are not done, So that we become bound by custom. They include:

a) *Unquestioning acceptance* of *the status quo*

There is a tendency to conform to established ideas an methods of working and not to question them or express ideas which depart from them. If something is not normal done we tend to look for the reasons why it can't be done or why it wouldn't work, rather that looking for 'the reasons why it should be done or why it could work'.

b) *Dislike* of *change*

The attitude that tradition is preferable to change can arise, from the need for security. If a situation is acceptable as it is, any change, which must involve some uncertainty, is felt to be threatening by some people. However, as we become more and more accustomed to change this block is becoming less common, but there must be reasons for change. Change for change's sake can be dangerous.

c) *Fantasy and humour are not productive*

There is still a widespread belief that fantasy and humour have no place in the serious business of problem solving. Subjective reports from innovators suggest otherwise. Fantasy and humour are connected by one common feature – the unlikely combination of ideas (think about it' next time you hear a good joke – the punch line is always unexpected). Innovative solutions to problems arise in the same way – by making a link between apparently unrelated ideas.

d) *Feelings, intuition and subjective judgements are unreliable'*

There is a strong bias towards reason, logic and quantitative judgements because they can be measured and communicated in accurate terms. Feelings, intuition and subjective judgements, which cannot be measured or communicated as effectively, are seen as unrealiable and are mistrusted.

Even in mathematics, one of the most logical of sciences, intuition is often reported as playing a key role in, problem solving. A good problem solver needs to be able to use both objective, logical methods and subjective, intuitive methods in the search for solutions.

e) *Over-emphasis on competition* or *cooperation*

A strongly competitive environment (for recognition, promotion, and so on) can make people unwilling to listen to the ideas of those with whom they are competing. Similarly, in a strongly cooperative environment we may avoid expressing new ideas because we don't want to stand out from the crowd.

f) *Taboos*

Some actions and ideas are excluded from problem solving because they are regarded as distasteful, or are harmful, or contravene accepted moral codes. For example, in a test of creativity a group of students were given a problem to solve using calculus. They had to follow certain rules and the objective was to see who produced the largest number of different routes to the correct solution. A few students produced a lot more than the others because they chose to break the rules they were told to follow.

Although eventually we may not decide to break a taboo, there is no harm in breaking them in thought. This can often lead to new perspectives on a problem.

We can overcome most of our own blocks permanently by re-learning, and overcome other people's blocks which hinder us by learning ways to sidestep them.

Self Assessment Questions

1) What are the various other barriers to problem solving?

.....

.....

.....

.....

.....

2) What is meant by perceptual blocks to problem solving?

.....

.....

.....

.....

.....

3) Discuss the emotional and Intellectural blocks in problem solving

.....

.....

.....

.....

.....

4) Discuss the expressive and environmental blocks in problem solving

.....

.....

.....

.....

.....

5) What are the cultural blocks that affect problems solving?

.....

.....

.....

.....

.....

Other barriers

Learning styles: Other barriers to problem solving include Learning styles or how persons learn to solve problems. Some people learn primarily visually, others aurally; some learn step-by-step, others employ an all-or-nothing process; some cogitate on a problem introspectively, while others find they work problems best when they can discuss them.

There is also evidence that some thinking styles that affect the ability to solve problems are gender-linked. For instance it has been found that females organise and relate data more efficiently than males.

Cognitive barriers: to mastering problem-solving is another important factor. The primary difficulty is the inability to identify and use concepts and procedures in analogous but novel situations.

The lack of transfer of structure: between problems is a significant cognitive difficulty, not only for inexperienced problem-solvers but also for experts. Successful transfer rests on the ability to recognise analogies, but even when given an analogy, students often fail to see how to employ it.

A lack of transfer skills: is frequently marked by functional fixedness, the perception that a particular object or concept has only one use. Another problem is superficial transference, where persons identify and link words or variables between problems instead of linking deeper, more meaningful structures.

4.10 TEACHING AND LEARNING STRATEGIES THAT ENHANCE PROBLEM-SOLVING SKILLS

There are two types of strategies that can overcome difficulties in problem-solving:

Pedagogical strategies, which are teacher-centered methods, and Methodological strategies, which tend to be learner-centered.

