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chapter 1

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CHAPTER-I

INTRODUCTION

1.1 Introduction

Thinking is one of the human qualities and that makes human being a unique creature in the world of animal kingdom. Human beings are creative in nature. Although people have been creative all through history, they seldom realized it. For instance, for many centuries Egyptian civilization continued to lead in the arts and in technology, yet their ideology stressed extreme faithfulness to tradition. In medieval Europe many saints and philosophers broke new ground in lifestyle and in ways of thinking, yet they tended to attribute their inventions to having rediscovered God's will, rather than to their own ingenuity. According to traditional Christian thought, only God is creative; men are created but cannot create anything.

Thinking is the ultimate human resource. The quality of our future will depend entirely on the quality of our thinking. This applies on a personal to a professional level, as well as on community level to the global level. In a rapidly changing world very often we find that our thinking is inadequate to meet the demands and challenges put upon it. With the advancement of Science and Technology, the world we live in becomes very narrow. Uses of internet and communication devices have broken all the boundaries and geographical limitations. With the rapid development of multimedia, access to information and communication has become very easy. All these and many more contributions by human beings make us feel proud of being human on this universe.

Teaching for creative and critical thinking is the need of the day. Indian society badly needs creative and critical thinkers and teachers who can begin early to help youngsters to think rationally, solve problem in original and innovative ways. Instead of relying on single textbook teacher should use reference books. Learning material should be practised in an environment that encourages creativity and critical thinking in to the children. Piaget's stages of cognitive development have made it clear that younger children cannot comprehend and use abstract subjects. So at these early stages while encouraging children to be innovative, teacher must break the content to suit to the level of the learner's mental ability. Teacher must provide children experiences in deriving many and different responses to a question and solutions to a problem. As for example, select a word 'book' and ask them to think of as many uses as possible for it. List them on board and then ask the children for many more uses. Thus, you as teacher are fostering divergent thinking and not just expecting single correct answer. One of the most important aspects of creative and critical thinking is the ability to tolerate ambiguity. Fear of failure, fear of the unknown makes people almost desperately desire some answer, suitable or not. Teacher should directly teach pupils that it is better to pause, to ponder, to think of alternatives and to search for it.

1.2 Concept and nature of thinking

Bruner (1957) defined thinking is a process which helps us to go beyond the information given and it is a complex and high level skill that fills up gaps in the evidence. Newell (1972) defined thinking as a process of searching through a problem space. Baron (1994) reported thinking as some types of mental processing that we do when we are in doubt.

Thinking is the most valuable human asset. The inventor of the term "lateral thinking", Edward De Bono (1994), defines thinking as a skill like any other skill such as communication, swimming or driving that can be improved through practice and attention. There are techniques through which we can expand our ways of thinking that lead to better problem solving and ultimately more effective thinking irrespective of the context. De Bono claims that every one can learn to think in a better way by taking time to master the techniques, exercises and principles of thinking.

There is no agreed and fixed definition of thinking. Authors of books on thinking and psychologists have attempted to define thinking in various ways. This is partly reflected through the views presented by Mc Cord (1965) as he notes that thinking covers a wide spectrum of activities that ranges from the way of raising the quality of specific thinking skills and their application in practical situations to the fostering of higher order thinking and reflection that aims at developing intelligence in people who have for reasons been held back in early childhood.

Thus, thinking is a mental process that analyses and synthesizes phenomena; that further helps in the process of formulating of a problem; that aims at solving a problem or helps in the process of solving a problem. Thinking is a mental process that facilitates us in the process of decision making in order to fulfill a desire, searches for the meaning of the word and generates ideas or helps us in the process of generating ideas.

1.2.1 Different forms of thinking

The term 'thinking' is not a simple entity. It is complex in nature and so scholars in the area of thinking have identified various types of thinking. The different concepts under the umbrella of different forms of thinking are:

Concrete thinking: It is the simplest form of thinking. It refers to the interpretation of sensation according to one's experiences. It is carried out on the perception of actual or concrete objects.

Abstract thinking: It is abstract thinking where one makes use of concepts, generalized ideas and language. It is superior to concrete thinking.

Critical thinking: It is the process of evaluating statements, events, arguments and experiences. It is assessing the accuracy, authenticity and validity of data. It is the judging of statements based on accepted criteria. It assesses the worth and validity of something existent. It involves precise, persistent and objective analyses.

Creative thinking: This type of thinking is associated with one's ability to create or construct something new, novel and unusual. Mayer (2002) defined creativity as a special form of thinking that involves putting different elements together in order to form a coherent functional whole, which is, reorganizing elements into a new pattern or structure.

