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THINKING AND PROBLEM SOLVING

Have you ever thought about how you have acquired knowledge about all that you know today? It may instantly come to your mind that your teachers have taught you about this, your parents made you learn all these things, or you read about all these in books. In all these situations you have learnt something to build your knowledge base. Thus the process of knowing or of acquiring knowledge is called cognition. The process of acquiring knowledge is facilitated by cognitive processes such as attention, thinking, remembering, and reasoning. These cognitive processes are controlled and regulated by higher center of the brain, the cerebral cortex. The cognitive processes are very much specific to human beings and are guided by concepts, facts, propositions, rules, and memories. All these cognitive activities are governed by thinking. Hence, in this chapter you will learn about what is thinking, stages of problem solving, stages of creative thinking, and processes involved in making decisions.



OBJECTIVES

After studying this lesson, you will be able to:

- understand the nature of thinking;
- describe various stages of problem solving;
- explain creativity and its role in life; and
- explain the process of decision making.

7.1 THE NATURE OF THINKING

Thinking is perhaps one aspect of our mental activity which continues even when we are asleep. The difference between what is thinking and what is not thinking is just our awareness about the particular thinking process. Hence thinking is a complex mental process which involves manipulation of information. Such information is



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collected through our senses (such as vision, hearing, smelling etc) from the environment, as well as the information which is stored in our memory because of our encounter with many events and situations in the past. Thinking is a **constructive process** in the sense that it helps us to form a new representation of any object or event by transforming available information. It involves a number of mental activities, such as inferring, abstracting, reasoning, imagining, judging, problem solving, and creative thinking. Such activities take place in our mind and can be inferred from our behaviours. Thinking is usually initiated by a problem and goes through a sequence of steps such as judging, abstracting, inferring, reasoning, imagining, and remembering. These steps are often directed towards solution of the problem. The example given below will help you to understand this in a better way.

In order to reach your new school on time suppose you are trying to find out the shortest route from your home to your new school. Your choice will be guided by many factors such as condition of the road, the density of traffic during your school time, safety while walking on the road etc. Finally you take a decision about the best possible shortest route after considering all these factors. Thus, a simple problem like this also requires thinking. The solution to this problem emerges after processing information that is available to us from the environment and our past experience. Thinking relies on a variety of mental structures such as **concepts** and **reasoning**. We will briefly learn about these mental structures.

Concepts: Concepts are one of the key elements of thinking. Concepts represent objects, activities, ideas, or living organisms. They also represent **properties** (such as “sour” or “brave”), **abstractions** (such as “anger” or “fear”), and **relations** (such as “smaller than” or “more intelligent than”). Concepts are mental structures which allow us to **organize knowledge** in systematic ways. We cannot observe them directly, but we can infer them from behaviour.

We as human beings have the capacity to abstract the essential characteristics of objects, events or whatever we perceive. For example, when we see a Potato we categorize it as ‘vegetable’, and when we see a towel we categorize it as ‘cloth’. Whenever we encounter a new stimulus we tend to treat it as a member of a familiar or remembered category and take the same action toward it and give it the same label.

Reasoning: Reasoning is also one of the key aspects of thinking. It is a process that involves inference. Reasoning is used in logical thinking and problem solving. It is goal directed, and the conclusions or judgments are drawn from a set of facts. In reasoning, information from the environment and the stored information in the mind are used following certain rules. There are two types of reasoning: deductive and inductive. In **deductive reasoning** we try to deduce or draw conclusion from a set of initial assertions or premises; where as in **inductive reasoning** we start from available evidence to generate a conclusion about the likelihood of something. Most cases of scientific reasoning are inductive in nature. Scientists and even lay people consider a number of instances and try to determine what general rule covers them all. For

example, the person is a priest, because he is wearing plain cloth, prays and eats simple food.



INTEXT QUESTIONS 7.1

1. What is thinking?

2. What are the different mental components of thinking?

7.2 PROBLEM SOLVING

Problem solving is part and parcel of our daily life. Every day we solve a number of problems ranging from simple to complex. Some problems take little time where as some take much time to solve. We look for alternative solutions if do not get the right kind of resources to solve the problem in hand. In the case of solving any type of problem our thinking becomes directed and focused and we try to use all the resources, both internal (mind) and external (support and help of others) to arrive at the right and appropriate decision. For example if you want to score good marks in an exam, you study hard, take the help of teachers, friends, and parents and finally you score good marks. Thus problem solving is directed thinking focused towards dealing with a specific problem. This thinking has three elements: the **problem**, the **goal**, and the **steps to reach the goal**. There are two methods which are used prominently in problem solving. These are- “**Means-end-analysis**” and “**Algorithms**”. In the case of Means-end-analysis a specific step-by-step procedure is followed for solving certain types of problems. In the case of ‘**heuristics**’ the individual is free to go for any kind of possible rules or ideas to reach the solution. It is also called rule of thumb.

