CHAPTER ONE
INTRODUCTION OF THE PROBLEM RATIONALE OBJECTIVES
AND HYPOTHESES
EFFECTS OF PATTERNS OF TEACHING UPON CREATIVE THINKING AMONG ADOLESCENTS

CHAPTER I
INTRODUCTION OF THE PROBLEM, RATIONALE, OBJECTIVES, AND HYPOTHESES

1.1.0 The Present Study

The present study entitled 'Effects of Patterns of Teaching upon Creative Thinking among Adolescents' aims at testing the effect of two techniques of developing creative thinking among the school students. These techniques are: (i) Morphological analysis developed by Zwicky (1969) and (ii) Brainstorming developed by Osborn (1951). Generally, such methods of developing creative thinking have been used in Industry, Army, Business, Administration, Advertising, etc. Very recently, the emphasis in Education has shifted in favour of developing creative thinking. It is in this context that the present attempt ventures to study the possibilities of teaching for developing creative thinking among school students.
The experimental treatment in this study has been the introduction of the techniques of Morphological analysis and Brainstorming. The criterion variables have been (i) general creative thinking, (ii) creative thinking in geography and (iii) school achievement in geography. The present chapter introduces the problem with the help of the following captions, namely, Background of the problem, Creativity, Classroom climate and creativity, Can creativity be deliberately developed?, Different techniques of fostering creative thinking, Morphological analysis and creative thinking, Brainstorming and creative thinking, Rationale for the study, Statement of the problem, Objectives of the study, Hypotheses and Plan of reporting.

1.2.0 Background of the problem

Identifying human talents of high level and developing them still further help the nation for its quicker development in various spheres. Manpower if properly utilised becomes the wealth of a country. Unused natural resources like minerals will remain as such without being wasted, if left unutilised, but human resources are wasted if left unrealised untrained and unutilised properly. A nation's educational system plays an important role in achieving the above objectives.
Cognising the imitative attitude, both at teachers' and students' levels, the tendency of not inducing original thinking among our students, the Education Commission (1964-66) remarked that Indian standard of education at all levels was not comparable with international standards. The Commission aspired that at least, at certain fields Indian standards should be at par with international levels.

Original and creative thinking among students and teachers, in their pursuit of knowledge, determines the standard of education, especially at the higher level. Failure to develop creative thinking in students is a loss not only to the individuals, but to the nation at large. In India, at present, as Tripathi (1969) said 'we have to produce leaders who do not fall back on the old patterns of thinking, but persons with vision who could boldly face the problems and find solutions to the challenges'. Taylor (1964) has aptly pointed out that because creative acts affect enormously not only scientific progress but society in general, those nations who learn best to identify, develop and encourage the creative potential in their people may find themselves in very advantageous position. Because highly creative people are an asset to the institution or organisation or to the nation at large, they cannot be
substituted by any number of second rate personnel. Conant (1959) has expressed a similar opinion when he said that ten second rate men are no substitute for one first rate man in science. It is quite agreeable to other fields also. Emphasising the duties of education in developing and preserving creative thinking, Faure et al. (1972) in their report of the International Commission on the Development of Education have said, 'Education has the dual power to cultivate and to stifle creativity. Recognition of its complex tasks in this domain is one of the most fruitful intellectual achievements of modern psychopedagogical research. These tasks may be described as preserving each individual's originality and creativity without giving up the need to place him in real life; transmitting culture without overwhelming him with ready made models; encouraging him to make use of his gifts, aptitude and personal forms expression without cultivating his egotism; paying keen attention to each person's specific traits without overlooking the fact that creation is also a collective activity'.

The ability to produce novel and workable ideas and solutions to given problems has to be developed among students from the early ages. Torrance (1962) said that there was rather a general consensus that the childhood years have been critical ones in the development of creative talent.
There have always been outstanding examples of creative achievement at a tender age. Newton spent his childhood making water clocks and windmill models, James Hillies constructed his first microscope as a boy, Pascal wrote his famous essay at 16, the great mathematician Karl Friedrich Gauss after performing distinguished work at 15, developed his method of least squares at the age of 18, Samuel Colt started working on his idea of the revolver at 16, at 19 George Westinghouse invented a device for replacing derailed cars. Again Torrance (1962) rightly emphasised that creative child should be identified early, since, the peer group exercises severe censure against him. He also said that educators should develop creative thinking in all children because it is associated with positive mental health, vocational success and social welfare.

As Torrance (1962) has pointed out, education is concerned about the mental health of the students, teachers and in general all. In fact creativity has to do a great deal with this. It is the most valuable resource in coping with life's daily stresses. A number of writers have called attention to the healing values of creative activities. Wilt (1959) in E.P.Torrance (1962) for example maintained that there
was therapeutic value in permitting a child to tell his own story in his own way. Such creative activities, she believed would provide children under stress a legitimate, socially acceptable way to reduce the pressure. Kubie (1958) in E.P. Torrance (1962) however insisted that under appropriately devised circumstances creative activities could be used as one ingredient in the therapeutic process. Hebeisen (1960) in E.P. Torrance (1962) found that schizophrenics manifested astonishingly impoverished imagination, inflexibility, lack of originality and inability to summon any kind of response to new problems. According to Torrance (1962) it may be either because they who 'break down' under stress constitute one of the most imaginative, non creative groups to be found or because it was lack of their creativity rather than its presence which brought about their breakdowns. The above hypothesis was again confirmed by Garfield (1971). His study also indicated that improvement in group psychotherapy correlated significantly with gains in ratings on the more dynamic aspects of creativity. Creative thinking proved to be a valuable outlet for the stresses, tensions and frustarations which manifested in all, at all ages and particularly so at the adolescent period.

Creativity is not reflected merely by high intelligence. Torrance (1962) found in the University of Minnesota Elementary School experiments that when creativity and intelligence
tests were administered, the top 20 percent of the highly creative students were different from the top 20 percent of the intelligent students. The monumental study of Getzels and Jackson (1962) has highlighted the fact that if selection is based on intelligence alone, at least two out of three of those persons best fitted to be the scientific leaders of the future will be missed. Passi (1971) found that 77 creative students out of 120 (64 percent) would be ignored if top 20 percent students selected on the basis of intelligence were termed as creative. The study of Bentley (1966) indicated how creative students in the classroom were affected. He found that creativity test scores and achievement scores correlated significantly with divergent thinking and evaluative scores and no correlation was found between the creativity scores and memory scores. He concluded that since the present day examinations favour memory and cognitive abilities, the creative students of the classroom are highly penalised.

Creative approach to teaching is helpful to the teachers in their profession. Teachers are to give adequate importance for the development of the creative thinking because it helps in keeping the students sufficiently motivated for their studies. Rubin (1963) in E.P. Torrance (1965) said that a number of contemporary learning theories stressed the point that young children drove a powerful impetus to learning from their tendency to explore unknown situations, sought challenges
which made use of freshly won skills and deliberately found problems at the edge of their capacities. The study of Carlson (1974) confirmed this view. He explored the effect of a specific programme, planned, implemented and evaluated with a young learning disabled child. By focusing on strength in creative thinking abilities and activating evaluative effort on the part of the child, he found that out of 10 measures used in the study to assess change in academic achievement five gave results indicating a change in a positive direction, that was improvement.

Creative teaching is economical. But somehow or other, a wrong notion has crept into the teachers that teaching by authority is economical. But recent experiments by Moore (1961), Ornstein (1961) have shown clearly that many things can be learned creatively, more economically than that can be by authority.