Reflective thinking: This is higher form of thinking. It aims at solving complex problems. It requires reorganization of all the relevant experiences and finding new ways of reacting. This is an insightful approach to thinking rather than trial and error. It takes all the relevant facts arranged in a logical order to arrive at a solution.

Associative thinking: This type of thinking is associated with day dreaming, fantasy, delusions, free flowing uncontrolled activities.

Convergent thinking: This type of thinking is cognitive processing of information around a common point and attempt to bring thoughts from different directions into unity or common conclusion.

Divergent thinking: This type of thinking starts from a common point and moves outward into a variety of perspectives. When fostering divergent thinking, teachers use the content as a vehicle to prompt diverse or unique thinking among students rather than arriving at a common view.

Inductive thinking: This is the process of reasoning from parts to the whole, from examples to generalizations.

Deductive thinking: This type of thinking includes reasoning from the whole to its parts, from generalizations to underlying concepts or examples.

The different perspectives that have been adopted to understand, discuss or investigate the dimensions of thinking indicate that we are confronted with a highly complex phenomenon. This is partly reflected by the diversity of the definitions. It is very difficult for researchers and scholars to define the terms 'critical thinking' and 'creative thinking' because of its complex nature. Hence, for the purpose of the investigation, it is obligatory to define these terms for precise understanding and conceptual clarity. These terms are explained in the explanation of terms in order to make the meaning of these terms that facilitated the present study.

1.2.2 Creative thinking

The creativity was a very minor concern of Psychology until fifth decade of twentieth century. In 1950, when J. P. Guilford became president of the American Psychological Association, in his inaugural speech he stressed the importance of studying creativity in addition to intelligence. Guilford's involvement with the subject came as a result of funding from the Department of Defense. During World War II the Air Force found that intelligence tests were not enough in selecting efficient pilots, those who could respond innovatively in emergent critical situations. Thus, the need of warfare spurred Guilford's research in originality and flexibility, which in turn stimulated decades of study in creativity.

There are many interpretation of the concept of creativity. The concept has been studied from Philosophical, Sociological, Neurobiological and Psychological perspectives and all of them explained the term in its own manner. As a Psychological construct, creativity has proved to be difficult to be understood using single definition. There is no universal accepted definition of creativity. Various definitions emphasizes creativity as a personal ability of creating in novel and original way, where as, other stress on how creative ideas and solutions are arrived at that is the product aspects.

Creative thinking is an ability to create unusual solutions to given problem in unusual ways. It is an ability of producing a large number of ideas on an issue, including even some eccentric ones. It further includes flexibility and originality regarding one's thought processes. It is visualized as a multivariate phenomenon. This is partly reflected by some of the definition of creativity given by different authors. According to Thurston (1955) "An act is creative if the thinker reaches to solution in a sudden closure which necessarily implies some novelty to him".

Torrence (1955) defined it as a process of becoming sensitive to problems, finding gaps in knowledge, identifying difficulties, searching for solutions, making guesses or formulating hypothesis, testing, and communicating the results.

Passi (1973) defined creativity as a multi dimensional attribute distributed among people and includes chiefly the factors of seeing problem, fluency, flexibility, originality and persistency.

1.2.2.1 Importance of creative thinking

Creativity and innovation have been a component of individual and social behavior since time immemorial. Form the very first attempts by people to organize themselves into more effective social groupings, human creativity has played a critical role in the development of society. Human history is a journey punctuated by an almost uncountable series of creative leaps. The chief list may include

- The invention of the fire
- The invention of wheel
- The cultivation of crops
- The use of tools
- Language
- Printing
- Space travel
- Technology

If we talk of any aspect of human activity we can trace a long line of development that includes the full range of creative human behavior and ingenuity to solve problems and make developments.

Human beings are not the biggest animal. We are neither the strongest nor the fastest. We are not the sharpest in sight or smell. It is really amazing how we survived and developed against the violent creature of nature. We survived and prospered because of our brain. The unique difference between the human being and animal being is the ability to think and to act. In the absence of our ability to think creatively we would have remained the same as we were in the beginning of our existence. Our ability to innovate has made us different from any other beings. It is creativity that decides our success and failure in any situation. In this age of competitive world it is therefore essential for any individual to exercise ones' own ability to think creatively. The art of creative thinking is concerned with exploring novel ways of thinking and deciding. It is in fact, a way of exploring ourselves and celebrating our uniqueness in this universe. As Langrehr (2001) reported that our brain is under utilized. We certainly need to use our brain if we wish to make the best out of ourselves. It is not necessary that a creative action should always lead to a great discovery. At times a creative action may lead to nothing other than a new insight or the liberation of a new thought. But if we keep practicing this thinking, it would add more value and meaning to ourselves. It may lead to improve our business or better job satisfaction.

