CHAPTER 1

INTRODUCTION

Thinking is the highest mental activity present in man. All human achievements and progress are simply the products of thought. The evolution of culture, art, literature, science and technology are all the results of thinking. Thought and actions are inseparable. They are actually the two sides of the same coin. All our deliberate actions start from our deliberate thinking. For a man to do something he should first see it in his mind's eye; he should imagine it, think about it first, before he can do it. All creations whether artistic, literal or scientific, first occur in the creator's mind before it is actually given life in the real world. All that a man achieves and all that he fails to achieve is the direct result of his own thoughts.

The purpose of thinking, paradoxically, is to arrive at a state where thinking is no more necessary at all. In other words, thinking starts with a problem and ends in a solution. Thus, thinking is a tool for adapting to the physical and social environment. In this fast moving and fast changing society, the quality of our future will depend directly on the excellence of our thinking. The world has become too complex to cope up. Ecology, economics, politics are all now a complex of interacting factors all of which affect each other in direct and indirect ways. Today man has no system for dealing with such complexity. He can’t cope with the rate of change brought about by technology. The effort to bring a balance between the fast changing technologies and preservation of humanity and human values, man devised the education system.

Education in common usage is thought to be merely the delivery of knowledge, skills and information from teachers to students. It is the process of becoming an educated person. Being an educated person means having access to optimal states of mind regardless of the situation a person is in and being able to perceive accurately, think clearly and act effectively to achieve self-selected goals and aspirations. It again brings in focus the term, thinking. But the schools and universities employ traditional teaching
methods that provide knowledge that is required by beginner but does not develop wisdom i.e. high order thinking skills. Also, it does not help in problem recognition, finding new solutions to a problem, choosing out the best solution so that they can become effective learners.

1.1.0 Thinking

Now the question arises, what is thinking? No one has yet explained the process of thinking much better than Dewey (1933), who described it as a sequenced chaining of events. According to Dewey, this productive process moves from reflection to inquiry, then to critical thought processes that, in turn, lead to a “conclusion that can be substantiated” by more than personal beliefs and images.

Thinking involves the cerebral manipulation of information as we form concepts, engage in problem solving, reason and make decision. It is a higher cognitive function. It may be taken as deliberate exploration of experience for a purpose. The purpose may be understanding, decision making, planning, problem solving, judgment, action etc. involving the employment of any kind of cerebral activities. It is an inner cognitive process with a definite end or purpose. It is initiated to solve some problem or difficulty and ends in its solution. In the solution of the problems, it does not resort to motor exploration but there is a mental manipulation of the objects, activities and experiences. For the same images, symbols and signs, concepts and language form the tool of thinking. It can also be defined in its simplest form as a series of activities the brain undergoes when presented with a stimulus. These stimuli are received through any of our five senses. It refers to a pattern of behavior in which we make use of internal representations (symbols, signs etc.) of the things or events for the solution of some specific purposeful problem. It is a tool for assimilating information, classifying it and putting it into its proper place. Yet information is not a substitute for thinking. At one extreme, thinking is impossible without some information on the subject. On the other hand, perfect information will make thinking unnecessary. Our education system, yet, most conveniently ignores thinking. We owe most of our great inventions and most of the achievements of genius to idleness —either enforced or voluntary. The human mind
prefers to be spoon-fed with the thoughts of others, but deprived of such nourishment it will, reluctantly, begin to think for itself—and such thinking is original thinking and may have valuable results.

The importance of thinking was highlighted by Gough, 1991, as he mentioned that perhaps most important in today’s information age, ‘thinking skills’ are viewed as crucial for educated persons to cope with a rapidly changing world. Many educators believe that specific knowledge will not be as important to tomorrow’s workers and citizens as the ability to learn and make sense of new information. Paul, 1988, an educator has identified following characteristics of complex thinking:

Thinking is non-algorithmic (i.e. its path of action cannot be fully laid out before the problem). It has multiple solutions and involves judgment and uses multiple criteria. It involves effort and imposes meaning.

Thus thinking has been variously defined and many lists of thinking skills exist, including Bloom's Taxonomy (1956), which describes several categories: knowledge, comprehension, application, analysis, synthesis, and evaluation. Nickerson (1981) has suggested that not one taxonomy exists. However, there is agreement on some common components of thinking. These include basic micro skills such as compare and contrast, classification, causal explanation, and complex processes such as decision-making, problem solving, as well as metacognitive strategies. In addition to cognitive skills, a good thinker possesses certain traits and dispositions such as perseverance in searching for information, open-mindedness, curiosity, empathy, reflective capability, making judgment after considering many angles, (Costa, 1996; Glatthorn & Baron, 1992).

Acknowledging the importance of thinking Presseisen, 1986, even remarked, “Throughout history, philosophers, politicians, educators and many others have been concerned with the art and science of astute thinking. Some identify the spirit of enquiry and dialogue that characterized the golden age of ancient Greece as the beginning of this interest. Others point to the age of enlightenment with its emphasis on rationality and progress”.
Teaching higher order thinking provides students with relevant life skills and offers them an added benefit of helping them improve their content knowledge, lower order thinking, and self-esteem (DeVries & Kohlberg, 1987; McDavitt, 1993; Son & VanSickle, 1993). In the twentieth century the ability to engage in careful, reflective ‘thinking’ has been viewed in various ways; as a fundamental characteristic of an educated person; as a requirement for responsible citizenship in a democratic society, and more recently, as an employability skill for an increasing wide range of jobs. Thinking techniques, once mastered, can be used both individually and in a group, dispensing with brainstorming. So it becomes imperative to pay more attention to ‘thinking’ in education also. Without creative, independent thinking and judging personalities the upward development of society is as unthinkable as the development of the individual personality without the nourishing soil of the community. Yet there are a lot of misconceptions about thinking in the society.

1.1.1 Misconceptions about thinking

1. The first misconception about thinking that most of us believe is that present education system develops and enhances thinking and so the more educated a person is, the better thinker he is. Certainly this is not true. Actually, education on the contrary suppresses free thinking. Experiments show that most children rank highly creative before entering school. Because our educational systems place a higher value on left brain skills such as mathematics, logic and language than it does on drawing or using our imagination, only ten percent of these same children will rank highly creative by age 7. By the time of adulthood, high creativity remains in only 2 percent of the population. Creative thinking has almost no place in current education. Moreover, education even destroys creative thinking abilities by it’s over emphasis on logical thinking and critical thinking which are relatively lower types of human thinking.