It has also been accepted now that creative thinking is inevitable for the success in any profession. Wallace (1960) found sales women who were successful in their profession scored significantly higher on tests of creative thinking. It may be because creative individuals can accomplish much more at much less expense than other people.
Considering the present position of research in the field of creativity in our country and visualising the importance to be given for this area of knowledge, the NCERT Working Group (1975) has emphasised the need to take up researches in teaching style, the classroom and the environment in fostering creative thinking. The same group also recommended that a 'Creativity Education and Research Unit (CERU) be established at the National Council of Educational Research and Training, (NCERT). The Indian Council of Social Sciences Research (ICSSR) has placed 'Creativity' as one of the priority areas in the psychological research. In this connection it is fit to quote Raina (1975) who remarked that Research in creativity is not a luxury that can wait till better times. It is during crisis that we need creatively intelligent approaches of creative the people to face various problems.

From the above discussion the importance of creative thinking in man and the significance of developing it to the maximum possible level in students has been made clear. As Taylor and Williams (1965) put it, it is high time that creativity should become one of the major objectives of education and that suitable classroom materials are to be prepared for its development.
1.3.0 Creativity

The efforts to understand the creative thinking started in the first quarter of this century. Terman, Flanagan, Taaffe, etc. continued working in this area at that time. Educationists took a great interest in the intriguing field of creativity in U.S.A. around 1950. Thurstone, Taylor, Guilford and their associates were the pioneers in this field. Between 1957 to 1961 Buel, Flanagan, Harman, Sprecher, Steltz, Smith, Chiselin, Sheets, Cochran, Torrance, etc. conducted a number of studies on creativity and contributed much to the knowledge of creativity.

A series of national conferences held at the University of Utah during the later part of Nineteen fifites gave impetus for the further researches taken up in this area. By 1960 several attempts were made for the creativity education. Reputable private as well as governmental agencies like the Carnegie Corporation of New York, the Institute of Personality Assessment and Research of the University of California, the Creative Education Foundation, University of Buffalo, New York and numerous such important institutions and agencies became involved in supporting and fostering large scale research in this field.

Like many other concepts, educationists and psychologists do not have consensus about the definition and meaning of
creative thinking. There are several definitions put forward by many researchers which differ from one to other slightly or to a great extent. Vinacke (1952), Ghiselin (1963) and Zimmerman (1964) realised the difficulty in arriving at a universally accepted definition of creativity and felt that different meanings to the term creativity could be assigned by different workers in the field. DeHaan and Havinghurst (1961) reported the efforts of Wilson who tried to focus the diversity in meaning of creativity process as below:

1. The outflow of individual or group through which a product is structured.

2. An action of the mind that produces a new idea or insight.

3. The mental process of manipulating the environment which results in the production of new ideas, patterns or relationships.

4. The capacity to produce through thought or imagination, the capacity for original work.

5. The emergence in action of a novel rational product, growing out of the uniqueness of the individual on the one hand and the materials, events, people or circumstances of his life on the other.

6. The mental process that involves the rearrangement of past experience with possibly some distortion, into new patterns to better satisfy some expressed or implied need.

7. The process which results in a novel work that is accepted as tenable or useful or satisfying by a group at some point in time.

8. The creative process is any process by which something new is produced - an idea or an object including a new form or arrangement of old elements. The new creation must contribute to the solution of some problem.
Good and Markel (1959) described creativity as a quality thought to be composed of a broad continuum upon which all members of the population may be placed in different degrees. He tentatively described the factors of creativity as associational and ideational fluency, originality, adaptive and spontaneous flexibility and ability to make logical evaluation. DeHaan and Havinghurst (1961) on the basis of Guilford's factorial studies observed that creativity included seven factors, namely (a) sensitivity to problems, (b) associative fluency, (c) ideational fluency, (d) spontaneous flexibility, (e) adaptive flexibility, (f) originality and (g) redefinition.

DeBono's (1970) lateral thinking is closely related to insight creativity and humour. It is an indefinite way of using the mind as logical thinking, but a very different way. He says that lateral thinking is an insight tool. It is concerned with the generation of new ideas. Vertical thinking is concerned with proving or developing concept patterns. Lateral thinking is concerned with restructuring such patterns (insight) and provoking new ideas (creativity).

The two best definitions of creative thinking of the Utah conference statement, according to Taylor (1964), are that of Ghiselin and Lacklen. Ghiselin proposed that the measure of creative product is the extent to which it
restructures our universe of understanding. Lacklen (1957) uses the extent of the area of Science that the contribution underlies: the more creative the contribution, the wider its effects. The working definition of creativity by Stein (1953) is that a process is creative when it results in a novel work that is accepted as tenable or useful or satisfying by a group at some point in time.

The process based definition of Torrance (1964) is that creativity is the process of sensing gaps or distributing missing elements forming ideas or hypotheses and communicating the results, possibly modifying and restructuring the hypotheses. Barron (1969) opined that creativity is energy being put to work in a constructive fashion.

Having perused the various definitions of creativity, Mackinnon (1970) explains that many are the meanings of creativity. Perhaps for most, it denoted the ability to bring something new into existence while for others it is not an ability but the psychological processes by which novel and valuable products are fashioned. For still others creativity is not the process but the product. Definitions of creativity range all the way from the notion that creativity is simple problem solving to conceiving it as the full realisation and expression of all of an individual's unique potent abilities. One would be ill advised to seek to choose from among these several meanings the best single definition of creativity, since creativity properly carries all of these meanings and many more besides. Creativity is indeed a multi-
faceted phenomenon. Though quite a number of meanings and definitions of creativity were put forward, it is clear that the recent trend is to accept creativity as a multi-dimensional ability, which is a complex, universal human attribute manifested by the cognitive empirical process and is differentially distributed among different people. Passi (1971) influenced by the definitions of creativity given by Good and Markel, Guilford and Torrance defined creativity in his own way. According to him 'Creativity is a multi-dimensional (verbal and non-verbal) attribute differentially distributed among people and includes chiefly the factors of seeing problems, fluency, flexibility, originality, inquisitiveness and persistency'.

The various definitions of creativity can generally be grouped into four approaches, such as, person, process, press and product. Rhodes (1961) writes that creativity may be considered from the standpoint of the person (i) who creates, that is in terms of physiology and temperament, including personal attitudes, habits and values, (ii) mental processes, such as, motivation, perception, learning thinking and communication, (iii) environmental and cultural influences, and finally (iv) products such as theories, inventions, paintings,carvings and poems.

The studies undertaken by Roe (1951, 1953), Barron
(1956, 1958) and Clark (1957) were based on the approach of person in creative thinking. Eminent individuals were nominated by peers in their field of endeavour. In these studies the achievement of the creative persons were the central point, which again measured indirectly the production of these individuals. Barron (1969) wrote that in the creative person one could clearly see at work the forces and forms that characterised the creative process in general. Indeed a person is a form in process and the evolution of the self in a creative person is an instance of the creative process in nature. Relationships between persons also may set the creative process in motion. The comment of Brogden and Sprecher (1959) is worth quoting here. They said that the distinction between persons as seen through products and persons as seen through their processes might be somewhat an arbitrary one but it was useful.

The term process is often used in contra-distinction to product. It refers to aspects of, on the job behaviour that are necessary in order to achieve products. According to Brogden and Sprecher (1964) process variables are not on their face, at least criterion variables. They do not, in other words, have any social value and they do not contribute directly to stated objectives. On the other hand it is Sprecher's (1959) belief that process measures may
well be involved in ultimate criteria. If some one produces valuable ideas with ease, he seems to be more creative than the individual who produces comparable ideas by dint of perseverance and hard work. How a product or end is achieved is the tremendous social importance. Torrance's approach of creativity as defined earlier is on the process nature.