4.10.1 Pedagogical Strategies

Some pedagogical strategies allow the teacher to address the emotional, psychological, and cognitive barriers to problem-solving simultaneously. For example, on the first day of class, the teacher could have open discussion about the nature of the course material, etc., and encourage students to voice their fears and concerns about it. This approach helps create a comfortable learning environment. Class discussion also reinforces success and transfer of learned skills.

One effective strategy is that active involvement is critical in developing problem-solving skills, and thus student learning groups can be used to promote active experimentation with problems.

Other effective strategies include accepting multiple attempts of solutions for an assignment. The persons should be asked to record how the problem was solved etc., and then discuss if there are other methods that could be used to solve the problem.

Different learning styles as well as gender-specific differences in thinking can be addressed by employing a variety of activities and approaches in teaching.

The traditional instructional mode of lecturing and explaining is effective for only one learning style.

One might use graphics to illustrate concepts, provide opportunities for practice in class, ask for the persons interpretations of data, etc. could also be used to address the other learning styles.

The five steps usually contained in many solution strategies is IDEAL.

1) Identify the problem.
2) Define and represent the problem.
3) Explore possible solution strategies.
4) Act on the strategies.
5) Look back and evaluate.

This scheme is beneficial in a large number of disciplines.

4.10.2 Promoting Transfer

Other strategies assist persons in transferring problem solving techniques from one problem to very similar or analogous problems.

For successful transfer to occur, it is essential for persons to identify the central theme that is common to a set of problems so they can readily recognise and apply it in more abstract settings.

Through the conscious use of analogy, persons can explore situations which are similar, transferring structure to the problem at hand.

4.10.3 Dialogue

This can also be useful in promoting transfer by highlighting the differences between the problem-solving techniques used by experts and novices. In order to solve a problem, both experts and novices do follow the same pattern, that is, they read and analyse, plan a strategy, act on that strategy to produce a solution, and then try to verify it.

Encouraging people to talk through the differences between problems that have similar superficial structures but different deep structures decreases the risk of incorrect transfer.

Having students work on numerous problems individually and in groups also facilitates transfer.

Choosing problems which evolve from simple and well-defined to complex and ill-defined will help people to develop transfer skills.

To develop better problem-solvers, persons should be helped to overcome both emotional and cognitive barriers to learning effective problem-solving skills.

By first creating a comfortable environment and helping people to overcome their fears and anxieties related to problem-solving, one lays the necessary foundation for successful learning.

Then using an array of pedagogical and methodological strategies, one can promote in the person the ability to reflect on the problem-solving process itself and provide critical tools for and practice in productive problem-solving.

Self Assessment Questions

1) Discuss the other barriers related to the person that affect the problem solving adversely.

.....

.....

.....

.....

.....

2) What is IDEAL. Elaborate. How do these help in problem solving?

.....

.....

.....

.....

.....

3) Discuss the pedagogical strategiesin problem solving.

.....

.....

.....

.....

.....

4) Explain how promoting transfer and dialogue help in problem solving?

.....

.....

.....

.....

.....

4.11 FUNCTIONAL FIXEDNESS

Functional fixedness discovered by Duncker (1935) refers to the tendency to see objects as having only a single, typical use. A hammer is for pounding nails and other things for instance. We categorise objects based on their functional features as well as their features. Generally the prototypical function dominates the way we think.

Duncker in his experiment led an individual into a room with a table holding several small objects. They included three cardboard boxes filled with candles, tacks and matches, respectively and an ashtray, paper, paper clips, string, pencils, and tinfoil. The individual was instructed to mount the candles at eye level on the wall, ostensibly to prepare the room for a vision experiment. Can you think of a way to put the candles on the wall using these materials?

Duncker found that only 43% of his participants could develop a solution to the problem. He hypothesised that they fixated on the common function of a box, namely, to serve as a container.

To help break their functional fixedness, he repeated the experiment but this time emptied the candles, tacks, and matches on the table, leaving the boxes empty. Under these circumstances, all participants solved the problem by first mounting the boxes on the wall using the tacks, which then served as platforms for the candles.

Here is another example of functional fixedness, called the *coin problem* (Simmel, 1953). Suppose you have eight coins and a balance. One of the coins is a counterfeit coin and therefore lighter than the others. The problem is to find the counterfeit coin by using the balance only twice?