Problem Solving and Mental Set: Sometimes we use a particular strategy/technique to solve a problem but we may or may not succeed in our effort to solve the problem. This creates a set to approach future problems that are encountered by a person. The set continues even if the problem is different. Despite this, we use the same strategy/technique when ever we come across the same problem and again fail to reach the solution. Such phenomenon in problem solving is called mental set. A mental set is a tendency on the part of an individual to respond to a new problem in the same manner that he or she has used earlier to solve a problem. Previous success with a particular rule produces a kind of mental rigidity/fixedness/set, which hinders the process of generating new ideas to solve a new problem. A mental set inhibits or affects the quality of our mental activities. However, in solving our real life problems we often rely on past learning and experience with similar or related problems.





In Activity 1 You may not be able to solve the problem, because of the mental set that one has to keep the lines within the grid of nine dots. By going outside the boundaries, you will succeed.



INTEXT QUESTIONS 7.2

1. Define problem solving. Discuss the two types of problem solving.

2. Discuss the role of mental set in problem solving.

7.3 CREATIVITY AND ITS ROLE IN LIFE

Do you know whatever you see around you, the things which you use for work in everyday life, the transport you use for commuting from one place to another etc are all the products of human thinking? Creativity is a particular kind of thinking which involves reaching out to the solution of a problem in a unique and novel way which was nonexistent earlier. Creativity is the mother of all inventions and discoveries in the world. Unlike routine solutions to the problems, creative solutions are novel, original, and unique, that others have not thought of before. The creative solutions or productions are sudden or spontaneous and are the outcome of a lot of work and preparation already done consciously and unconsciously. The sudden appearance of new ideas is called insight. The creative thinker can be any more such as an artist, musician, writer, scientist or sports person.

Stages of Creative Thinking: Graham Wallas, one of the leading psychologists of early twentieth century stated that there are five stages of creative thinking. These are *Preparation, incubation, illumination, evaluation, and revision*. We briefly discuss these five steps of creative thinking in the subsequent section.

1. **Preparation:** This is the first stage in which the thinker formulates the problem and collects facts and materials necessary for the solution. He/she finds that the problem cannot be solved after days, weeks, or months of concentrated effort. Unable to solve the problem the thinker deliberately or involuntarily turns away from the problem, initiating stage two i.e. incubation. At this stage of problem solving, it is important to overcome negative consequences of mental set and any kind of mental set or bias.
2. **Incubation:** This is a stage of no solution and involves a number of emotional and cognitive complexities. However, the negative effects of mental set, functional fixedness, and other ideas that interfere with the solution tend to fade. Perhaps, fatigue and too much of concern with the problem also mount up during this



period. Further, the unconscious thought processes involved in creative thinking are at work during this stage.

- 3. Illumination:** In this stage a potential solution to the problem seems to be realized as if from nowhere. It is about having the insight about the possible solution. Illumination occurs with its “aha” experience when a sudden idea or solution appears into consciousness.
- 4. Evaluation:** In this stage the obtained solution is verified or tested to see if it works. Frequently, the insight may turn out to be unsatisfactory, and may need some modification in the strategy of approaching the problem.
- 5. Revision:** Revision is required in the case a solution which is not satisfactory.

It has been found that creative people are generally talented (e.g. artists, musicians, mathematicians etc.), and have specific abilities. Creative people have been found to have some specific personality characteristics such as they are independent in their judgments, self-assertive, dominant, impulsive, prefer complexity, etc.



INTEXT QUESTIONS 7.3

1. What is creativity? What are the possible characteristics of a creative person?

2. Discuss in brief the stages of creative thinking.

7.4 DECISION MAKING

We make several decisions in our day-to-day life, such as decisions pertaining to our personal life, social life, education, career etc. When we take a decision which gives us success where as our faulty decisions do not yield the desired result. Decision making is also related with another term ‘judgment’. Let us discuss these two aspects of thinking separately.