The product approach emphasises the concrete outcome or the tangible production of something creative. A person is called creative because he has produced some creative thing tangible. As discussed earlier a product may be a theoretical system of a design or physical object or an article or patent, etc. Any way the distinction between the creative product and the creative process is widely recognised now. According to Rogers (1954) that assessment of product is much more important and acceptable for several reasons than the assessment of the process. One reason is that the product is far more tangible.

The press approach is the environment and cultural influences upon creative thinking. They include educational setting, working conditions, climate, training programmes, home environment, etc. These external influences can enhance or hinder the development of creative thinking. Whatever may be the different approaches towards creative thinking, the recent trend is to analyse creativity as a mental and
emotional process, an approach that is all the more demanding and subtle because much of its subject matter lies in the inner state of creative person (Kneller, 1965). Having perused the different definitions and approaches of creative thinking, the investigator accepts the definition put forward by Passi (1971), that is 'creativity is a multi-dimensional (verbal and nonverbal attribute differentially distributed among people and includes chiefly the factors of seeing problems, fluency, flexibility, originality, inquisitiveness and persistency.

1.4.0 Classroom Climate and Creativity

Environment is one of the major factors which enhances or curtails the development of creativity. Many studies have demonstrated that the findings were in favour of this hypothesis whereas a few were contradictory to this. In the following paragraphs a brief discussion of the development of creative thinking with respect to socio economic status, teacher's personality, behaviour, open mindedness, attitude and rewards are made.

Ogletree and Wilma (1973) found from a study of 1165 primary school children of England that creativity scores were a function of socio economic background. They also said that in all countries children of upper class families...
obtained significantly higher creativity scores (verbal and nonverbal) than children of middle and lower class families. The same significant difference was evident in middle class children and lower class children. There was no evidence to support this contention that youngsters of lower class background performed better on nonverbal tasks than on the verbal tasks.

Teacher's personality traits also play an important role in influencing the development of creative thinking. Gallagher (1966) reported that there were numerous indications that only slight changes in style and approach could modify the child's output in terms of originality and uniqueness on tests. Gallagher and Achner (1963) found that the number of questions requiring divergent thinking asked by the teacher in the social studies classes of gifted children determined the proportion of divergent thinking expressed by the students. Spaulding (1963) found that students' feelings and performances were related to the affective and emotional atmosphere developed by the teacher as measured by time sampling observation of the teacher in the class-room. He found that the teacher was an important figure in the development of both cognitive processes and personality characteristics in children. The above finding was supported by the study of McNary (1967). An investigation was made by him to see the relationship
between teacher characteristics and the degree of change shown by gifted elementary pupils in convergent and divergent thinking areas. Convergent and divergent tests were administered over one academic year. A series of multiple regression equations were calculated. It was found that the teacher personality traits were the most effective of the change producing variable and that different types of teachers influenced different areas of growth.

The study of Wodtke and Wallen (1965) gave strength to the above point. They reported that a high degree of controlling behaviour by teachers was detrimental to verbal creative performance. Torrance's studies have also demonstrated that dominancy of the teachers mar the creative thinking of the pupils. Torrance (1966) found that 43 percent of those potential dropouts indicated that they were afraid to ask questions to their teachers among the 45 seventh graders nominated by their teachers as likely dropouts. Asking questions is the minimum of the student's participation in the classroom activities compared with other direct ways of students' participation. If that too is not possible, the students are helpless to think independently.

In a laboratory study conducted by Penick (1974), the physical facilities and the available science materials were held constant, while teacher behaviour was manipulated to
form two distinct patterns. These teaching patterns were referred to as Student Structured Learning in Science (SSLS) and Teacher Structured Learning in Science (TSLS). One way analysis of variance of the students' observational data revealed that the two classes did, on the average, behave differentially. While students in both the classes exhibited comparable amounts of lesson related behaviour, TSLS students showed behaviour of dependency on the teacher.

A four year study was conducted by Weber (1968) to test the hypotheses that indirect teacher behaviour foster pupil creativity more than do direct teacher behaviour. Results suggested that verbal creativity was fostered more under the influence of indirect teacher behaviour and that figural creative potentialities were encouraged more under the influence of consistent patterns of teaching behaviour. From the above it would seem then that consistently indirect teaching behaviour would encourage the growth of both verbal and non figural creative expression and scholastic achievements also.

A study conducted by Bary (1974) tried to see the effects of teachers' open-closed mindedness as a predictor of student creative progress. A teacher sample consisting of 112 second grade students stratified equally by sex from each class of the teachers receiving 10 highest and 10 lowest scores on the Dogmatism Scale were put into a pretest
posttest control group design to examine the treatment of dogmatism on student creative progress. Findings indicated that there was a significant difference in the creativity development of children of high and low dogmatic teachers. In an Indian study undertaken to find the relationship of school climate and creativity, Goyal (1973) reported that the more the 'open system' of education and the more 'responses' and stimulating environment in school' the more would be the evidence of the development of creativity. The results also suggested the need for changes in the curricular programmes of the school and better selection and training practices of teachers.

The development of creative thinking in the students, depends upon the attitudes of the teachers also. Studies are found in the related literature to support this point of view. Ray (1974) obtained data from a selected sample of 147 fourth grade and 156 fifth grade students and 40 fourth and fifth grade teachers from a small New England working class school district. Findings led to the conclusion that the teachers in the sample, whose educational attitudes were progressive, tend to think that behaviours considered important for a productive creative personality should be encouraged and teachers whose educational attitudes were traditional tend to think that behaviours considered not important for creativity should be encouraged.
In this context it is interesting to note the study of Marrinan (1974). He designed an experiment to explore psychological class-room climate in which creative students' functions and relationships were examined between teachers' preference for certain teacher abilities and judgements, peer judgements and perceptions and students' self ratings. One of the findings showed that the teachers did not prefer students similar to themselves in creative thinking abilities. In fact they preferred nearly equal number of high or low creative students. In a different attitude study, Gruber (1974) conducted an experiment to find out the effect of a course in basic science processes on attitudes and creative behaviour of teachers. Data from two measures of attitudes, one measure of science processes and one measure of creativity were collected. Gain scores on all the four variables were also calculated. In a control group design 21 early childhood students were experimented with a basic science process course. The results indicated that the experimental group experienced greater positive change in openness and science process competence than the control group. Significant correlations between teachers' attitude towards students' originality, science process competency and openness at the .05 level were obtained even though there was no overall creative behaviour change between the two groups.
Teachers agree that free congenial classroom climate is more suitable for the development of creative thinking in the students. Treffinger and others (1968) conducted an attitude study. About 250 teachers and administrators from all grade levels of an urban area attended a four day institute in creative problem solving. The problem consisted of one hour formal presentation on current theory and research in creativity and problem solving and discussions of the presentations. A 14 item Likert type attitude scale was administered before and after the programme. It was found that more teachers agreed with the statements like '(i) The creative child is not likely to well liked by his classmates', (ii) It is possible to improve students' ability to think creatively and to solve problems and more teachers disagreed with the statements like '(i) our efforts to improve creativity are in vain because it is probably a national strength'. It was concluded that such in-service programmes are valuable in developing increased understanding of creativity. Rosenthal and others (1974) conducted experiments in a predominantly black inner city school. The results revealed that greater gains in creativity scores were made by children whose teachers behaved in a more motivated, more child centred, more professional and more encouraging manner. Branch also (1974) found in his study of 15 classes of fifth grade and 15 classes of first grade in a large urban school system in Georgia that classrooms having nurturing conditions for creativity had positive statistical relationship with creativity test scores.
Torrance's studies about the classroom climate and creativity were of different nature. Torrance (1965) conducted a number of experiments about classroom climate for creativity development and reported that engaging in a large variety of creative activities may result in greater word fluency. He also found that differential rewards influence originality of thinking. If rewards were for correctness or for quantity with secondary attention to originality it worked against the production of original ideas. In an inter-cultural study to understand the fourth grade slump in creative thinking, Torrance (1967) reported that discontinuities in development occur in most cultures and concluded that there was evidence to suggest that they were associated with the imposition of additional social demands. He also reported that the conformity studies revealed an increased tendency for children to consult with their peers at about fourth grade and the longitudinal study confirmed the existence of the slump in individuals.