2. The second misconception is that less Educated or uneducated can never become good thinkers.
3. Another misconception about thinking is that IQ and thinking ability are the same. The more IQ one has the better thinking ability he has. On the contrary, those who have lower IQ have only low thinking abilities.

4. Thinking ability, decision making ability and problem solving ability are inherent and there is very little we can do to develop these.

5. Many people even perceive thinking as nothing but a matter of cleverness and difficult problems.

To remove these misconceptions awareness about thinking needs to be generated. There is a need to teach children to become effective thinkers which is increasingly being recognized as an immediate goal of education. If students are to function successfully in a highly technical society, then they must be equipped with lifelong learning and thinking skills, necessary to acquire and process information in ever changing world (Robinson, 1987). If intelligence is the potential, then thinking is the ability to use this potential, this belief is very firmly established today. Just as the skill of the driver determines how a car is used, thinking determines how intelligence is used. One may be a good thinker without being an intellectual and vice-versa. Intelligence is an innate quality that depends on the genes, early environment, or a mixture of two. Thinking, on the other hand, is the operating skill through which intelligence acts upon experience. Knowledge or information is the basic material handled during thinking. In recent years societal demands for higher order thinking has generated a strong interest among educators in the teaching of thinking skills. The emphasis on promoting thinking and creativity was spearheaded by the recognition that rapid changes brought about by globalization and the onslaught of the technological and information revolution necessitate the development of a "new" type of citizen - one who can manage increasing amounts of information, who can sort through the information, choose information that is relevant and effectively use that information. The traditional "drill and kill' approach was deemed inadequate in educating such a citizen.
1.1.2 Thinking Skills

Norris, 1985 remarked “But in spite of all the research work, data show that critical thinking ability is not wide spread. Most students do not score well on tests that measure ability to recognize assumptions, evaluate arguments and appraise inferences.” However the silver lining is that a great deal of research currently being reported indicates that earlier supposed to be innate and inherent, thinking is now proved to be trainable and learnable (Stein 1975, Feldhusen and Treffignes 1985, Feldhusen 1988 & 1990, Parnes 1987, Torrance 1972 & 1987, Van Gundy 1981) and can be acquired and practiced as a skill. Thinking techniques, once mastered, can be used both individually and in a group, dispensing with brainstorming. Thinking skills have been defined and classified in many ways. The most important classification of core thinking skills includes following components:

**Focusing Skills** – Focusing skills include attending to selected pieces of information and ignoring others.
1. Defining problems: clarifying needs, discrepancies, or puzzling situations.
2. Setting goals: establishing direction and purpose.

**Information Gathering Skills** – These skills require bringing to consciousness the relative data needed for cognitive processing.
3. Observing: obtaining information through one or more senses.

**Remembering Skills** – Remembering skills deal with storing and retrieving information.
5. Encoding: storing information in long-term memory.
6. Recalling: retrieving information from long-term memory.

**Organizing Skills** – Organizing skills are required in arranging information so it can be used more effectively.
7. Comparing: noting similarities and differences between or among entities.
8. Classifying: grouping and labeling entities on the basis of their attributes.
9. Ordering: sequencing entities according to a giver criterion.
10. Representing: changing the form, but not the substance of information.

**Analyzing Skills** – These skills are essential for clarifying existing information by examining parts and relationships.
11. Identifying attributes and components: determining characteristics or the parts of something.
12. Identifying relationships and patterns: recognizing ways elements are related.
13. Identifying main ideas: identifying the central element; for example the hierarchy of key ideas in a message or line of reasoning.
14. Identifying errors: recognizing logical fallacies and other mistakes and, where possible, correcting them.

**Generating Skills** – These skills are concerned with producing new information, meaning or ideas.
15. Inferring: going beyond available information to identify what may reasonably be true.
16. Predicting: anticipating next events, or the outcome of a situation.
17. Elaborating: explaining by adding details, examples, or other relevant information.

**Integrating Skills** – Integrating skills are used while connecting and combining information.
18. Summarizing: combining information efficiently into a cohesive statement.

**Evaluating Skills** – These skills are related to assessing the reasonableness and quality of ideas.

Bloom's taxonomy of knowledge contains six levels of skill; the higher-level thinking skills of analysis, synthesis, and evaluation are often integrated into models of creative problem solving. Thinking skills that promote creative solutions to problems are critical
Higher order thinking includes critical, logical, reflective, metacognitive, and creative thinking. These skills are activated when students of any age encounter unfamiliar problems, uncertainties, questions, or dilemmas. Successful applications of these skills result in higher order thinking skills like explanations, decisions, performances, and products that are valid within the context of available knowledge and experience, and promote continued growth in higher order thinking, as well as other intellectual skills.

Further the most basic premise in the current thinking skill movement is the notion that students CAN learn to think better if schools concentrate on teaching them HOW to do SO (Presseisen, 1986). In his study Ristow (1988) asserted that direct teaching of thinking skills can produce better, more creative thinkers. Further a large number of researchers (like Barba and Merchant 1990, Bass and Parkins 1984, Robinson 1987, Freseman 1990, Kagan 1988) have emphasized that thinking skills instructions enhance academic achievement. Not only this, the benefits of developing thinking ability are manifold. By developing one's thinking skills one can make achievements; can become successful; can shine in social life; can attain emotional, social and economic maturity and so on. By developing one's thinking abilities it is possible to transform one's aggressive tendencies, bad temper and other negative tendencies creatively and constructively. It has been found by de Bono that when school students were taught to think effectively, their ill-temper and aggressive tendencies reduced significantly. Interestingly, when neurotics were taught to think effectively, they showed a remarkable reduction in their neurosis.. Bransford (1986), emphasized the importance of high order thinking skills by explaining that: "Blind" instruction [in which students are not helped to focus on general processes or strategies nor to understand how new concepts and strategies can function as tools for problem solving] does not usually lead to transfer to new tasks...as the instruction focuses on helping students become problem solvers who learn to recognize and monitor their approaches to particular tasks, transfer
is more likely to occur. Yet there are some common errors in thinking which hinder the normal progress in thinking abilities of people.

1.1.3 Errors in Thinking

It is necessary that we should be aware of the errors in thinking. There are five such errors in thinking: 1. Partialism 2. Adversary Thinking 3. Time Scale Error 4. Initial Judgement and 5. Arrogance and Conceit.