Most people initially think of dividing the coins into two groups of four coins each. One of the groups of four will be lighter and so must contain the counterfeit coin. Then you can take the four coins from that group, and weigh them two against two. Of course, one of the groups of two will be lighter. However, you cannot determine which of the two remaining coins is counterfeit, because you have already used the balance twice.

Before we consider how to approach this problem correctly, let us analyse the previous solution attempt. Why do we initially divide the coins into two groups of four? One reason is that we know that eight things can be evenly divided into two groups of four. One of the functions of the number eight is that it can be so divided.

The fact that 4 + 4 = 8 is a highly available bit of knowledge for us. Because this property of the number eight is so available, it is the first thing we think of. In fact, when people try to solve this problem, they often keep coming back to the four versus four divisions. When the obvious way of using things keeps us from seeing the correct way of using them, then we are functionally fixed.

In Simmel's coin problem, the solution is often very difficult to see. You need to divide the coins in a way that is far from obvious at first. Suppose you divide them into three groups of three, three and two coins. Then weigh three versus three. If they balance, then the counterfeit coin must be in 'the group of two coins. Your second weighing, then, is to take the group of two coins, and weigh one versus one. Alternatively, suppose on your first weighing one group of three coins is lighter: Then on your second weighing, take any two of the three coins and weigh one against the other. If they balance, then the third (unweighed) coin must be the counterfeit one. If they do not balance, then lighter one is counterfeit. This procedure is guaranteed to find the solution. However, it is much more complex and unfamiliar than the wrong procedure.

Thus, finding solutions to problems may require you to overcome functional fixedness. It may only be after you have realised that the obvious ways of tackling a problem do not work that you will be open to a reorganisation of the problem that will allow you to see the solution.

4.12 USING INCOMPLETE OR INCORRECT REPRESENTATIONS

A related difficulty in problem solving has to do with initial interpretation of the problem. If the information is misunderstood, or if the wrong information is provided/ focused upon, the solver is at a disadvantage. This can be illustrated by a problem from Perkins (1981):

"There is a man at home. That man is wearing a mask. There is a man coming a home. What's happening?"

Most of the people start to go wrong in making assumptions about the home in situation. Many equate home with house, although the answer is baseball game. Perkins (1981) argue that assumptions people make in interpreting the problem are a kind of mental set and that this mental set hinders problem solving.

In terms of representation, representing the problem in terms of a person sitting in a house would lead you down the wrong path. It would be a case of using an incorrect representation, that is one that included information not presented in the problem and not correct.

The choice of representation can often make a great difference. Schwartz (1971), studying problems such as this one found that people who constructed charts and flow charts were successful in solving the problems than people who merely wrote down available facts.

Here's another example of a case where representation can make a problem either very easy or very hard. It is called the numbers game and the objective of each player is to choose from the set of digits enough to make an exact total of fifteen from three digits.

Two players are given a sheet of numbers, 1 2 3 4 5 6 7 8 9.

They take turns crossing one of the digits off the list and adding it to their own list.

The first player to have three digits totaling 15 (for example 4, 5, 6; or 1, 6, 8) wins.

If you were to play this game, what would your problem solving strategy be? What if you played first, which digits would you choose? What if you played second and your opponent had first chosen a five?

The first time or two if you play this game, you might find it surprisingly challenging. Now look at the figure below and notice how this problem can be represented alternatively:

6	7	2
1	5	9
8	3	4

Notice that, depicted this way, the difficult numbers game is actually the game of tic tac toe in disguise. Represented this way the game is easy but without this representation the problem is much harder to solve.

Self Assessment Questions

1) What is Functional Fixedness? Explain mental set in problem solving.

.....

.....

.....

.....

.....

2) Present Duncker's experiment.

.....

.....

.....

.....

.....

3) How does coin problem demionstrate functional fixedness?

.....

.....

.....

.....

.....

4) What is meant by incomplete or incorrect represtnations? How do these affect problem solving? Give suitable examples

.....

.....

.....

.....

.....