1.2.2.2 General characteristics of creative thinkers

Calvin Taylor (1961) has identified some of the characteristics of creative individual:

- Creative thinkers have good memory.
- They tend to have high degree of sensitivity to problems.
- Their level of curiosity is higher compared to ordinary persons.
- They like to manipulate ideas.
- They have a high achievement need that is linked with intellectual persistence.

- They seek challenges, prefer the complex and can tolerate uncertainty.
- The creative person has an intense commitment to his work.
- The creative person tends to be independent.
- They are also inclined to take risk, adventurous, and extrovert.
- Creative individuals are resourceful.

1.2.2.3 Characteristics of Creative Students

- They are interested in creating and exploring possibilities
- Like to investigate and discover
- They enjoys experiments
- They enjoys finding alternatives
- Enjoys simulations in their learning practices
- Likes brainstorming and divergent thinking
- Value trial and approach

1.2.2.4 Characteristics of Creative Teachers

- Focus on ideas, concepts and theories
- Expects their students to analyze and evaluate
- Posses and follow logic of reasoning
- Develop and prove theories easily
- Consistent and reliable
- They follow rules and procedures
- Challenges students intellectually
- Wants students to be curious about 'WHY'
- Encourage students to learn by reading

1.2.3 Critical thinking

The term critical thinking is derived from ancient Greek. The word 'critical' derived etymologically from two Greek roots "kriticos" meaning discerning judgment and "kriterian" meaning standards. Thus, the word critical implies development of "discerning judgment based on standard'. In Webster's New Word Dictionary the relevant entry reads as "characterized by careful analysis and judgment" and is followed by the gloss: "critical- in its strict sense, implies an attempt at objective judgment so as to determine both merits and demerits. For example, those who think critically, typically engage in intellectual practices of the following sort: monitoring, reviewing and assessing goals and purposes; the way issues and the problems are formulated; the information, data or evidence; the quality of reasoning presented or developed, basic concepts or ideas inherent in thinking, assumption made, implications and consequences that may or may not follow. Those who think critically characteristically strive for such intellectual ends as clarity, precision, accuracy, depth, breadth and logicalness.

Thus, critical thinking is thinking more deeply. It involves reasoning logically and analyzing, comparing, examining and questioning information to attain several possible answers rather than focusing on finding just the correct one.

Robert Ennis (1985) defined critical thinking as thinking that is concerned with deciding what to believe or do. This definition allows flexibility and diversity of application, including decision-making, problem-solving, meta cognition, value judgment and higher levels of reasoning of Blooms' taxonomy.

Critical thinking means opening one's mind. There are no limitations to one's thinking processes. It means finding out every possible thing about a subject or thing.

Critical thinking helps to deal with complex ideas in the simplest way. It is not accepting what someone says as gospel truth, but analyzing, criticizing, questioning, synthesizing that information to determine if is reasonable for them. It also involves discussion which takes time. It can not be rushed. It involves asking questions which foster more questions. A simple yes/no answer is not sufficient in critical thinking. One must scrutinize why the answer to a question is correct. The true answer must always be explained further and thought through by analyzing and searching continuously.

Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do. This definition allows flexibility and diversity of application; it can include decision making, problem solving, meta-cognition (thinking about thinking), value judgments and higher levels of thinking of Bloom's taxonomy, which may be arranged in order from the simplest to the most complex: to recall, understanding, application, evaluation, analysis and synthesis.

1.2.3.1 Importance of critical thinking

Education, understood in its real essence, is not merely imparting information to the learner but to help the learner acquire and integrate knowledge. Knowledge as it is viewed as a distinctive construction by the learner, something that issues out of a rational use of mental processes. In this line of thought schools can be viewed as a workplace that facilitates the students for independent thinking and rational being. In the age of information technology mere acquisition of knowledge will not be sufficient. Rather education should concern itself as to how to use the knowledge in new and innovative way for the welfare of the society. Critical thinking is the process by which acquired knowledge is applied to new problems or situations in order to

devise new solutions. By applying knowledge to solve new problems, higher order thinking takes place, and often creative thinking is integrated into the process. Creative thinking implies thinking beyond traditional / standard ways of thinking and becoming limitless in creating solutions. By using critical and creative thinking, one is more flexible in accepting new knowledge because of the opportunity to "bounce things" around in one's mind. The use of Socratic dialogue and questioning, as well as writing, are essential tools in the implementation of both critical and creative thinking processes. Critical thinking means to become a questioner. It is an ability to question and express one's ideas and views with a rational attitude. It enables one to question the experience or information with an open mind and without fear. It is opening one's own mind to the reality as it presents itself to one's mind.