Partialism
This error occurs when the thinker observes the problem through one perspective only. That is, the thinker examines only one or two factors of the problem and arrives at a premature solution.

Adversary Thinking
This is a "you are wrong. So, I should be right." type of reasoning. Politicians are the masters in this type of thinking and they use it to their advantage. Most of the crimes and arguments are the resultant of this type of thinking.

Time Scale Error
This is a kind of partialism in thinking in which the thinker sees the problem from a limited time-frame. It can be likened to short-sightedness.

Initial Judgement
Here, the thinker becomes very subjective. Instead of considering the issue or problem objectively, the thinker approaches it with prejudice or bias.

Arrogance and Conceit
This error is sometimes called the "Village Venus Effect" because like the villagers who think that the most beautiful girl in the world is the most beautiful girl in their village, the thinker believes that there is no better solution other than that he has already found. This blocks creativity. Not only individuals but societies and even the whole mankind
sometimes fall prey to this error. For example, before Einstein, the whole scientific community (and thus the whole mankind) believed that time was absolute.

Naturally to remove these errors in thinking, there is a dire need to understand different types of thinking.

### 1.1.4 Types of Thinking

In his book “Mechanism of mind” de Bono has even explained about three types of thinking i.e. natural, subjective and directed. In **natural thinking** mind flows from idea to idea- this type of haphazard movement leads to considerable distance from topic. In **subjective thinking**- the central idea is kept firmly in mind. So from the idea thinking moves back to central subject. So thinking is not as remote as natural. But here the exploration is limited. In **directed thinking** there is less drift. Central subject is supported by series of techniques having tools. Directed thinking is basically about CORT i.e. cognitive research thrust.

Further thinking is supposed to be of many types.

**a) Critical thinking**- It is a type of thinking that helps a person in stepping aside from his own personal beliefs, prejudices and opinions to sort out the facts and discover the truth, even at the expense of his belief system. Reflective and reasonable thinking that is focused on deciding what to believe or do is thus the critical thinking. Brookfield (1987) defines five aspects and four components of critical thinking:

Aspects of critical thinking:

Critical thinking is a productive and positive activity. It is a process, not an outcome. Manifestations of critical thinking vary according to the contexts in which it occurs. It is triggered by positive as well as negative events. Last but not least, critical thinking is emotive as well as rational.

Components of critical thinking:
Identifying and challenging assumptions is central to critical thinking. Challenging the importance of context is crucial to critical thinking. Critical thinkers try to imagine and explore alternatives. Imagining and exploring alternatives leads to reflective skepticism. Faccione (1998) introduced a five-step process of critical thinking:

Interpretation, Analysis, Evaluation, Inference skills, Presenting arguments and Reflection that may be used in the critical analysis process. Critical thinking therefore requires the understanding of a broad knowledge base, the ability to identify inferential relationships, examining the credibility of the statements, the search for elements to draw conclusions, and the ability to explain the reasoning to get to this point. This analysis process is quite different from the other literature that had more parallels to creative thinking processes.

b) **Perceptual/ concrete thinking** - It is the simplest type of thinking that is purely based on the perceptions.

c) **Conceptual/ abstract thinking**- Instead of perception of actual objects or events, this type of thinking makes use of concepts, the generalized ideas.

d) **Convergent thinking** – This type of thinking is considered a closed or single point. Here a person adopts a quite narrowing and focused process leading him to pinpoint the one most appropriate solution or response to his problem. This type of thinking is, therefore involved with situations, which requires the production of only one correct solution or answer. Since it provides a lot of inhibitions and restrictions on finding multiple ways of solving a problem or creating a thing, it is quite harmful in the development and expression of creative abilities and creative faculties.

e) **Divergent thinking**- It involves a broad scanning process, enabling a person to evolve as many solutions as possible. So it is used when one is confronted with a problem, which has many possible solutions. This type of thinking is, therefore essential for the development of creativity, creative expression and inventions.

Guilford (1956), in his well known ‘structure of intellect’ conceptualized creativity as a convergent production. He differentiated between convergent and divergent
thinking. He defined convergent thinking as thinking that leads to right answer, to a recognized or conventional answer. Divergent thinking processes are those which stem from the assumption that there may be several new ways to solve a problem.

g) Reflective thinking- It is a higher form of thinking which involves re-organisation of all the relevant experiences and finding new ways to reacting to a situation or of removing an obstacle instead of simple association of experiences or ideas. It is aimed at solving rather complex problems. It is insightful and takes logic into account.

h) Creative thinking- It is the thinking that helps an individual to create, discover or produce a new idea or object including the re-arrangement or reshaping of what is already known to him. De Haan and Havighurst (1961) stated that creativity is the quality which leads to the production of something new, may be new to society or merely new for the individual who created it.

Techniques that help establish an environment for creativity are set breaking, warm-ups, blockbusting processes, constructive discontent, creative dramatics, relaxation training, autogenics, psychodrama, sociodrama, and future studies. General systems that develop general creative processes or that value creativity are bionics, synectics, future problem solving, creative problem solving, creativity by design, entrepreneuring, and intrapreneuring. Thomas (1999) has listed barriers to creativity. His list is based on the work of Alexander (1999), and lists nine barriers to creativity. Failure to ask questions, failure to record ideas, failure to revisit ideas, failure to express ideas, failure to think in new ways, failure to wish for more, failure to try being creative, failure to keep trying and failure to tolerate creative behavior are the barriers to creativity.

In general, it is accepted that there are several levels of creativity. True, relatively few of us at attain to the highest levels, but at the other levels we all have a good chance. One series of "levels" that was proposed many years age still works well.
This describes creativity levels as emergent, innovative, inventive, productive, and expressive.

**Emergent creativity** involves bringing forth a principle or idea that is entirely new to humankind and that has far-reaching effects on how we perceive reality. Einstein and Newton come immediately to mind, which explains why such a level may not be attainable for most of us.

Next is **Innovative creativity**. Here creative individuals build on their knowledge of whatever field they are in, climbing on the shoulders of their predecessors, so to speak, to reach even higher levels of new understanding and ideas.

**Inventive creativity** finds new uses for existing concepts and parts, while productive creativity is the description given when someone develops objects or ideas that are new to him or her, but not necessarily to other people. Quite often, this may be a developmental stage for those who will, if they do not get discouraged, move on to inventive or innovative creativity.

