CHAPTER ONE

INTRODUCTION OF THE PROBLEM RATIONALE OBJECTIVES

AND HYPOTHESES

EFFECTS OF PATTERNS OF TEACHING UPON CREATIVE THINKING
AMONG ADOLESCENTS

C H A P T E R   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, Advertise-
ment, 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, Back ground 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 Back ground 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 the 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 nations 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 atleast, 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 pre-
serving 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 over-
looking 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 stu-
dents 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 distinquished work at 15, developed his method of least squares at the age of 18, Samual 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 indentified 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 Minnisota 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 high lighted the fact that if selec-
tion is based on intelligence alone, at least two out of
three of those persons best fitted to be the scientific
found
leaders of the future will be missed. Passi (1971) that
77 creative students out of 120 (64 percent) would be ignored
if top 20 percent students selected on the basis of intelli-
gence were termed as creative. The study of Bentley (1966)
indicated how creative students in the class rooms were
affected. He found that creativity test scores and achieve-
ment 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 cogni-
tive abilities, the creative students of the class rooms
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 unkown situations, sought challenges

which made use of freshly won skills and deliberatley
found problems at the edge of their capacities. The study of
Carlson (1974) confirmed this view. He [she] explored the effect
of a specific programme, planned, implemented and evaluated
with a young learning disabled child. By focussing on
strength in creative thinking abilities and activating
evaluative effort on the part of the child, he [she] 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 [by] 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 Reaearch 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, Flannagan,
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, Flannagan, Harman, Sprecher,
Steltz, Smith,Ghiselin, 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 Univer-
sity of Utah during the later part of Nineteen fiftees gave
impetus for the further researches taken up in this area.
By 1960 several attempts were made for the creativity educa-
tion. Reputable private as well as governmental agencies
like the Carnegie Corporation of New York, the Institute
of Personality Assessment and Research and of the University
of California, the Creative Education Foundation, University
of Buffalo, New York and numerous such important institu-
tions and agencies became involved in supporting and foster-
ing 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 efferts 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 rearrangment 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 associa-
tional 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) redefini-
tion.

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 con-
cerned 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
those
—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 satis-
fying 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 communica-
ting 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 creati-
vity 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 chief-ly 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 stand point 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 motions. 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, atleast 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
theoritical 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 assesment 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 eductional
setting, working conditions, climate, training programmes,
home environment, etc. These external influences can enhance
or hinder the developmmnt 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 demand-
ing and subtle because much of its subjects 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 hypo-
theses 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 indicat-
ions that only slight changes in style and approach could
modify the child's output in terms of originality and uni-
queness on tests. Gallagher and Aschner (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 import-
ant 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 strenth to the above point. They reported that a high degree of controlling behaviour by teachers was detrimental to verbal creative perfomance. 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 class room activities compared with other direct ways of students' participation. If that too is not possible, the students are helpless to think independently.

In a loboratory 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 ref-
fered to as StudentStructured 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 creatvity
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 'res-
ponses' and stimulating environment in school' the more
would be the evidence of the developemt of cretivity. The
results also suggested the need for changes in the curri-
cular 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 conclu-
sion 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 jedgements 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 prefered 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 consistedof 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 class mates', (ii) It is possible to impoove students' ability to think creativæly and to solve problem 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 wære valuable in developing increased understanding of creativity. Rosenthal and others (1974) conducted experiments in a predominently bæack 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 origina- lity 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-cultu- ral 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 statups 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
r 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 mea-
sured components of divergent thought. To test the development
ment 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 creati-
vity. Only one F-ratio of the factors involved was signi-
ficant 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 studénts. It is also found that there are a few studies
that demonstrated conflicting results. But they are negli-
gible in number, when compared with the enormous number of
studies that favour environment as an ingrediant for crea-
tive 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 think-
ing has led to the hypothesis that it can be identified
by proper tests and developed deliberately. Several attem-
pts have been made in whidh deliberate practices and environ-
ment were provided to find out the results. In the following
paragfaphs 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 rela-
tively 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 proceedures 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, modifying 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 whether creativity can be measured and taught. Results of these studies indicated that the students in the classrooms, 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 atleast 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 apporximately 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 uniformaly 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 impoved 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 occured 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 class-room has been developed by Covington and Crut-
chfield (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 out-per-
formed controlled subjects on certain problem solving, crea-
tigity and relevent 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.