The above discussion reveals that the creative thinking of the students to a great extent depends upon the teachers' personality and behaviour. His position in the classroom is vital and this makes the whole environment congenial or uncongenial for the creative thinking of his pupils. But a few studies are also found in the related literature which point out a negative view. Stein (1955) reported that parents
of high creative subjects had not gone as far educationally as parents of his low creative subjects. Further more he reported that the socio-economic status of the parents of his high creative subjects was not so high as that of low creative subjects.

There are certain other studies found in the related literature which also showed a negative point of view. Humes (1975) investigated the relationship of selected teacher characteristics to the development of specific component of young child's divergent thought. Results of the study showed significant gains in only one of the measured components of divergent thought. To test the development of creativity which has been frequently claimed as one of the advantages of open education, Ruedi (1974) compared the fourth, fifth and sixth grade children of traditional and open environment schools. He found scant support to the belief that open environment would tend to more creativity. Only one F-ratio of the factors involved was significant at .05 level to be higher for the subjects of the open sixth grade.

From the above discussion, it can be seen that proper environments with regard to socio-economic status, teachers' personality, behaviour, open mindedness, attitude, rewards to students, etc. affect the development of creative thinking
in students. It is also found that there are a few studies that demonstrated conflicting results. But they are negligible in number, when compared with the enormous number of studies that favour environment as an ingredient for creative thinking.

1.5.0 Can Creative Thinking Be Developed?

As Parnes (1962) has said, it is true that the studies of creativity is too immature to say exactly what happens in a person who studies and practices the principles of creative thinking. But the knowledge about creative thinking has led to the hypothesis that it can be identified by proper tests and developed deliberately. Several attempts have been made in which deliberate practices and environment were provided to find out the results. In the following paragraphs some of such studies are discussed.

In 1972 Torrance recorded that 72 percent of the total number of one hundred and forty studies dealing with the various ways of teaching for creative thinking have shown success in fostering this ability. The Creative Education Foundation, Buffalo, conducted a series of studies involving a number of students and other executives. Students and others of the control group of these studies showed relatively insignificant gains on the criterion tests. Besides
the specific findings Parnes, (1962) the director of the foundation, also noticed that creative problem solving courses were found to be equally helpful to students of low and high initial creative ability and equally helpful to those with low and high intelligent levels. In an interesting study conducted by Schuler (1973) one of the hypotheses tested was that those fifth grade students who were poor in problem solving and high in school anxiety, if trained to solve problems, would develop greater confidence and show decrease in school anxiety. This study revealed that very small initial relationships were found to exist between school anxiety and problem solving skills. It was also found that students who received training in problem solving showed slightly higher gains in valuation of problem solving activities.

Callahan (1973) spoke of a New Connecticut Mark I Creative Programme. In this study an attempt was made to find the effects of the above programme on creative thinking of sixth grade students. The results indicated that there was a trend towards high mean scores for experimental group. Amran and Giese (1969) reported that creativity training gave the under achiever the motivation and skill to solve his own problems by showing him the procedures of problem definition and solution. For this study a six week training for the 63 students of average ability but with meagre cultural backgrounds, was given in becoming aware of
surroundings and experience noting habits and functional
fixations, finding idea-spurring questions, listing, modi-
ifying and attributing, for stimulating imagination. From
this study, it was inferred that creativity training should
be included in the school curriculum particularly for the
socially handicapped.

It was found from certain studies that some mental
abilities that contribute for general creative thinking
can be developed by way of training. Three studies were
designed by Amram and Giese (1965) in order to study whe-
ther creativity can be measured and taught. Results of
these studies indicated that the students in the class-
rooms, by training could gain originality. Ridley and
Birney (1967) experimented 159 college freshmen males,
for the effect on original behaviour as measured by two
tests from Guilford's originality test battery. Major
hypotheses based on previous literature were that all
variables would significantly facilitate performance on
Plot Titles Test. The results confirmed the hypotheses.

In a carefully controlled experiment, Maltzman and
others (1958, 1960) studied the effects of training on
originality. They found that training in the production
of responses low in an individuals response hierarchy,
increased originality of verbal associations and that the
effect of such training tended to endure at least under the
given experimental condition. Davis and Manske (1966) undertook a study to find out the effect of an instructional method for increasing originality. The college students served as samples. The investigator found that the experimental group of students produced good, more original and larger number of ideas compared to the students who did not receive the treatment.

In order to develop the ability of elaboration, Weinstein (1975) conducted an experiment. The experimental subjects participated in a series of five, one hour elaboration skill training sessions administered at approximately one week interval. The results of the experiment revealed significant mean differences in favour of experimental group. Alencar (1974) studied the effects of a creativity instructional programme (the Purdue Creative Thinking Programme) on 4th and 5th grade public and private school pupils' creative thinking abilities. In the experimental conditions, after the reading of a story about a famous American Pioneer, by the teacher, the pupils worked on some creativity exercises. A pretest posttest parallel form design of experiment revealed that, (i) the Purdue Creative Thinking Programme had a positive effect on the development of pupils' creative thinking abilities. The pupils from the experimental classes scored higher than controls on figural fluency, flexibility and originality for the task unusual uses,
(ii) Reinforcing pupils' performance on the creativity exercises did not result in greater gains from the programme than using it without reinforcement, (iii) Differences among classes within treatments were observed for figural fluency, flexibility and originality for the task 'lines' and verbal flexibility and verbal originality for the task 'unusual uses'. Thus treatment could not be assumed to be uniformly effective for all the participating classes.

Certain studies have been reported using programmed materials for the development of creative thinking. A controlled experiment was conducted in forty-four fifth grade classrooms to investigate the extent to which creativity and problem solving skills of children could be nurtured through a series of self instructional programmed lessons by Wardrop et al. (1969). Significant differences were found favouring the experimental group which received the programmed lessons. Improvements in productive thinking skills were found for both boys and girls of both higher and lower I.Q. Olton (1967) investigated mainly the extent to which thinking and problem solving of fifth grade students could be improved by the use of self instructional programmed lesson. (The Product Thinking Programme). A total of 704 students participated in this project. It showed statistically significant increments in thinking and problem
solving performance on a wide variety of productive thinking measures. These instructional benefits occurred for virtually all types of students regardless of sex or general I.Q. level and were especially marked for students in classrooms having environments which were judged to provide relatively little support and encouragement for the development of productive thinking.

An intriguing technique for stimulating originality in the classroom has been developed by Covington and Crutchfield (1965). They devised auto-instructional programmes composed of detective and mystery story material which they gave to fifth and sixth grade children. The results revealed that the subjects who used the programmes markedly outperformed controlled subjects on certain problem solving, creativity and relevant attitude measures. These findings were replicated in a second study also.