Lastly is **expressive creativity**, which expresses feelings and ideas but does not need any particular skill or originality. This is well illustrated by the pictures that parents often place on their refrigerators or family notice-boards after young children have excitedly brought their latest art effort home from school. Most of us probably hope we have moved past the expressive level, and realize that the emergent level may be beyond us. However, the other three levels may well be open to us. Clearly the person who is innovatively creative needs to have mastered a field of knowledge in order to be able to add to it. The more the field is mastered, the less likely is an individual to come up with an idea that has already been discovered, which would move it down to the "productive" level.

i) **Vertical thinking**- Vertical thinking refers to solving a problem by analysis. It focuses on the known and correct method to address a particular problem. It
involves the solving of problems using conventional logical processes. It is just in contrast to lateral thinking.

j) **Lateral thinking**- According to the Oxford English dictionary, Lateral Thinking is “...a way of thinking which seeks the solution to intractable problems through unorthodox methods, or elements which would normally be ignored by logical thinking.” Edward De Bono. Human brain, which is the centre of thinking process, has two parts, namely right hemisphere and left hemisphere. According to Wonder and Donovar (1984) we have two distinct thinking processes, vertical and lateral. The traditional, logical thought that looks at a reasonable view of a problem or situation and works generally in a path of least resistance comprises mainly vertical thinking. On the other hand, Lateral Thinking suggests that the student or problem solver should explore different ways of examining a challenging task, instead of accepting what appears to be the solution with seemingly the most potential and going forward. We may say that the left hemisphere is concerned with vertical thinking which comprises analytical and verbal thinking process. Right hemisphere is concerned with lateral thinking consisting of intuitive and visual thinking processes.

De Bono, 1996, suggested five approaches to teaching thinking. Natural, logic, by product, Discussion approach, Puzzle and game.

**Naturally** it is difficult to convince people that they are not thinking the way, they imagine themselves to be. **Logic approach** is very limited in due. A person may learn all the rules of logic but finds it impossible to apply it in real life. **By product approach** is a traditional view that hold that thinking is by product of using mind to learn subjects. **Discussion approach** is good for argument and debate but not for teaching thinking as skill. **Puzzles and games**- games or situations are found to be more useful but then these are not enough.


1.1.5 Comparison between Lateral and vertical thinking

Vertical thinking refers to solving a problem by analysis. It focuses on the known and correct method to address a particular problem. Consequently, it helps saving time, money and energy; and getting the results by hitting the bull’s eye. This approach may be the right one if one is operating under tight budgets. Better solutions and creative processes can be discovered only when one breaks out of his comfort zone of knowledge. Lateral thinking does just that. It attempts to break traditional notions which develop vertical or conditional thinking. Conditional thinking fails one in exploring the other possibilities or probably the best ideas.

Structured Vs. Restructured: Vertical thinking encourages a sequential approach. There is a structured approach which you follow to redress a problem. You make decisions on the basis of the available knowledge base which you attempt to extend. On the other hand, lateral thinking attempts at restructuring the set pattern. By disorienting and restructuring the set pattern, it arrives at a new insight or a new approach to the organizational problem. Lateral thinkers believe that what is the best idea now can be out of fashion tomorrow. This attitude leads to the generation of new perspectives and ideas.

Logical vs. Illogical: Vertical thinking takes a logical approach. In fact, its methods have already proven to give the desired results. However, with lateral thinking, this is different. It seeks to approach a problem through ostensibly illogical methods. This does not mean lateral thinkers make illogical decisions. They combine both reasoning and imagination to arrive at the most suitable solution. They use critical and creative thinking skills to reach the desired outcome. Nevertheless, they do not believe this is the best solution forever. That is the crux of lateral thinking. Vertical thinking deprives one of novelty, which is essential to find and apply to innovative processes in business management. It does not help generate any new ideas since it looks for a finite approach to a problem. So, there is little chance for experimentation and deviation from the right
course. Vertical thinking helps to use details at every step yet if information is not available, no further course of action can be taken. Therefore, one can’t solely depend on this problem solving approach, especially if the problem looks intractable. Even when one is 100 percent sure that vertical thinking can help to solve a problem, he must not forget that he is closing the doors for better solutions. It always pays to have more alternatives to a problem than just one, so that one can choose the best and most creative approach.

To sum up, we may say that vertical thinking is selective whereas lateral thinking is generative. Rightness is what matters in vertical thinking. Richness is what matters in lateral thinking. Vertical thinking is analytical but lateral thinking is provocative. Vertical thinking is sequential, lateral thinking can make jumps. One may jump ahead to a new point and then fill in the gap afterwards. It may be necessary to be on top of the mountain in order to find the best way up. With vertical thinking one has to be correct at every step, with lateral thinking one does not have to be. With vertical thinking one uses the negative in order to block off certain pathways. With lateral thinking there is no negative. With vertical thinking one concentrates and excludes what is irrelevant, with lateral thinking one welcomes chance intrusions. With vertical thinking categories, classifications and labels are fixed, with lateral thinking they are not. Vertical thinking follows the most likely paths, lateral thinking explores the least likely. Vertical thinking is a finite process, lateral thinking is a probabilistic one. With lateral thinking there may not be any answer at all. With vertical thinking one uses information for its own sake in order to move forward to a solution. With lateral thinking one uses information not for its own sake but provocatively in order to bring about repatterning.

Using De Bono’s system, ideas are explored from a variety of angles. De Bono stated that lateral thinking is the way of thinking which approach different principles and ideas. He described Lateral thinking: “You cannot dig a hole in a different place by digging the same hole deeper. De Bono’s concepts of lateral thinking are designed to circumvent the brain’s natural patterns and tendencies. This is possible through lateral thinking. Methods have been devised to "shut off" the left brain, allowing the right side
to have its say. Creative writing courses often use this method to combat "writer's block." But the curriculum gives not much opportunity to develop thinking. Lateral Thinking techniques are also the attempt in the same direction. De Bono has suggested a number of techniques that can be learned to develop Lateral Thinking. Following are some of these techniques like alternatives, this technique involves thinking of many ways beyond the obvious approach and comprises exploring as many alternatives as possible, Nonsequentiality, which involves jumping out of the frame of reference or work from several points and link them together. It also involves breaking of thought pattern and switching to new thinking, Undoing selection processes, It can be done by thinking outside of logical progression into pathways that might seem wrong. For the same the immediate judgement based on the logic has to be shut off, Attention: this technique seeks a shift in the direct focus of concern. Whereas we tend to focus on certain things while thinking logically, this technique requires focus on the things of even the least concern. In case of vertical thinking all these techniques are seen as hindrance mostly whereas they play a very important role in thinking laterally.