Critical thinking is the ability to process information and use that information to solve problems. To take what one has learned and lead to new ideas, thoughts- to discover a new concept, open other doors by being able to question. Using these new ideas to write, express our thoughts, being able to interpret someone else's writing, wanting to read and find out more about a subject, to be able to come up with one's own way of thinking without someone else to direct. Being able to express without fear of failure or being wrong. Critical thinking is a process which allows one to question the validity as well as the reliability of understanding of information obtained. It enables one to establish a point of view upon which to analyze information received. It also encourages one to develop and utilize one's own thought process in any given situation. It is a process in which the brain begins to encourage one to question, comprehend and digest a situation, thought, or idea. Critical thinking is a skill to be learned, developed, and practised. After practicing critical thinking, it becomes more

automatic and natural. Critical thinking can be fostered through writing, discussing and constructive arguing.

1.2.3.2 General characteristics of critical thinkers

- They ask pertinent questions.
- They generally assess statements and arguments.
- When he/she lacks understanding and information they admit openly.
- Have a sense of curiosity and are interested in finding new solutions.
- They are able to clearly define a set of criteria for analyzing ideas.
- They are willing to examine beliefs, assumptions, opinion and weigh the evidences.
- They listen carefully to others and are able to give feedback.
- They see critical thinking as a lifelong process of self-assessment.
- They suspend judgment until all facts have been gathered and considered.
- They look for evidence to support assumptions and beliefs.
- They are able to rectify opinions when supportive facts are found.
- They are able to discriminate fact, opinions, beliefs and prejudices.
- They are always looking for the proof.
- They examine problems closely and formulate it clearly.
- They are able to reject information that is incorrect or irrelevant.

1.2.3.3 Characteristics of Students with critical thinking

- They like to gather much information
- They values analysis
- Likes to gather and weigh the evidences

- Likes to read and research
- Likes to explain and debate
- Likes to question ideas, authorities and sources of information
- Like to take notes and records

1.2.3.4 Characteristics of Teachers with critical thinking

- Emphasize on investigation and exploration of possibilities
- Plays role of guide and facilitator
- Plays many varied and unusual activities
- Challenges students to move beyond the given information or knowledge
- Encourage student to think independently
- Interested in futuristic and discovery learning
- Promotes original creations
- Wants students to think for themselves

1.2.4 Difference between creative and critical thinking

Critical thinking	**Creative thinking**
Analytical	generative
Convergent	divergent
Vertical	lateral
Probability	possibility
Judgment	suspended judgment
Focused	diffused

• Logical	independent
• Objective	subjective
• Reasoning	risk taking
• Rational	investigative
• Studious	adventurous
• The answer	alternative answer
• Left brain	right brain
• Linear	associative
• Reasoning	novelty
• Yes but	yes and

1.3 Obstacles in the way of developing creative and critical thinking

There are several unsatisfactory conditions, trends or blocks to creativity. Some of these conditions are unique to the individual while others are related to school environment. Adams (1974) noticed following types of block to personal creativity;

- Fear of taking a risk

  Children in schools have constantly been rewarded for the right answer. To propose something other than the correct one may lead to disapproval and ridicule of others. New ideas are always risky. As long as the child fears taking a risk he cannot be creative.

- No appetite for chaos

Some people are unable to tolerate ambiguity. They cannot endure vague and ill filling ideas. They must have everything in a proper place. But creative thinking presupposes a tolerance for ambiguity.

- Quick judging

Judging is basic to creativity. But some people judge early in the process of solving a problem. As a result of this, many fragile ideas that could possibly lead to other ideas are lost.

- Lack of imagination

Creativity requires the manipulation and recombination of ideas based on imagination. Lack of imagination hinders creativity.

Olson and Ames (1972) also noted five major obstacles that stands in the way of developing creative and critical thinking, namely (i) use of single textbook, (ii) halo effect being attached to the printed world, (iii) the desire on the part of school administration and teachers to avoid controversial subjects, (iv) emphasis on conformity and (v) emotional involvement and prejudices.

Apart from these factors there may be many other factors or conditions which are unique to the individuals or others in the present day school system.