Some attempts were also made to study the effect of the use of visual instruments upon creative thinking. Lindgren (1967), Belcher (1973), etc. were some of the pioneers in this respect. Belcher (1973) demonstrated the feasibility of using film-mediated models to engender creative (original) verbal responding in children. The purpose was to examine whether observational learning has a visible training effect with regard to creative behaviour and even more importantly
whether the potency of the effect exceeds the more commonly employed media of written instruction. Six groups of equal size were employed with a total sample size of 187 eighth graders. Two groups viewed the experimental film two were the controls and two read the creativity training programme. One group in each of the three pairs received a pretest while the other did not, to determine if there was a testing effect. The results indicated of the three groups taking the pretests and posttests, the two experimental groups (film and reading) showed a significant positive effect of fluency from pre to post test.

Khétena (1973) conducted a study to find out the effects of his creative thinking strategies with children, between the ages of five and eleven to think creatively. Teachers were trained for these patterns of teaching. The two groups randomised subjects post-test only design was used. The results showed that the children under training to think creatively with pictures had significant influence on their productivity in terms of figural flexibility, originality and evaluation, especially so at the kindergarten and grade one levels for the three abilities.

Covington (1968) described a research programme at Berkely for developing curriculum programmes aimed at promoting the general level of creative thinking among elemen-
tary school children. After pilot tryouts and several full-scale experimental studies, the General Problem Solving Programme (GPSP) was constructed with a series of sixteen creative tasks in miniature for the fifth and sixth grade levels. These problem episodes acted as a vehicle, by which the student practised a number of broad rules and strategies concerned with facts of effective problem solving. The author reported that in general the outcomes of the various studies employing the GPSP have been highly consistent. The performance of the instructed children was markedly superior to that of the control children both on the tests of problem solving ability and on the tests of creative thinking.

Colgrove (1967) reported a stimulating creative problem solving performance, that was an innovative set for the development of creative thinking.

Some studies are found in the related literature about the training given for teachers to see the effects. Mohan (1973) developed a course in creativity for teachers which was reviewed by teachers and researchers. The need for the course was assessed by surveying 180 graduate students and senior students in teacher education and 70 experienced teachers. The effectiveness of the four inservice creativity workshops was surveyed. It was concluded that such a course was needed.
Attempts were also made to give some kind of training for the changed behaviour of teachers in their classrooms for the development of creative thinking in students. Williams (1973) reported a novel method which was known as 'Operation Snow Fall' introduced and sponsored by the U.S. Office of Education. The purpose of this 'National School Project' was to try the entire staff of selected elementary schools throughout the country on methods, procedures and techniques for developing intellectual creative talent among young children. Teacher inservice training was conducted across a basic model of Williams (1966). Materials and techniques utilising the teaching strategies were demonstrated to inform teachers how a particular subject matter area could be taught as a means for guiding pupils to think. Williams remarked that each project school was allowed to select their own subject and specialisation for training. Once teachers were shown how to become comfortable in this mode of teaching in the one selected subject area using new materials via the various teaching strategies to develop pupils productive divergent thinking process, they would be then encouraged to experiment on their own, using the same strategies with other materials across the whole curriculum. In this manner, the entire elementary school programme was being modified and all of the teachers from kindergarten schools through sixth grade in each of the project were being trained and worked together to innovate and experiment with ideas for developing intellectual creativity.
Williams again said that experiences with this pilot project indicated that in-service training should be continued in the operational phase to improve the teachers' familiarity with those progressive educational strategies.

Besides the training for teachers, training for administrators also was found to be successful. Wilson (1972) studied the effects of the pre-service creativity training on the creative abilities of prospective teachers and their pupils. He found that the prospective teachers improved in fluency and flexibility during the training period and originality and personal worth during student teaching. He also found that the pupils improved in fluency, flexibility and originality but declined in elaboration. Irving (1973) tried to evaluate the effect of creativity training for the chairmen. In a pretest posttest control group design, seventy four high school department chairmen took part in the experiment. Eight week workshop programme in creative thinking and problem solving was designed for the participants. Results from the analysis of covariance yielded significant differences (P < .01) on six of the seven sets of scores. All differences were in favour of the experimental group.

Certain efforts have been made in India for the development of creative thinking among the children. In 1971, a 'Creative Teaching Unit' was established in the Aligarh Muslim University which was sponsored by the National Council
for Science Education. The purpose was, (i) to nurture a group of students and to compare the performance of the students in creativity tests, intelligence tests and University Examinations, with those taught through the traditional methods, (ii) to study the question of creativity in science and to develop specific courses materials and methodology for creative teaching utilising the best modern approaches in this field. This unit has floated a programme of innovation which is being tied with three batches of about 12 B.Sc (Hons) students each of whom has opted for Physics as his main subject. The experimental and the control groups have to follow a common syllabus. But the treatment is different. This open ended educational experiment will have its results after three or four years since it is a long longitudinal programme.

Making use of the research findings to educational causes, Torrance (1972) reported a new deliberate attempt put forward in U.S.A. to motivate 'readers' to think creatively. The new technique 'Gin Reading 360' has been a novel venture to facilitate creative functioning. Some of the stories, poems, illustrations, and graphic elements of the book have been arranged in such a way in this system that they try to motivate creative thinking among readers.

Apart from the reviewed studies, the findings of Rusch et al. is important for the educators. Rusch et al. (1967)
found in their study that fostering creativity did not have a negative effect on achievement. This result gives confidence to the investigators, that their attempts for the development of creative thinking may not in any way affect the students' achievement.

Contrary to the above discussion there are studies that showed no significant effect of training upon creative thinking. Brandt (1974) conducted an experiment which revealed that there were no significant treatment effects of group counselling and creativity training on creativity, adjustment and achievement of fifth grade children. Zelnick (1973) concluded from his study that creative learning experiences were not more effective in improving over all reading and arithmetic skills. Again Stern (1973) reported that the treatment of watching of special television programmes like cartoons, sports, comedies, dramas etc. were not effective for the development of creative thinking among mentally gifted minors. Instead, the scores of control group showed an increase in creative ability when the post test scores were compared with the pretest scores.

From the above discussion it can be seen that a number of studies have been attempted to see the effect of different programmes of fostering creativity. To summarise briefly, it is found, that training sessions of various types were conducted by Creative Education Foundation, Callahan, Amram
and Giese, Ridley and Birney, Davis and Manske, Alencar, etc., in which school students participated as subjects. The results indicated in general, higher mean scores for the experimental group on creative thinking and its components, such as, originality, elaboration, etc. Wardrop et al., Olton, Covington and Crutchfield etc. used programmed material in their experiments. The results found were favourable for the experimental group in problem solving and productive thinking abilities. Visual instruments were used by Lindgren Belcher, Khetena etc., for developing creativity in their experimental subjects. Fluency, figural flexibility originality and evaluation were found to be developed by the treatments through the visual instruments. Certain attempts have also been made to give creativity training to teachers and administrators in order to find the effect upon their students' creative thinking. Mohan, Williams, etc., who tried with this approach concluded that such training courses were needed for the teachers. Torrance reported the novel venture of motivating creative thinking among readers. Rusch et al., found that fostering creative thinking did not have a negative effect on achievement. Conflicting with the above results, Brandt, Stern, etc., found that their treatments were not effective for the development of creative thinking. From the above, it is seen, barring a handful of studies, others indicated that there are sufficient evidences for the hunch that creative thinking can be fostered.
Getting momentum from the results of various studies, different research workers in this field started working from different approaches for the development of creative thinking. This resulted in a number of techniques possible for the same. In the following paragraphs a brief discussion of some of the methods of creativity development will be made.