1.2.0 Lateral thinking

We are in a constant state of change. We think differently as we gain knowledge and skills in thinking. One generation to the next have different aims, ambitions and morals. What might be seen as a good thing by one generation could be seen as a bad thing by the next. Political parties change their views, as do their voters. Due to personal circumstances, individuals can change their whole philosophy of life within months. Technology and other inventions now change the world faster than most people can keep up with. What seemed impossible one week can become plausible the next, reality within months and an accepted way of life in a year or two. Whatever was considered to be a fact in the past has now become inappropriate due to changes which have happened since then. Still the education system places very little value upon the un-quantifiable traits a designer uses as the principal source of their inspiration. Our education system is so information oriented that it gives readymade answers killing the natural tendency of students to explore, experiment and to experience. As creative individuals man has
managed to escape an education system that has deprived him access to many qualities of the right brain. Education systems are designed to cultivate the verbal, rational, time-based left hemisphere, resulting in half of the brain of every student being ignored. Educational system, as well as science in general, tends to neglect the nonverbal form of intellect. What it comes down to is that modern society discriminates against the right hemisphere. The need for development of lateral thinking was also recognized as de Bono remarked “Everyone knows that instant judgment is the enemy of creativity”. It isn’t necessarily that all judgment is wrong; it’s allowing the ideas to emerge without screening them out. It is repeatedly mentioned that there is a need for a quantity of ideas for a good one to emerge. “innovation is ‘ideas to action’—taking something that seems to be a good or even exceptional idea and transforming it into something that it tangible for others to use. Creativity is essentially a divergent activity, expanding beyond current experience, while innovation is essentially a convergent activity, bringing those same ideas back into people’s experience…creativity is an aspect of innovation;…the goal of creativity is exploration and invention. The goal of innovation is transformation and implementation.” (Richards, 2003)

A US study found only 1.7% of the total academic curriculum to be involved with divergent skills. What would be the training strategy is a matter of research which needs formulations and empirical verifications. Researches on our education system have concluded that 75% class time is used in giving instructions. 70% time in class teachers talk. Only 1% of it invited students to engage in anything more than recall of information. With inclusion of thinking as well as lateral thinking educational systems have finally given due recognition to this much ignored cognitive function. So Developing ‘Lateral Thinking’ has already become a pedagogical challenge to modern educators.

So, out of different types of thinking, emergence of ‘Lateral Thinking’ in recent years is a natural reaction to the enormous increase of information, a human being is bombarded with in the post industrial revolution era. Heart of critical thinking is willingness to face objections to one’s own belief, a willingness to adopt a skeptical attitude not only
towards authority and towards views opposed to our own but also towards common sense. So this along with vertical thinking moves forward by sequential steps each of which must be justified logically. Critical or vertical thinking with its sequential and fixed order rules and to some extent with arrogance of logics, which have been the foundation of traditional education, is increasingly being complemented by ‘Lateral Thinking’. It represents quite a new way and approach in the realm of thinking process. As a new term it was coined and used first by De Bono in his publication “New Think: The Use of Lateral Thinking” published in 1967. De Bono defines lateral thinking as methods of thinking concerned with changing concepts and perceptions. Excerpted from Wikipedia, “Thinking outside the box” used to refer to looking at a problem from a new perspective without preconceptions. It aims at freeing the mind from the imprisonment caused by already established thinking patterns and generating new ideas. This low probability sideways thinking is used not only in generating new ideas but also in problem solving, in periodic assessment of idea that seem beyond doubt, in processing perceptual choice and in prevention of sharp divisions and polarization. It is a special information handling process like mathematics, logical analysis or computer simulation.

Lateral Thinking is a way of thinking which seeks the solution to intractable problems through unorthodox methods or elements which would normally be ignored by logical thinking.” De Bono differentiates this from vertical thinking, which can be described as traditional, logical thought; vertical thinking looks at a reasonable view of a problem or situation and works through it, generally in a path of least resistance. On the other hand, Lateral Thinking suggests that the student or problem solver should explore different ways of examining a challenging task, instead of accepting what appears to be the solution, seemingly the most potential and going forward. It differs from critical thinking in the sense that where critical thinking is primarily concerned with judging the truth value of the statements and seeking errors, lateral thinking is more concerned with the movement value of statements and ideas. In the traditional step by step logic one has to move from one truth to the next in a systematic way, whereas lateral thinking is about reasoning that is not immediately obvious, and about ideas that may not be obtainable
by using only traditional, step-by-step logic. So whereas critical thinking moves forward by selecting out what is relevant, lateral thinking deliberately seeks out irrelevant information. It is specifically concerned with changing preconceived notions to bring out new ideas and can be acquired and practiced as a skill. But that freedom is more effectively obtained by using certain deliberate techniques rather than by hoping to be free. There is a prevailing belief that structures are restrictive for creative thinking but this is not entirely true. Lateral Thinking would not be helpful in situations of fixed knowledge (e.g., 1+1=2) nor would it be helpful in critical time-constrained problems where the problem solvers are unfamiliar with the Lateral Thinking concept.

De Bono further states that Lateral Thinking has relations to insight, creativity and humor; the difference is that lateral thinking is meant to lead the way into purposeful methods yet, humor (by itself) does not put forward ways to resolve a question or issue. So in its concept lateral thinking seems to be quite similar to the creative thinking. But it is not the same as creative thinking. Creative thinking means the predictions and/or inferences for the individual are new, original, ingenious unusual – Skinner 1968. While lateral thinking may be a creative process, it is not meant to be a part of the chaos of some creative thinking. Creativity is too wide a concept which applies to everything, still is quite apart from the ability to generate new ideas. Lateral thinking on the other hand is specifically directed towards emerging with new ideas. Lateral thinking strives to get to an objective end point while certain acts of creativity are bound by subjective judgment. Besides creative thinking is very vast and more of a gift while lateral thinking is proved to be trainable. It is a general attitude of mind which can be taught in formal setting using specific material and exercises.