1.4 Development of thinking through various methods

Our system of schooling provides many opportunities to a teacher to create an environment where learning takes place. Professionals in the area of teaching have developed various techniques and methods in order to promote ability of thinking

through learning various school subjects. Teachers, teacher educators, researchers are also inventing various techniques and strategies of teaching in order to facilitate various aspects of thinking in the minds of the young students. Some of these methods of teaching are very popularly and practised in the process of teaching and researches are discussed as under:

(I) Brain-storming:

It is a problem solving technique most commonly used in the classroom. Obsorn developed this technique following the principle of deferred judgment because he believed that judgment and imagination can't work together. It can be used individually or in a group. In a group of about 12 which include one leader, one associate, five core members and five other members. Similar procedure can be utilized when we take a whole class as a group as per the need. The teacher can act as a leader who conducts the session, explains the rules of the matter at hand, and control the behavior of the group members. One of the students can act as an associate and record the ideas produced during the session. Those who are not included in the group, act as observers. The members of the group are kept changing so that everyone in the class gets an opportunity to participate in the brain-storming session.

Usually, such session can be conducted in the morning hours when the mind is fresh. There is no fixed time limit for the session. It may continue for forty to sixty minutes but usually fatigue sets early and the session ends in about 40-45 minutes. However, the session is stopped as soon as the group is tired or dried of ideas.

The teacher, as a leader, creates suitable conditions for free thinking in the class. He also has to purposefully encourage the production of ideas in the participant. As a matter of fact, the brain-storming procedure itself has inbuilt mechanism to create an

environment that is conducive for development of focused thinking. Effective use of brain-storming method helps us in creating an environment were constructive learning takes place.

Some of the necessary steps of problem solving session using brain-storming technique are discussed here:

1. Sensing the problem:

   The group has to identify a problem for brain-storming. Any confusing situation, doubt or gap etc. about which the group is concerned, can serve as a problem. If the group is not in a position to identify a problem, the teacher should point it out to them. In the beginning, the problem would be hazy, unclear and too broad. At the end of detailed discussion, this should be made clear, familiar and specific to the group.

2. Fact finding:

   After the problem is identified or selected, necessary information and relevant facts are required to be collected to define the problem for brain-storming session. At the beginning, a lot of information is collected from all the possible sources of information i.e. books, references, journal and so on. Then the problem is broken down in to specific sub-problems, relevant facts are selected, a framework for problem is built and the problem is redefined in specific, familiar and clear terms.

3. Ideation:

   Actual brain-storming is done at this stage and a large number of ideas are produced. To facilitate generation of ideas, the following ground rules of the session is to be established by the teacher:

Criticism is ruled out: the group is given to understand that all forms of criticism, i.e. laughter, comments, ridicule, gestures, etc, are not allowed in the session. They have to continue thinking. No evaluation of ideas is permitted at this stage.

Freewheeling is welcome: the group is told that wilder the ideas, the better it is. The teacher rather insist for the most wild and unusual ideas.

Quantity is wanted: it is believed that quantity breed quality because best ideas come at the later stage of thinking. Therefore, the teacher must insist for maximum number of ideas and variety in thinking.

Combination and improvement of ideas sought: it is also encouraged by the teacher to use the ideas of others to produce new ideas as well as to combine different ideas into newer ideas.

The ideation continues till all the ideas are put forth, accepted and noted without exception. This list of ideas is then circulated to all the members of the group. They are advised to add to the list any new idea they could think of till the time of evaluation of these ideas.

4. Evaluation of ideas:

Out of the plenty of ideas, the selection of the best ideas is done at this stage on the basis of variety of criteria such as time, cost, availability, safety, practicability, testing, effectiveness, economy like-dislike, usefulness etc. The group itself decides the criteria for evaluation of ideas produced by them. Best solutions thus selected are considered for implementation.

5. Planning and implementation:

   It is a challenge for a group to make promising ideas acceptable as solution. In classroom situation, this stage normally is not involved unless the problem demands implementation of ideas as a solution.

This stepwise procedure is to be followed while conducting the brain-storming session. This technique can be used in teaching of any school subject, especially, when the content demands debate, discussion and dialogue on variety of ideas.

(II) Synectics:

The word 'Synectics' is derived from Greek means joining together of two different and apparently irrelevant elements. Gordon (1960) is the originator of this method. 'Synectics' theory applies to the integration of diverse individuals into problem solving groups. 'Synectics' defines creativity process as "the mental activity in problem solving in order to arrive at solutions of fundamental novelty." According to Gordon, creativity can be enhanced by a series of group exercises. These exercises are designed to help individual in understanding the process of creativity more completely and to use new metaphors and analogies to generate new alternatives. He further stated that creativity in Arts, Sciences and Engineering were similar and were characterized by the same fundamental intellectual processes. The process by with an individual create was directly analogous to the way a group create.