4.13 LACK OF PROBLEM SPECIFIC KNOWLEDGE OR EXPERTISE

Until now we have been discussing general problem solving abilities with problems that have a puzzle like character. The assumption is that most of these problems are about equally unfamiliar to everyone and that people basically go about solving them in the same way. Other kinds of problems – for example,

those in chess or others killed games; textbook problems in physics, geometry, or electronic; computer programming and problems in diagnoses and management of health problems – seem to be different kind from the puzzles we have been talking about. In particular, experts and novices approach most such problems differently (Chi, Glaser & Farr, 1988).

Familiarity with a domain of knowledge seems to change the way one solves problems within a frame of reference. A good example is to compare the ability to of undergraduate psychology students from their professors in designing experiments.

A classic study of expert novice differences was carried out by de Groot (1965). He examined the thinking process of both chess masters and weaker players considered about the same number of possibilities but somehow chose the best move more easily. Chase and Simon (1973), in a replication study, found that the more expertise a chess player had, the more information he extracted even from brief exposures to chess boards set up to reflect ongoing chess games. That is, when a chess master and chess beginner are both shown a chess board for five seconds, the chess master will remember more about where the pieces were placed, but only if the pieces are configured to depict a chess game.

In problem solving, experts see and represent a problem in their domain at a deeper and more principled level than do novices, who tend to represent information superficially (Chi, Feltovich, & Glaser 1981). For example, when solving physics problems experts tend to organise the problems in terms of physics principles like Newton's first law of motion; novices instead tend to focus on the objects mentioned in the problem, such as an inclined plane or a frictionless surface. Experts tend to spend proportionately more time qualitatively analysing the problem, trying to grasp or understand it; relative to novices who are more likely to plunge in and start looking at solutions. Finally, throughout the process of problem solving, experts are more likely to check for errors in their thinking.

Expertise by itself is not always enough for problem solving other factors like medical status, mental status and other related aspects can also affect problem solving abilities (Goel & Grafman, 2000).

4.14 LET US SUM UP

As discussed in earlier chapters problem solving involves both domain specific and general strategies that people may use and may be attained through various techniques. However, most of us often come across many situations when our attempts at problem solving fail. This is largely because there are numerous factors that are influential impediments to problem solving. Einstellung (or set or mental set) and functional fixedness are classic obstacles to both proper representation and search identified by the gestalt psychologists. Einstellung is the tendency to set the mind into a routine approach to problem solving. Functional fixedness refers to the tendency to see objects as having only a single, typical use. Researchers have also talked about the novice versus expert differences in problem solving.

4.15 UNIT END QUESTIONS

1) What is a mental set? Think of the few problem situations where you think your mental set hampered effective problem solving.
2) Describe some novice expert differences in problem solving.
3) Critically evaluate the concept of functional fixedness.
4) Compare and contrast with the help of examples the concept of Einstellung with the concept of functional fixedness.
5) How does lack of problem specific knowledge or experience affect problem solving?

4.16 SUGGESTED READINGS

Hunt, R. R., & Ellis, H.C. (2006). *Fundamentals of Cognitive Psychology.* New Delhi: Tata McGraw Hill.

Reed, S.K. (2010). *Cognition: Theories and Applications.* London: Cengage.

Solso, R.L. (2006). *Cognitive Psychology.* New Delhi: Pearson Education.

Sternberg, R.J. (2009). *Applied Cognitive Psychology: Perceiving, Learning, and Remembering.* London: Cengage.

References

Gage, N. L. and D. C. Berliner (1992). *Educational Psychology*, 5th ed., Houghton Mifflin Co..

Galotti , K.M. (2008). *Cognitive Psychology In and Out of the Laboratory*. Canada: Nelson Education.

Gick S. and G. Holyoak (1983). "Schema Induction and Analogical Transfer," *Cognitive Psychology* 15: 1-38.

Feldman, R. S. (2008). *Essentials of Understanding Psychology*. New Delhi: Tata McGraw Hill.

Kimura, D. (1992). "The Mind and the Brain," *Scientific American*, September.

Kurfiss J. (1988). *Critical Thinking: Theory, Research, Practice, and Possibilities*, ASHE-ERIC Higher Education Reports #2.

Wason, P. (1982). "Realism and Rationality in the Selection Task," *In Thinking and Reasoning: Psychological Approaches*, J. Evans, ed., Routledge and Kegan Paul.

Woolfolk, A. E. (1993). *Educational Psychology*, 5th ed., Allyn and Bacon.