To understand lateral thinking further we need to discuss the terms concepts and perceptions. Concepts are the tools used in language. We attach some meaning to concept according to our information or experience. So an apple, chair, student, school, and criminal, all the words come along with a concept package where we assign some characteristic features to them. Whereas these concepts are essential for development of language, for preserving our information and our culture, but they have major
drawback. They form a sort of patterns or a concept prison due to which all of us end up by thinking in a very similar fashion. So it leaves no space for new thinking. Whenever some invention has occurred, somebody has actually thought out of the concepts existing at that time for example first time. But these are some of the successful attempts. But what about those attempts which were definitely out of box but due to some reason failed. So the inventions had to face shame or humiliation and even were sometimes punished for thinking out of box. The death penalty was faced by Aristotle for declaring Sun the central part of solar system and earth revolving around it. This idea was rejected at that time but ultimately proved to be a stepping stone for new thinking.

Our thinking also has a unique pattern. It consists of two phases. Phase-I is the perception stage. First of all we get a sensation and the meaning attached to sensation is called perception. Perception gives us a way to look at the things or situation. Second stage comes after perception stage. It is called the processing stage. Generally we are concerned with only the thinking that comes after perception. We don’t pay heed to perception as we believe that there could be only one way to look at things. This way of looking at a situation can be called concept package. But if we somehow escape from the most obvious ways there may be some other ways also to look at the things that may be useful.

We are habitual of recognizing patterns and reacting to them. These reactions come from our past experiences and logical extensions to those experiences. PO is a tool to escape from concept prisons so that we can look at something in a new way. For example- thought of a school and school children always leads to some common things due to our concept. This concept makes the thought of a school where student come at age 15, 25, 40, 65 to get the requisite skill or training according to their age very difficult. It is all because our brain works as a processing system. All the information gets processes in it so leaves some impression. New information automatically gets accommodated according to the previous knowledge. So a sort of sequence trap or pattern is formed. The only way to escape from these concept prisons and patterns is that we use some special tools and techniques.
1.2.1 Tools/ Techniques of lateral thinking

Contrary to popular belief, lateral thinking is not a natural born talent. It is a skill like any other which can be taught (Fieldman 2004), becoming second nature with consistent effort, practice and adherence to guidelines set by various training organizations (Burton & Sack 1991) which develops and sharpen lateral thinking skills. The techniques that apply lateral thinking to problems are characterized by shifting of thinking pattern, away from predictable thinking to new or unexpected ideas. Now the question arises how to impart the training in lateral thinking. De Bono identifies four critical factors associated with lateral thinking

1) Recognize dominant ideas that polarize perception of a problem
2) Searching for different ways of looking at things.
3) Relaxation of rigid control of thinking.
4) Use of chance to encourage other ideas.

De Bono has suggested a number of tools and techniques that can be learned to further lateral thinking: random input from external sources (thus influencing the older relationships), set a fixed allocation of alternative approaches before proceeding with a further step, attention rotation (divides a problem up into parts so that one part does not create monopoly of attention), cross-fertilization (what another person “sees” may be a fresh and dissimilar approach), reversal of direction (in looking at the question).

De Bono, 1996 has devised some thinking tools and techniques to help us practice thinking as a skill. Most important of them are:

1. AGO

AGO stands for Aims Goals Objectives. Since deliberate thinking is actually the manifestation of deliberate use of Will Power, it is important that the thinker should be well aware of the aims, goals and objectives. In other words, a sense of direction is required if one is to use his thinking effectively.
2. **CAF**
CAF stands for Consider All Factors. It reminds us that all factors or parameters of a problem should be considered to analyze it. This thinking operation is essentially related to action, decision, planning, judgement, and coming to a conclusion. By doing so, one can avoid the error of partialism in thinking.

3. **PMI**
PMI is the abbreviation for Plus Minus Interesting. When making decisions, this technique is very useful. First write down all the plus (i.e., positive) suggestions or aspects of a solution. Then write down all the minus (i.e., negative) aspects. Lastly, write down the interesting ideas or suggestions or aspects of the same. Now it is easy to arrive at the best suitable solution of the issue or problem at hand. The PMI is a way of treating ideas, suggestions and proposals, bypassing the emotional reaction to an idea.

4. **OPV**
OPV means Other People's Views. In this technique, the thinker thinks from the perspective of the different people involved in or affected by the decision or solution. For example, a change in syllabus mainly affects the students, teachers, management and parents either directly or indirectly. So, before implementing a new syllabus, we should think from the perspective of all these people. This is especially important when the decision is enacted upon and through other people.

5. **APC**
APC is the short form for Alternatives Possibilities Choices. In this technique, the thinker generates as much alternatives, possibilities and choices for the solution of the problem. It is an attempt to focus attention directly on exploring all the alternatives or choices or possibilities- beyond the obvious ones. The best suitable one can then be selected by applying PMI or OPV. De Bono’s(1982) credits this method for brainstorming alternatives for explanations, hypotheses, perceptions, problems, reviews, designs, decisions, course of action and forecasting. Objections to this process are time wastage and indecision due to abundance of alternatives.
6  C & S

This is the process of looking ahead to see the consequences of some action, plan, decision, rule, invention etc. it is a short form of consequences and sequel.

7  Alternatives and the Concept Fan

This method extracts the concept alternatives. Alternatives run onto The Concept Fan de Bono’s(1996) which is the process of moving from an idea to a concept then becoming the starting base for other ideas, producing a flow of alternative ideas.

8.  The Stepping Stone

It is the most provocative technique (De Bono, 1996) and can lead to new ideas. De Bono, 1982, gives following two phases

- The intentional setting of provocation or stepping stone.
- The effective use of the provocation to create practical new solutions.

9.  The Escape/ Creative Pause

Here the main direction of thinking is identified and avoided. The most obvious answers or solutions to a problem are blocked intentionally so as to make way for new ideas.

10. Challenge

It is human nature to think of better alternatives only when the situations are deemed inadequate thus limiting creativity and innovations (Mumford, Connelly & Gaddis 2003). This technique is based on the willingness to explore the reasoning why things are done and whether there are any alternatives.

11. Movement and Provocation
Provocation breaks traditional patterns after deployment of movement. Provocation is the generation of new ideas whereas movement acts as an alternative to judgment.

12. Six Thinking Hats

It is a pragmatic technique maximizing individual and group thinking. White hat symbolizes information, Red Hat, Intuition and feeling; Black hat, caution and logical negative; yellow hat, logical positive; green hat creative effort and creative thinking; blue hat, control of the thinking process itself. Studies show (Curtis & Smith 1998; Mumford, Connelly & Gaddis 2003) that the Six Hats method becomes rapidly entrenched in the organizational culture.