The earliest landmarks in this tradition are the creative problem solving courses instituted by Crawford in 1931. His method is now known as Attribute listing. To explain his method, in his own words, Crawford (1954) says that 'each time we take a step, we do it by changing an attribute or a quality or something or else by applying that same quality or attribute to some other thing. It is not only a method but an explanatory theory of creative process'. Attempts have been made to use this method in classroom situations. Raouf (1973) investigated the possibility of stimulating and developing creative thinking in junior high school students in science classes by employing Divergent questions, Attribute listing, Brainstorming, etc. It was found that creative thinking in students can be stimulated and developed by these techniques.

'Symectics' is another technique put forward by Gordon
Synectics methods represent a problem solving strategy approaching Brainstorming in its impacts. It emphasises the principle of making familiar things unfamiliar and unfamiliar things familiar. It is a state of mind disciplined for deliberate flexibility and imagination. Gordon talks about four mechanisms for making strange, each metamorphical in character. They are (i) personal analogy, (ii) direct analogy, (iii) symbolic analogy and (iv) fantasy analogy. According to him, without these mechanisms no problem stating and problem solving attempt will be successful. In personal analogy, members of the group achieve new perspectives on a problem by imagining themselves to be one of the problem objects. Fantasy analogy proposes ideal but far fetched solutions. The direct analogy describes actual comparison of parallel facts, knowledge or technology. The symbolic analogy is the statement of the implications of a key word selected from the problem or having some connection with the problem. Barron (1969) conducted a programme using this method in Goleta, California Public Schools. The immediate goal of the programme was to increase the creative thinking in the teachers and principals themselves. The long term goal was to enhance creative thinking in the students by changing the entire school climate through changes in the teachers and the administrators. From this study Barron concluded that the technique was quite useful in the training and research programmes.
'Bionics' as described by the Advanced Technology Staff (1963) Martin Company, Florida, is another technique using living things as engineering prototype. It is based upon the study of structure, function and mechanism of plants and animals. This approach involves three steps, such as, (i) study and description of the biological model, (ii) translation of the biological description into mathematical or logical models as far as possible and (iii) development of hardware models (usually electronic) from the mathematical models.

In the 'Check-list' procedure, students or members of the group have to consult the prepared list for the problem. Each item of the prepared list will be considered as a possible source of innovation in respect of the given problem. It is nothing but an organised and systematic consideration of each item on a prepared list as a possible innovative source relative to the problem at hand. The checklist starts with several questions which spur ideas. They could be as follows. Put to other uses? New ways to use as it is? Other uses if modified? Adapt? What else is like this? What other ideas does this suggest? Does past offer parallel? What could I copy? Whom could I emulate? modify, New twist?-----etc. Davis et al. (1969) have developed a checklist to stimulate idea for changing a product which includes items like, (i) add and or subtract something, (ii) change colour, (iii) vary materials, (iv) rearrange parts, (v) vary shape, (vi) change size, (vii) modify design or sign.
Haefele (1962) developed a technique called the Collective Note Book. A note book is given to all competent individuals. Every one records in his note book one to several times a day, his thoughts and ideas on the problem for a period of a month. In the last, he summarises his best ideas, suggestions for fruitful directions, other new ideas etc. At a specified time all hand over the note book to the co-ordinator. He carefully summarises the ideas.

Another method most extensively used both in human relations and engineering programme is 'Black Box Technique'. It is also known as input-output technique. The use of this technique is similar to the personal analogy of the Synectic method. (Gregory 1967). Little (Gregory 1967) developed a technique which is in some ways like a group Brainstorming. The difference is under this method, the group leader knows the exact nature of the problem under consideration but not the members. This is to avoid the ego-centric involvement and arriving at set solutions too rapidly. This technique is known as 'The Little Technique'.

'Organised Random Search' is another method introduced by Williams (1960). It can be called an innovation of Brainstorming technique. This method imposes an organisational method of problem analysis during the stage of ideation, in the place of random jumping around for ideas. The diver-
gent thinking is still possible in finding out solutions, within a directional pattern rather than hit or miss attack.

'Buzz Session' or the other wise known as Phillip's 66 was developed by Donald Phillips (Gregory, 1967). In this session the audience is divided into a number of small groups of about five to eight persons. Each group selects its own chairman and retires to a convenient place for discussion. At the appointed time they meet again, when the chairman of each group summarises its findings for the benefit of the audience.

The above are some of the techniques used for the development of creativity in different fields, besides techniques of Morphological analysis and Brainstorming. The description of these two techniques are given under caption 1.6.1 and 1.6.2. As said earlier, the techniques above discussed are useful to produce new ideas. But their suitability to the classroom are to be tested. Considering the feasibility of introducing the techniques into classroom situations, the investigator thought it fit to use the techniques of Morphological analysis and Brainstorming in the present study.

1.6.1 Morphological Analysis and Creative Thinking

The Morphological analysis as method of creativity development is fairly similar to attribute listing. This
method can be used to produce more combinations than any other. It gives an intrinsic investigation of all the possible combinations. Zwicky (1969), the father of Morphological analysis says that since the Morphological analysis leads to all embracing vistas and perspectives and also strives for perfect achievements, it is logically, artistically and ethically extraordinarily satisfying. The solution of any problem, derives with the aid of Morphological analysis methods affords the same pleasure and deep contentment as as the successful first accent of a difficult mountain peak. Zwicky (1969) gives the following instructions for the construction of the Morphological box (matrix) and the subsequent evaluation of the information that may be contained in it.

First step: The problem to be solved must be very concisely formulated.

Second step: All the parameters that might be of importance for the solution of the given problem must be localised and analysed.

Third step: The Morphological box or multidimensional matrix which contains all the potential solutions of the given problem is constructed.

Fourth step: All the solutions contained in the Morphological box are closely scrutinised, and evaluated with respect to the purposes that are to be achieved.

Fifth step: The optimally suitable solutions are being selected and are practically applied provided necessary means are available.
In this method the combination increases geometrically as the factors in each parameter increase. It involves combining the various attributes of the variables of a problem into a grid so that all possible combinations can be considered. Thus in this method all the solutions possible of any given problem are analyzed in a completely unbiased way. There is no chance of any circumstances being overlooked in the solution of the problem. This method can be applied to solve any problems with a hope of success. Zwicky (1969) remarks it will give a rich source of inspiration because it is not only technically fruitful but its pursuit is also very pleasant, in as much as one’s intuition is constantly being stimulated and new surprising and constructive ideas in all fields of human endeavour are continually forthcoming.

This method believes that every individual is a potential genius, and therefore it is suitable for all types of men in the intellectual hierarchy. This approach enables to systematise the inventiveness. It allows to make the problem solving methodically and in some cases automatically. Morphological analysis, as a method of creative problem solving, has been used in many other fields. Among the earliest applications of this method, the studies by Stanner (1952) on radio electronic surveying methods, the inventors of early yarn, and the famous 'Hallenca' stretch fabrics of textile firm, Heberlein and Company in Wattwill, Switzerland, (Zwicky 1969) have extensively investigated the various physical and chemical methods for processing individual
fibres, for instance nylon and silk. In collaboration with Fritz Zwicky the above group of Engineer Scientists also explored the totality of the methods. This approach to specific but many sided projects of this kind almost invariably yields technically and commercially important results.