There are four famous analogies in synectics.

1. Fantasy analogies:

   In this, all the members of the group are told to imagine freely as if they are in their day-dreaming. It is desirable to find out the solution of the problem with

the help of imagination in an irrational way. Soaring imagination is found in "if I were....." type of essay writing. The same is possible in different subjects.

For example,

- What will happen if the temperature of the earth increases gradually?
- What would you suggest to control voice pollution?
- What will happen with the city if population is doubling in every ten years?

2. Direct analogies:

   It is a simple comparison of two subjects or concepts. The comparison does not have to be identical in all respects. Its function is simply to transpose the conditions of the real topic of problem situation to another situation in order to present a new view of an idea or problem. This involves identification with a person, plant, animal or non-living thing.

   - How can one remove the heavy furniture from the classroom?
   - How to clean or paint the ceiling?

3. Personal analogies:

   Personal analogy requires loss of self as one transports oneself into another space or object. The greater the conceptual distance created by loss of self, the more likely it is that the analogy is new. The emphasis in personal analogy is on empathetic involvement. Students must feel that they have become part of the physical element of the problem. The identification may be with a person, plant, animal or non-living things. Gordon believes that the usefulness of analogies is directly proportional to the distance created. The greater the

distance, the more likely the student is to come up with new ideas. For example,

- Imagine that you are a tree. Write down your emotions and feeling?
- Imagine that you are a student. Write down hour expectations from your teachers?

4. Symbolic analogies:

   In this, generally a two word description of an object, in which the words seem to be opposite or to contradict each other. According to Gordon, this activity provides the broadest insight into a new subject. They reflect the student's ability to incorporate two frames of reference with respect to a single object. For example, the title of a book "Gandhiji's demise" can be entitled as "lover of peace", "Mortality of the God", "the murderer gun" etc.

   In this way synectics is based on two different mental processes:

   (1) The process of visualizing the unfamiliar things in familiar ways and

   (2) The process of visualizing the familiar words in an unfamiliar ways.

   Both these processes help students to make new, unfamiliar ideas more meaningful and to see old problems, ideas or products in a new, more creative light respectively.

(III) Socratic Questioning

It is helpful to recognize that there are identifiable categories of questions for the adapt Socratic questioner to dip into questions of clarification, questions that probe clarification, assumptions, reasons, evidence, viewpoints or perspectives, implications and consequences, and questions about the question itself. Socratic questions can

come from the teacher or from the students. That can be used in a large group discussion, in small group discussion, one to one or even with oneself. Here are some of the examples of generic questions in each of these categories:

Questions of clarification

- What is your main point?
- What do you mean by (concept word may be given)?
- Could you put that another way?
- What do you think is the main issue here?
- How does this relate to our problem/ issue?
- Could you give me an example?
- Could you explain it further?
- Would you say more about that?
- Why do you say so?

Questions that probe assumptions

- What are you assuming?
- What are they assuming?
- What could we assume instead?
- You seem to be assuming…….. Do I understand correctly?
- You seem to be assuming …….How would you justify taking this for granted?
- Is it always the case? Why do you think the assumption holds here?

Questions that probe reasons and evidence

- What would be an example?
- What are your reasons for saying that?

- What other information do we need to know?
- Could you explain your reasons to us?
- Are those reasons adequate?
- Is there reason to doubt that evidence?
- Who is in a position to know if that is the case?
- How do you know?
- Why did you say that?
- Why do you think that is true or false?
- What led you to that belief?
- Do you have any evidence for that?
- What difference does that make?

Questions about view points or perspectives

- You seem to be approaching this issue form this perspective. Why have you chosen this rather than that perspective?
- How would other group of people respond? Why? What would influence them?
- How could you answer the objection that they make?
- Can anyone see this another way?
- What would someone who disagrees say?
- What is an alternative?
- How are these ideas alike? Different?

Questions that probe implications and consequences

- What are you implying by that?

- When you say that, are you implying this?
- But if that happen, what else would also happen as a result? Why?
- What effect would that have?
- Would that necessarily happen or only probably happen?
- What is an alternative?
- If this and this are the case, than what else must also be true?

Questions about the question itself

- How can we find out?
- How could someone settle this question?
- Is the question clear? Do we understand it?
- Is this question easy or hard to answer? Why?
- Would you put the question differently?
- Does this question ask us to evaluate something?
- Do we all agree that this is the question?
- What makes anyone to disagree with this?
- What does this question assume?
- Why is this question important?
- What consequent questions will follow if we ignore this question?
- To answer this question, what questions would we have to answer first?