Khetena (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 pro-
moting 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. Willi-
ams (1973) reported a novel method which was known as 'opera-
tion 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 intellecual creativity.

Williams again said that experiences with this pilot
project indicated that inservice 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 adminis-
trators also was found to be successful. Wilson (1972) stu-
died 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 ori-
ginality and persoanl worth during student teaching. He also
found that the pupils impyoved in fluency, flexibility and
originality but declined in elaboration. Irving (1973) tried
to evaluate the effect of creativity training for the chair-
men. 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 pro-
blem 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 develop-
ment 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 Uni-
versity Examinations, with those taught through the tradi-
tional methods, (ii) to study the question of creativity in
science and to develop specific courses materials and metho-
dology for creative teaching utilising the best modern
approaches in this field. This unit has floated a programme
of innovation which is being tiied with three batches of
about 12 B.Sc (Hons) students each of whom has opted for
Physics as his main subjects The experimental and the control
groups have to follow a common syllabus. But the treatment
is different. This open ended eduaational 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
creativ&ly. 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 think-
ing. Brandt (1974) conducted an experiment which revealed
that there were no significant treatment effects of group coun-
selling 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 effecive for the deve-
lopment 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 origina-
lity and evaluation were found to be devloped by the treat-
ments 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 nega-
tive 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.

1.6.0 Different Techniques of Fostering Creative Thinking

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 into classroom situation. 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 sudents can be stimulated and developed by these techniques.

'Synectics' is another technique put forward by Gordon

(1961). Synectics methods represent a problem solving stra-
tegy approaching Brainstorming in its impacts. It emphasises
the principle of making familiar things unfamilear and un-
familiar 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) persoanl analogy, (ii) direct
analogy, (iii) symbolic analogy and (iv) fantacy analogy.
According to him, without these mechanisms no problem stating
and problem solving attempt will be successful. In persoanl
analogy, members of the group achieve new perspecives on a
problem by imagining themselves to be one of the problem
objects. Fantacy 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
methodin Goelta, 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 train-
ing and research programmes.

'Bionics' as described by the Advanced Technology Staff (1963) Mattin 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, sugges-
tions for fruitful directions, other new idea etc. AT a speci-
fied 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 findcingout 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 eightpersons. 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 suitabilitysto 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 Morpho logical 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 analysed in a completely unbiased way. There
is no chance of any circumstances being over looked 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 pleasurable, in as much as one's intuition is constantly being
stimulated and new surprising and construcitve 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 amake 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 methods, the studies by Stanner (1952)
on radio electronic surveying methods, the inventors of
early yarns, and the famouss '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 speci-
fic 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 powereddvehicle. 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
the/third 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 aatomic power, etc.,
In this case 4 x 7 x 8 224 combinations of solving the pro-
blem 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 (i) 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 porblems.

(i) Problems for whose solutions only small number
of pegs of knowledge need to be known.

(ii) Problems for whose solution, pegs of knowledge of
are necessary that are as yet unavailable. This approach
cannot to 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 applica-
tion of this procedures conceivable might prevent a thinker
from approaching a problem from different but more imagina-
tive 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 the-
rapeutic 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 peoples' 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 Clark (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-
ming 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.
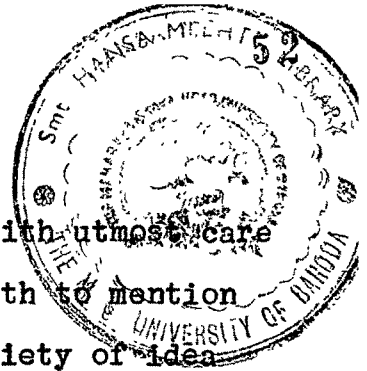
He wants to help edudation to do more to develop creative
ability. In this regard he says, the following three efforts
are to be made to achieve the end.

(i)   To facilitate establishment of separate courses in
        creativeproblem 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, Manage-
ment, 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 disucssed, 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 benefi-
cial results and these results have some degree of permana-
nce also. Parnes (1962) reported a study in which over 1200
day and evening students have completed the creative train-
ing 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 follow-
ed through out 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 Parneys 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. P: 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 studcies, 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 tempo 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 Brain-
storming 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 Lureine 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 techni-
que. As Tripathi (1975) remarks that theoritical discussions
do not provide a sufficient base for initiating new practi-
ces. The researhes in the field of creativity are quite
voluminous, but atleast 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) sandwitched 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 made 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