He even advocated various thinking tools like:

1. **Idea generating tools**- These tools are used to break the existing thinking patterns. People are habitual of thinking in very similar manner due to their culture, beliefs, custom etc. but by adopting these tools, thinking can be diverted to a new direction giving birth to new ideas. These tools include use of following techniques to generate new ideas:-

   a) **Alternatives**: In this technique concepts are used to breed new ideas. Here, the features related to an object are used to produce new ideas,

   b) **Random Entry**: These techniques use unconnected input to open new lines of thinking. Any random word is picked from dictionary and using this tool, that word is used to solve the problem in a totally new perspective.

   c) **Provocation**: These techniques make use of a provocative statement, a statement that may be even absurd or meaningless. Now the thinking is moved from a provocative statement in such a way that it can generate useful ideas,
d) **Challenge:** These techniques are used to break free from the limits of accepted ways of operating. By using this technique, anything that is otherwise acceptable, can be challenged so as to bring improvement.

2. **Focus tools**- These tools provide a clear, comprehensive and broad area to focus upon the search for new ideas.

3. **Harvest tool**- these tools are designed to yield a good harvest and value from the idea generation output.

4. **Treatment tools**- these tools help the individual in generating and applying the new ideas in consideration with real world constraints, resources, and support.

Further it has been seen that whereas children are born thinkers, education does nothing to enhance thinking abilities of a child. **De Bono** even has marked three stages of child.

**0-5: Age of why**- A small baby in this age wants to enquire about everything. So this is the state of active thinking.

**5-8: Age of why not**- At this age child loves to explore the unusual. So the child will ask about even those things which are logically not possible. This is the state of thinking differently.

Whereas **after 8: Age of because** – Till this age our system trains the child only to justify the things. So it may be considered to be the lowest thinking stage.

While some people may be better at or more natural to Lateral Thinking than others, de Bono points out that this is also true in mathematics or other subjects; people can improve by being taught this concept (directly) and making it into a resident skill. The present study revolves around one of these methods which combine the use of three specific techniques that comes under the category of idea generating tools. This method is called ‘PO’ or ‘Provocative Operation’.
1.3.0 PO METHOD

First presented by Edward de Bono (1967), PO creates open blocks to provide opportunities to explore alternatives and is used to propose an idea, which may not necessarily be a solution, or a 'good' idea in itself, but moves thinking forward to a new place where new ideas or solutions may be produced. PO is an extraction from words such as hypothesis, suppose, possible and poetry, all of which indicate forward movement and contain syllable. It is in the nature of hypothesis where a situation is first conceived or imagined and then one proceeds to arrive at unique plausible conclusions. According to De Bono, the words hy(po)thesis, sup(PO)se, (PO)ssible and (PO)etry all indicate the forward or proactive use of a statement, which implies that we make a statement first and see where it takes us. This is against prose and description, in which we seek to show something as it is, currently. PO may refer to any of the following-provoking operation, provocative operation or provocation operation. People in conversation could use the word "PO" to notify others that they are intentionally making a provocative comment that should be best applied using lateral thinking techniques. It is an anti-judgment device that is based on forward movement which includes making a statement and seeing where it leads to. In this technique a provoking idea is suggested. This idea may not be a good idea. But it can be used to move thinking to a new place from where new ideas may originate. “PO” is a thought provoking tool. It blocks the obvious way of thinking and helps to create new thinking.

As already discussed thinking is believed to be having two stages- perception and processing. Perception is the meaning attached to the sensation. Traditionally we are concerned with only the thinking that comes after perception. This is the second stage thinking which involves the processing of the situation that has been presented by perception. Even computers can work well with second stage of thinking. So better it is that now we focus on our first stage thinking. Mostly we do not pay much attention to perception because we believe that there could be only one way to look at things. This way of looking at a situation can be called as concept package. Starting with the perception and concept package, our brain makes a pattern where new information gets
adjusted in relation to the old information. So a sequence trap or concept prison is formed. But this way of looking things may not be the only way or even the best way. So instead of taking perception for granted, we need tools to change it and escape from concept prisons, one such tool is PO.

1.3.1 Strategies of PO method

De Bono has developed several techniques of lateral thinking under the three broad categories: Challenge, Alternatives and Provocation. For this we can use specific tools of “PO” method namely PO-1, PO-2 and PO-3. These tools block the obvious ways of thinking. So the students start thinking in new and different ways.

**1.3.2 PO-1 (Intermediate impossible)**

Intermediate impossible are ideas or statements which are illogical and impossible. We may get such ideas while thinking over our problems. As these statements are illogical and absurd, we are trained to reject these statements immediately. PO-1 is a tool that helps us to use these statements to provoke new ideas.

**1.3.3 PO-2 (Random Word technique/ Random juxtaposition)**

It is the most basic and obviously creative technique known as PO-2 where a person can use a random word (hence the name!) to generate new ideas. By getting a random
word as a prompt and forcing himself to use it to solve his problem a person is practically guaranteed to attack the problem from a different direction to normal. One takes a word from a random word generator, extracts its underlying principles and then applies them to his problem to see how they can help.

1.3.4 PO-3 (Challenge the Facts)

This technique, PO-3 asks a person to consider what he thinks are facts and investigate what differences and advantages it would make if they were not facts. One could try to imagine what would be the case if the fact were totally wrong. Or one could try to modify the fact and see whether that now fits into the current situation better than the original one.

1.4.0 Role of Thinking skills, Lateral Thinking and PO in teacher Education

As we know that the teaching is an activity designed and performed for multiple objectives in terms of the changes in pupil behavior. So the main notion is that teacher’s education is an appropriate environment for developing complementary incorporation of ‘different types of thinking. Effective teachers model what they espouse and thinking skills are no exception (Costa, 1996). The teachers are less likely to teach students to think if they themselves lack the skill. Seitsinger, mentioned “Abstract national curriculum standards call for meaningful teaching and learning that are developmentally appropriate and that help students reach proficiency not only in basic skills but also in high order thinking skills and real world applications of skills.”