1.5 Thinking tools and thinking strategies to promote creative and critical thinking

Thinking tools and thinking strategies that can promote creative and critical thinking skills. These thinking tools and strategies are utilized for the present investigation.

Thinking tools:

Edward De bono (1994) had designed some tools in order to facilitate thinking in general which are useful to enhance creative thinking. Some of these major tools are:

P.M.I. (Plus Minus Interesting)

C.A.F. (Considering All Factors)

O.P.V. (Other People's View)

C & S (Consequences and Sequel)

S & D (Similarities and Differences)

NSEW (North South East West)

A.G.O. (Aims Goals Objectives)

A.P.C. (Alternatives Possibilities Choices)

Thinking strategies:

Paul (2004) had identified and listed as many as 35 thinking strategies in order to facilitate the process of thinking which are given as under. They are classified under affective and cognitive categories:

Affective strategies:

1. Thinking independently
2. Developing insight into egocentricity or sociocentricity
3. Exercising fair-mindedness

4. Exploring thoughts underlying feelings and feelings underlying thoughts
5. Developing intellectual humility and suspending judgment
6. Developing intellectual courage
7. Developing intellectual 'good faith' or integrity
8. Developing intellectual perseverance
9. Developing confidence in reason

Cognitive strategies

10. Refining generalizations and avoiding oversimplifications
11. Comparing analogous situations: transferring insights to new contexts
12. Developing one's perspectives: creating or exploring beliefs, arguments, or theories
13. Clarifying issues, conclusions, or beliefs
14. Clarifying and analyzing the meaning of words or phrases
15. Developing criteria for evaluation: clarifying values and standards
16. Evaluating the credibility of sources of information
17. Questioning deeply: raising and pursuing root or significant questions
18. Analyzing or evaluating arguments, interpretations, beliefs, or theories
19. Generating or assessing solutions
20. Analyzing or evaluating actions or policies
21. Reading critically: clarifying or critiquing texts
22. Listening critically: the art of silent dialogue
23. Making interdisciplinary connections
24. Practicing Socratic discussion: clarifying and questioning beliefs, theories, or perspectives
25. Reasoning dialogically: comparing perspectives, interpretations, or theories

26. Reasoning dialectically: evaluating perspectives, interpretations, or theories
27. Comparing and contrasting ideals with actual practice
28. Thinking precisely about thinking: using critical vocabulary
29. Noting significant similarities and differences
30. Examining or evaluating assumptions
31. Distinguishing relevant from irrelevant facts
32. Making plausible inferences, predictions, or interpretations
33. Evaluating evidence and alleged facts
34. Recognizing contradictions
35. Exploring implications and consequences

1.6 Rationale of the study

According to Edward de Bono (1994) "future" is one very important area where we can never have complete information and where we must use our thinking. All our actions, plans, decisions and choices are going to be worked in the future. By means of Education, we are teaching our students about the past. We never take into consider the future. In the absence of this it is impossible to progress in any walk of life. Present system of education depends heavily on the matter of sorting, reviewing, describing and absorbing existing knowledge. As a matter of fact skill of doing require much more than mere information. It requires thinking about priorities, about the consequences of action and about the other people involved.

Our basic psychological makeup has not only provided us with a brain, but with a need to use it. We use it to adapt to our circumstances and environment, to control it. We survived and prospered because of our brain. Our curiosity and our ability to use our brains to make sense of the world is what distinguish us from other species.

Ability of thinking creatively and critically is a chief component of the way that we tackle living in the world and dealing with the problems and challenges that life throws at us.

Enhancement of thinking skills among students through learning activities is employed across a wide range of school curricula. In a rapidly changing world, the cultivation of a creative personality who is sensitive to his environment is not only important but is urgent. The age of information technology has led to information explosion. Today, multitudes of avenue are open to students to access information. Therefore, it is not the content that requires to be taught rather it is how to think on the content, to explore and to interpret its newer application should be the focus of instruction. Many research studies have pointed out that education can play a vital role in this direction.

From a philosophical point of view, creativity and critical thinking abilities cannot be separated. The creative thinker has to be critically aware, because creative thinking, except in the simplest situation, involves the generating and shifting of possibilities and reworking them which has to be a critical process (Perkins 1994). Also, critical thinking is thinking that is insightful. It cuts through the heart of the matter and that is plainly a creative thinking. Thus, both are hand-in-glove and cannot be separated. When a thinker broadens his/her perceptions and begins to use creative thinking, he/she obviously needs the critical/evaluative aspects of thinking. It should be noted that both of these thinking skills are based on a sense of order, balance and harmony.