Decision Making: Decision- making is a kind of problem solving in which we select an appropriate alternative out of a number of alternatives available to us. For example, you have the option to choose between History and Psychology courses in your eleventh grade. You attend classes in both the subjects to decide upon the course to choose. Suppose you find that the contents of psychology are relevant, interesting and new and the teacher is intelligent, friendly, knowledgeable, and having good verbal ability; all qualities that you value in a teacher. So, on the basis of judgment about the subject and qualities of the teacher you decide to choose the psychology course.



Judgment: Judgment is a process of forming opinions, arriving at conclusions, and making critical evaluations about objects, events and people on the basis of available information. The process of judgment is often automatic and spontaneous. It does not require any prompting. Some judgmental choices are habitual like need for going for a morning walk before getting ready. Judgments involve evaluating information about the world (objects, events, persons, etc.), while decisions require making choices.



INTEXT QUESTIONS 7.4

1. What is the difference between decision making and judgment? Discuss in brief.



WHAT YOU HAVE LEARNT

- The process of knowing or acquiring knowledge is called cognition. The process of acquiring knowledge is facilitated by processes such as attention, thinking, remembering, and reasoning. These cognitive processes are controlled and regulated by higher center of the brain, the cerebral cortex.
- Thinking is a complex mental process which involves manipulation of information. Such information is collect through our senses (such as vision, hearing, smelling etc) from the environment, or is based on information which is stored in our memory because of our encounter with many events and situations in the past.
- Thinking is a constructive process in the sense that it helps us to form a new representation of any object or event by transforming available information. It involves a number of mental activities, such as inferring, abstracting, reasoning, imagining, judging, problem solving, and creative thinking.
- Concepts are one of the key elements of thinking. Concepts are mental structures which allow us to organize knowledge in systematic ways. We cannot observe them directly, but we can infer them from behaviour.
- Reasoning is another key aspects of thinking. It is a process that involves inference. Reasoning is used in logical thinking and problem solving. It is goal directed, and the conclusions or judgments are drawn from a set of facts.
- There are two types of reasoning: deductive and inductive. In *deductive reasoning* we try to deduce or draw conclusion from a set of initial assertions or premises; where as in *inductive reasoning* we start from available evidence to generate a conclusion about the likelihood of something.



- Problem solving is directed thinking focused towards dealing with a specific problem. It has three elements: the problem, the goal, and the steps to reach the goal.
- A mental set is a tendency on the part of an individual to respond to a new problem in the same manner that he or she has used earlier to solve a problem. Previous success with a particular rule produces a kind of mental rigidity/ fixedness/set, which hinders the process of generating new ideas to solve a new problem.
- Creativity is a particular kind of thinking which involves reaching out to the solution of a problem in a unique and novel way which was nonexistent earlier. Creativity is the mother of all inventions and discoveries in the world. Creative solutions are novel, original, and unique that others have not thought of before.
- There are five stages of creative thinking. These are *Preparation, incubation, illumination, evaluation, and revision*.
- Decision- making is a kind of problem solving in which we select an appropriate alternative out of a number of alternatives available to us. Judgment is a process of forming opinions, arriving at conclusion, and making critical evaluations about objects, events and people on the basis of available information.



TERMINAL QUESTIONS

1. Give any 2 examples each for (a) Concepts (b) Reasoning (c) Problem solving.
2. Identify any 5 creative persons who are famous in India.
3. Explain the concept of decision-making and its importance in daily life.



ANSWERS TO INTEXT QUESTIONS

7.1

1. Complex mental process involving manipulation of information.
2. Concepts and reasoning

7.2

1. Directed thinking focussed towards dealing with a specific problem Means-and - analysis and Algorithms
2. Mental set inhibits the quality of mental activities.

7.3

1. Thinking which involves reaching out to solutions in a unique and novel way

**Notes**

which was nonexistent earlier. Creative persons can be self-assessive, dominant, impulsive, may prefer complexity etc.

2. Preparation, incubation, illumination, evaluation revision.

7.4

1. Decision making is a kind of problem solving. Judgement is a process of forming opinions, arriving at conclusions and making critical evaluations.

Hints for Terminal Questions

1. Refer to section 7.1 & 7.2
2. Refer to section 7.3
3. Refer to section 7.4