Since 1999, thinking skills have been included in the National Curriculum alongside ‘key skills’ such as those to do with communication and information and communications technology (ICT). Thinking skills are expected to be developed at all key stages and centre on information-processing skills, reasoning skills, enquiry skills, creative thinking skills and evaluation skills. Guidance on how to implement the curriculum in the Foundation Stage was published in 2000 and suggested that practitioners should ‘challenge children’s thinking’ and ‘support children in thinking in open-ended ways’. However, the extent to which young children can reason or engage
in ‘metacognition’ (thinking about their thinking) is unclear. (Taggart et al, 2005). Even Resnick (1987) accepts that although it is not new to include thinking, problem solving and reasoning in someone’s curriculum … It is a new challenge to include it in everyone’s curriculum….. It is a new challenge to develop educational programs that assume that all individuals and not just an elite, can become complete thinker.

Although Indian Education System has started recognizing urgent need to bring changes in teacher education and thinking as a hot topic is making place in curriculum yet no such provision for the same is suggested even in National Curriculum Framework in India. As The Education Commission (1964-66) professed, “The destiny of India is now being shaped in her classrooms”. So did the National Policy on Education 1986 emphasized: “The status of the teacher reflects the socio-cultural ethos of the society; it is said that no people can rise above the level of its teachers”. Therefore a dire need is being felt to include various thinking training methods, new innovations and techniques of thinking in teacher education.

**1.5.0 Rationale of the study**

Scientific advancements and technologies advancement have led to knowledge explosion. Yet the schools and universities employ traditional teaching methods that provide only knowledge which is required by beginner but does not develop wisdom i.e. high order thinking skills. Thus, it is not an easy task for the students to keep pace with new knowledge. The students of today live in the world of tomorrow where the things are totally different. In such circumstances, the students require high order thinking skills i.e. problem recognition, finding new solutions so that they can become effective learners. Consequently, it becomes the duty of educators to realize the importance of teaching thinking skills to students. Many such training programs that teach thinking skills are available. One such method that develops lateral thinking to generate new ideas is PO (Provocative Operation) method, devised by de Bono. He found the programme to be very effective in developing lateral thinking skills among students, parents and professionals.
But the programme was not suitable for Indian students due to cultural constraints and the absence of awareness among teaching faculties. So the need was to develop a self learning module: such a method that trains the future teachers so that they may further bring out the change in the thinking of their students. As the effectiveness of the module was tested and supported by Merwin and Schneinder (1973), Mukhopadhyay (1982), Hopper (1983), Dhillon (2007). The findings of the studies paved the way for the construction of the module. While a lot of research has been done in the field of critical and creative thinking, there is a dearth of the researches in the field of lateral thinking, which is a must to cope up with the changing needs of the society. That is why; an attempt is made to see the effect of PO method on lateral thinking. The module has been developed on PO method keeping in view the Indian students, our belief, custom, culture and educational environment so as to be helpful in developing lateral thinking among student-teachers.

1.5.1 Statement of Problem

In the context of the above rationale, the problem can precisely be stated as follows:

“Effectiveness of Training Module in Provocative Operation on Lateral Thinking of Student Teachers”

1.5.2 Operational Definitions of the Key terms

Various terms used in the statement of the problem are defined operationally below:

Training Module: Module is essentially a unit of learning experiences. It can be defined as self- contained unit of structured learning experience to facilitate student’s attainment of a specific set of objectives. Therefore, module has many characteristics such as specific and small units, self instruction, individualized independent and self paced employing different types of media having specific steps ranging from objectives to evolution. The same definition of module is adopted in the present study.

Provocative Operation (PO): in the present study, it refers to provoking operation, proactive operation or provocation operation. It is an extraction from words such as hypothesis, suppose possible and poetry of all of which indicate forward movement and
contain the syllable “PO”. So it suggests forward movement i.e. making a statement and seeing where it leads.

**Thinking** – A pattern of behavior in which we make use of internal representations (symbols, signs etc.) of things and events for the solution of some specific, purposeful problem is the definition of thinking adopted in the study.

**Lateral Thinking:** It is low probability sideways thinking. It will address to fluency, flexibility, elaboration and originality. Edward de Bono defines it as method of thinking concerned with changing concepts and perception. It is about reasoning that is not immediately obvious and about ideas that may not be obtainable by using only traditional step by step logic. The term lateral thinking has been defined in the same context in the present study.

**1.5.3 The Objectives of the Study:**

The major objective of the study was to find out the effectiveness of training module in Provocative Operation on lateral thinking of student teachers. However to fulfill the said objective, the objectives were delineated as under:

1. To develop and standardize the training module on Provocative Operation method for the development of lateral thinking.
2. To develop and standardize a lateral thinking test.
3. To study the effect of the training module on lateral thinking abilities of student teachers.
4. To develop a willingness scale.
5. To find out the willingness of student teachers towards the module.
6. To develop a reaction scale.
7. To find out the reactions of student teachers towards the training module.

**1.5.4 Hypothesis of the Present Study**

Although there are a lot of research evidences to show the effectiveness of training modules and self instructional programs and teaching strategy (Singh (1985), Gill
(1990), Talegaonkar (1984), Patel (1987) etc. over the traditional methods even in field of creativity, divergent thinking, researcher could find no directional evidence of research in lateral thinking. So in the absence of the same and in order to achieve the objectives of the study, a null hypothesis is framed as they are the only testable form of hypothesis. Following is the hypothesis framed

“There is no significant effect of Training Module in Provocative Operation on Lateral Thinking of Student Teachers”

1.5.5 Delimitations of the Study

The study has its delimitations with respect to title, sample selected, experimentation process and treatment applied. Apart from this, other delimitations of the study are:

1. The study applied only one method i.e. PO method along with its strategies. There could be some other effective methods also to develop lateral thinking.
2. As already mentioned the study has adopted the definition of lateral thinking as given by de Bono. The basic components of lateral thinking, considered in the study i.e. escape, originality, and outrageousness were also adopted from De Bono’s work.
3. The experiment continued for nearly full session. Student-teachers may have received some extra information or knowledge about the method during this period.
4. The home environment, marital status and age of the student-teachers were not included in the study. Further, viewing television or other gadgets by student-teachers for developing lateral thinking were not the part of study.
5. The sample was selected from a private, teacher education, women college located in an urban area.
6. The other variables like use of computers, internet and extra study materials available through any other source, that may have affected the thinking process have not been accounted for.
7. Various extraneous variables might have affected the results. The variables that the researcher could not think of, or the variables which were beyond the control of the researcher, have not been included in the study.
8. The study is also limited to teacher variable. Teachers of varying aptitude, with
different culture, ideologies and background, teaching the student-teachers have not
been taken care of. This variable has neither be controlled nor matched for different
groups of student-teachers.