Piaget's theory of developmental stages indicates that during the period of concrete operation (8-11 years) and formal operation stage (11-15 years) the thought processes of the child gradually become logical, systematic and well integrated. During this

period, a child starts learning the rules of logic. At this stage, development of formal operation enables the child to transfer his/her understanding form one situation to another. Since, primary school teachers are dealing with children of this age group they can make remarkable contribution in the development of their thinking process.

Review of related literature indicates that a large number of studies are conducted in the area of creative thinking and continuously adding on realizing the importance and need for it, however, only few studies till date are reported in the area of critical thinking. Realizing the importance of creativity in early years of schooling and dire need of critical thinking for survival of democracy researcher felt a strong need to conduct a study in this very important area of thinking. As a matter of fact, it should be noted that creative and critical processes are inseparable and make use of each other. In this line of thought investigator strongly felts a need to have comprehensive study that aims at development of instructional strategy for primary school teachers to teach creative and critical thinking using content.

1.7 Statement of the study

Development of an instructional strategy for primary school teachers to teach creative and critical thinking skills

1.8 Objectives of the study

1. To select appropriate thinking tools for enhancing creative and critical thinking skills.
2. To develop an instructional strategy using selected combination of thinking tools using appropriate content to enhance creative and critical thinking skills.

3. To enable teachers to develop lesson plans incorporating the creative and critical thinking skills.
4. To study the effectiveness of the instructional strategy in enhancing creative and critical thinking skills in teachers.

1.9 Explanation of the terms

Instructional strategy: in this study refers to the lesson plans incorporating thinking tools and thinking strategies using appropriate content which is to be practised for developing creative and critical thinking on sampled group of teachers.

Instructional strategy consisted of thinking tools, thinking strategies and lesson plans incorporating these thinking skills and strategies.

Creative thinking: the thinking ability to come up with new ideas, to solve problems in original ways, one's imagination, creative behavior in productivity. Following are some of the dimensions of creativity which the investigator had included in this study:

1. Fluency- the speed and ease with which one comes up with new idea/s
2. Flexibility- ones' ability to see things from different angles, including ability to see all senses in the creation of new idea
3. Originality: an ability to produce ideas that are unique and unusual

Critical thinking: the thinking that determines the authenticity, accuracy and worth of information or knowledge claims. A few dimensions of critical thinking that would be considered for the study are comparing analogous situations; evaluating or examining actions; abilities of reasoning or decision making and ability to solve complex problems.

Thinking tools:

A tool is a device or an instrument, which helps us to focus our attention in particular direction. Through practicing these tools of thinking we are exploring the possibilities that in turn facilitate our thinking more creatively and critically. The major thinking tools that were embodied in the present study have been adopted and adapted from CoRT lessons of de Bono. De Bono is considered to be the leading authority all over the world on the direct teaching of thinking as a skill. His thinking lessons and in particular CoRT thinking lessons have been in use for many years and in countries Venezuela, Singapore, Australia, New Zealand, Canada and many more.

Following thinking tools were selected by the investor in order to infuse creative and critical thinking skill of the sample group of subject during the intervention.

Plus Minus Interesting (PMI)

Alternatives Possibilities choices (APC)

Considering All Factors (CAF)

Consequences & Sequel (C & S)

Effectiveness

Effectiveness will be measured on the scores obtained by sampled teachers on test constructed by the investigator. This test consisted of items based problem solving and brainstorming.

It will also be studied based on reaction of teachers on reaction scale.

1.10 Hypotheses of the study

Ho1 : Sampled teachers will have no significant difference in the means on awareness of creative and critical thinking on the pre test and post test.

Ho2 : There will be no significant difference in the mean fluency scores of the sampled teachers on the pre test and post test.

Ho3 : There will be no significant difference in the mean flexibility scores of the sampled teachers on the pre test and post test.

Ho4 : There will be no significant difference in the mean originality scores of the sampled teachers on the pre test and post test.

Ho5 : Sampled teachers will have no significant difference in the means of critical thinking scores on the pre test and post test.

1.11 Delimitations of the study

- Study was delimited to the content of standard I to VII appropriate to selected tools during the instructional process.
- Study was delimited to the Gujarati medium primary school teachers following syllabus of Gujarat State Board of School Textbooks.
- Instructional material and test measuring creative and critical thinking is in Gujarati language because the selected sample for the study was from Gujarati medium only.
- Test to measure creative and critical thinking into the teachers is validated through the comments of experts and not the standardized one.

- Selected components for creative thinking are fluency, flexibility and originality only.