Arnold (1962) described how a Morphological box can be formulated to the problem of getting something from one place to another via a powered vehicle. For this problem three independent variables possible are (i) vehicle, (ii) media in which the vehicle operates, (iii) power source. Each of these parameters will have some sub-variables like some kind of cart chairs, sling, bed etc., for the first parameter; and air, water, oil, hard surface, rollers, rail and a solid frictionless surface etc., for the second parameter; and the third variable, power source can be broken down into compressed air internal combustion engine, electric motor steam, magnetic fields, moving cables, moving belt and atomic power, etc. In this case $4 \times 7 \times 8 = 224$ combinations of solving the problem which are concrete than the average person could produce by any other process.

In the classroom situations, the following may be a geography problem for the teacher, wherein Morphological analysis can be used. Problem: What are the different energy systems possible for different purposes in North America? why
and why not?. For this problem the first parameter will be source of power, such as, water, coal, wood, atom, natural gas, petroleum, etc. The second parameter may be the 'system'. such as thermal power, hydro-electric power, oil power, gas power, atomic power, etc. For the third parameter the different purposes, viz. traffic, manufacturing industries agriculture, mining, household purposes, etc. may be the variables. The suggestions coming out of the morphological chart are like (1) Hydro-electric power can be produced, wherever water is available and used for manufacturing goods, (2) atomic power is used in sea traffic, etc. In the above example 6 x 5 x 5 = 150 combinations or more depending upon the variables are possible. Allen (1962) devised an aid which he named 'Morphologiser', which helps to relate the factors of each parameter. He has also approached this method through the establishment of upto eight parameters.

It shall be noted that with the aid of Morphological method it is not possible to solve all problems without further preparation. It must nevertheless be stressed that the Morphological analysis always opens up new vistas. The chances for success in dealing with various situations can generally be weighed if they are visualised. Success will not be achieved through Morphological analysis in the following three types of problems.
(i) Problems for whose solutions only small number of pegs of knowledge need to be known.

(ii) Problems for whose solution, pegs of knowledge are necessary that are as yet unavailable. This approach cannot produce miracles as long as essential pegs of knowledge are missing.

(iii) Problems that involve great number of parameters.

It shall be remarked here that as Davis et al. (1969) points out, it is also possible, however, a rigid application of this procedures conceivable might prevent a thinker from approaching a problem from different but more imaginative perspectives. But it happens very rarely in problems relating to classroom situations.

1.6.2 Brainstorming and Creative Thinking

The person most directly responsible for the interest in training ingenuity, is Osborn. His early books, 'How to think up', 'Your Creative Power and 'Wake up your mind', and the early editions of 'Applied Imagination' (1951) influenced the development of a great many creative problem solving programmes in industry. His reasons for the very wide acceptance of Brainstorming are quite clear. It is intuitively appealing, it is simple, it is fun, it is therapeutic and it works. It stimulates interest, the power
of association, a spirit of competition, a free use of imagination and active participation. It develops an understanding and an appreciation for the thoughts and points of view of others. It is relatively economical in terms of time, does not necessitate any elaborate classroom arrangements and can be effectively used with both small and large groups. It eliminates time wasting arguments during discussion and encourages participation by all students without the possibility of destruction or cynical criticism by others.

Osborn (1951) describes the features of his technique for the deliberate development of creative thinking in his book 'Applied imagination'. The main principles of this creative thinking technique are:

(i) Eliminate all judgements and argumentation from the idea session. Keep all statements positive and constructive. This technique believes that an individual cannot look forward and backward at the same time. There must have been a respective cycle starting with creative thinking and ending with judgement.

(ii) Try to get a large volume of ideas by keeping all statements very short and eliminating long winded talks. No complete sentences are needed. 'Quantity breeds quality' is the accepted principle in this method. This is what Osborn (1951) calls 'free wheeling'.
(iii) Create an environment in which every idea is acceptable, regardless of how fantastic it seems. There should be a 'psychologically secure environment.

(iv) Encourage participants to build or 'hitchhike' on the people's ideas. Cross stimulation or combination and improvement of all ideas present is desirable.

Based upon these four ground rules, this technique tries to elicit as many solutions to a problem as possible. Two stages are important in this technique. One is called ideational session, (Green session) and the other is called evaluation session (Red session). Ideational session is the stage when the four above mentioned ground rules are to be followed to produce new ideas. In the evaluation session the given solutions are analysed, valued, and sorted out. According to DeBono (1970) at the end of the evaluation session one can have different categories into which each idea is placed. These might be (i) directly useful, (ii) interesting approach, (iii) for further examination and (iv) discard, etc.

Brainstorming in general depends in part upon the understanding of the procedures by the participants and a careful selection of a topic and qualified chairman and secretary. Under this method the chairman or the leader is the key person who leads the group for success. He may have to face uncomfortable silent periods, (if any) during the session. In short, he may have to handle and face different expected situations. In those situations, it is the
imperative duty of the chairman to behave with utmost care
and tactfulness. In this respect, it is worth to mention
about Glark (1971). He has enumerated a variety of idea
squelching and idea killing phrases and apologetic self
killer phrases, which may hinder in the way of brainstor­
mimg more solutions in the group situations. The recordings
of all comments and statements during the session could be
done by the secretary.

Besides the above principles the following points
have also to be taken care of, before Brainstorming is
introduced to a group. This technique should not be used
until the problem has been well defined. Regarding this
point, it is better to look into the words of Patton and
Giffin (1973). They say that uninhibited creativity combined
with ambiguity can produce a general sense of confusion.
De Bono (1970) also says that too wide a statement of the
problem may bring about a variety of ideas but they are so
separated that they cannot interact to bring about that
chain reaction of stimulation that is the basis of Brain­
storming.

Having fully realised the nature of education given
at present and visualised the education needed for tomorrow
Osborn (1951) frames the objectives of his Brainstorming.
He wants to help education to do more to develop creative ability. In this regard he says, the following three efforts are to be made to achieve the end.

(i) To facilitate establishment of separate courses in creative problem solving.

(ii) To encourage incorporation of creative principles and procedures into existing courses.

(iii) To help bring about a more creative type of teaching which will combine thinking effort with learning effort and thus develop thinking ability while imparting knowledge.

Followed by the publication of Osborn's book 'Applied Imagination' several attempts were made to find the effects of Brainstorming upon creative thinking. Many studies have been conducted in the areas like Industry, Commerce, Management, and to a certain limit studies are found to have been taken up in the classroom situations also. Results of these studies, though conflicting to some extent, reveal that this technique has significantly positive effect upon creative thinking. In the following paragraphs some of the studies which have found, Brainstorming significantly useful in developing creative thinking are discussed, followed by some of the studies which are not agreeing to it.

Meadow, Parnes, and Reese (1959) reported that with suspended judgement (Brainstorming) the production of 'good' answers was a little more than double. Again Meadow and Parnes (1959) and Parnes and Meadow (1960) showed that
courses on creative thinking that were heavily weighted with Brainstorming exercises seem to leave students with beneficial results and these results have some degree of permanence also. Parnes (1962) reported a study in which over 1200 day and evening students have completed the creative training courses. In these courses, the students were taught the principles of deferred or forced separation of creative and judicial functions, checklists of idea spurring questions, forced relationships to find out new solutions, were followed throughout the course. The results showed that the creative problem solving students showed substantial gains in quantity of ideas on two tests of the idea, quantity repeated at the end of the course. Brilhart and Lureine's study (1964) supports the findings of Parnes regarding the effectiveness of the deferred judgement (Brainstorming) principle when used by groups, also found that unevaluated practices tend to produce greater originality, elaboration and sensitivity than evaluated practices. Again Torrance (1965) observed that pupils permitted to practice without teacher evaluation were able to perform more creatively on subsequent occasions than (Except sixth grade level) were pupils who had practised with teacher evaluation. Similarly, White and Owen (1970) found that the classroom setting in which evaluation was the responsibility of the student himself, resulted in the development of greater creative potential than classroom settings in which evaluation was the responsibility of class mates.
In another study, Turner and Rains (1965) tested 30 high and 29 low creative subjects for the effects of 'Brainstorming' upon idea production. They found positive effects of the Brainstorming instruction between the two groups. Similar results were found by Lindgren and Lindgren (1965). In their study group Brainstorming was followed among the Middle East University students whose primary language was not English. The results indicated that group Brainstorming was followed by increases in number and quality of cartoon captions written in English.

Almost on the lines of the present study, Hutchinson (1967) conducted a fifteen day study of modified instructional methods (Brainstorming) which treated social studies students as thinkers. The results showed that the modified instructional method of Brainstorming produced distinct change in the ratios of verbal response categories. There was a sharp increase for the experimental group in total productive thinking particularly in evaluative thinking which is the last in the sequence of mental operation.

In certain other studies, working individually on the lines of Brainstorming was found to be more effective than group Brainstorming. In a study by Taylor, Berry and Block (1958) they found that larger number of unrepeated ideas were produced by individuals working alone than by those working in groups. Similar results were found by Dunette
and others (1963). But the investigators found that group participation may be useful as a warm up for individual Brainstorming. This finding is confirmed by Lindgren and Lindgren (1965).

Fleming (1972) conducted a study upon eleventh and twelfth grade Biology students to find out the social facilitation effects upon selected cognitive activities including Brainstorming. For testing hypotheses suitable experimental design were made under controlled conditions. The results indicated that there is significant difference between the number of different usable ideas produced and orally recorded on tape by students, Brainstorming a problem in an individually isolated situation and an equal number of students Brainstorming the same problem, in a group oral interaction situation. It was concluded that five students Brainstorming a problem individually and recording their ideas on tape and having their efforts pooled will produce 71 percent more usable ideas than five students Brainstorming together in an oral interaction situation recording their ideas using a single tape recorder.

As mentioned earlier, there are certain studies which revealed that Brainstorming has no positive effect upon creative thinking. A research project conducted at Yale University, (Taylor et al. 1957) indicated that Brainstorming as a means of group ideation was inferior to individual
creative thinking. Recently, Frantz (1975) selected Brainstorming, Synectics and Physiogonomic response training for investigating their effects upon creative thinking among fifth grade pupils. It was also hypothesised that pupils receiving Brainstorming instruction would outscore pupils receiving Synectics or Physiogonomic response instruction on measures of fluency, elaboration as well as total creativity. The results indicated only partial support for the hypotheses that pupils receiving creativity instruction would out-score pupils not receiving creativity scores. It was also found that Brainstorming instruction was the least effective of three groups.

Silvestro (1974) investigated the differential effects of training with convergent and Brainstorming thinking tasks on the conceptual temporal of impulsive and reflective third grade children. He found from the results that only training with convergent tasks increased significantly in Matching Familiar Figure Test's (MFF) time score of impulsive students. Parloff and Handlon (1963) found that, however, increasing the number of ideas did not itself increase the number of good ideas. But the authors agree that efficacy of Brainstorming is a function of lowering the evaluative standards, thereby permitting the reporting of ideas that would otherwise be dismissed.
From the above discussion, it can be seen that Brainstorming has been used as a method for the generation of ideas by Meadow, Parnes and Reese in different studies and the results have been found favourable for Brainstorming. Brilhart and Lureins found Brainstorming useful for the development of originality, elaboration and sensitivity. Turner and Rains, Lindgren and Lindgren found positive effects of Brainstorming in their studies. Hutchinson's results revealed a sharp increase in productive thinking. Individual Brainstorming was found to be more useful in producing usable ideas than group Brainstorming. The studies conducted by Fleming, Taylor et al., Dunette et al., etc. demonstrated the above finding. The Yale University study, and the studies by Frantz, Silvestro etc., found that Brainstorming was not effective. Thus it is seen that many studies found Brainstorming with significant positive results, while some of them do not agree with it.

1.7 Rationale for the Study

The significance of creative thinking among students has been emphasised under caption 1.2. The various attempts made for the deliberate development of creative thinking by researchers have been discussed under 1.4, 1.5, 1.6.1, and 1.6.2. From the above review, it is seen that except a few studies, all the others have taken up Brainstorming as a mere creativity development variable. Regarding Morpho-
logical analysis it appears that no attempt was made to introduce it into the classrooms as a teaching technique. As Tripathi (1975) remarks that theoretical discussions do not provide a sufficient base for initiating new practices. The researches in the field of creativity are quite voluminous, but at least in India, they have hardly made any impact on teaching. In view of the conflicting and contradictory research findings as reviewed above, and in view of introducing creativity techniques as teaching methods in order to teaching the content of the subjects, and due to lack of authentic research findings in the Indian context, it was thought desirable to undertake the present investigation to understand the effect, if any, of Morphological analysis and Brainstorming upon general creative thinking, creative thinking in geography and achievement in geography of eighth graders. The problem is stated below under caption 1.8.

1.8.0 Statement of the Problem

The problem specifically reads as 'Effects of Patterns of Teaching upon Creative Thinking among Adolescents'. In order to have a specific and clear picture of the problem the meaning of the important concepts involved in this study have been elaborated below:
(i) The phrase 'patterns of teaching' means the two techniques of creativity development proposed, such as, Morphological analysis (Zwicky 1969) and Brainstorming (Osborn 1951) sandwiched with traditional methods of teaching. For the convenience of the reader, this pattern of teaching as explained above will be named as 'Creative Teaching Method' throughout the entire report hereafter.

(ii) The 'creative thinking' in the present study denotes the scores obtained on the Passi Tests of Creativity. For 'creative thinking the present investigator accepts the definition of Passi (1971) which has been discussed under caption 1.3.

(iii) The word 'adolescents' in this study denotes the eighth grade students. For the sake of convenience, hereafter they will be called as 'eighth graders'.

1.8.1 Objectives of the Study

The following are the objectives of the present study.

(i) To find out the effect of the 'Creative Teaching Method' upon the general creative thinking of eighth graders.

(ii) To find out the effect of the 'Creative Teaching Method' upon creative thinking in geography of eighth graders.

(iii) To find out the effect of the 'Creative Teaching Method' upon the achievement in geography of the eighth graders.
1.8.2 Hypotheses

Bearing the above objectives in mind the investigator formulated the following null hypotheses for the present study.

(i) There is no significant difference in general creative thinking ability between the group taught through the Creative Teaching Method and the group taught through the traditional method.

(ii) There is no significant difference in cognition abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

(iii) There is no significant difference in memory abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

(iv) There is no significant difference in divergent production abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

(v) There is no significant difference in convergent production abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

(vi) There is no significant difference in evaluation abilities in geography between the group taught through the
Creative Teaching Method and the group taught through the traditional method.

(vii) There is no significant difference in creative thinking in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

(viii) There is no significant difference in achievement in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

1.9. Plan of Reporting

The reporting of the present study will be as per the following:

Chapter I Introduction of the problem, rationale, Objectives and hypotheses.

Chapter II Method and Procedure.

Chapter III Test Construction.

Chapter IV Collection of data and Analysis of Results.

Chapter V Discussion

Chapter VI Summary and Conclusions*

Bibliography

Appendix