CHAPTER-3

METHODOLOGY

In order to fulfill the objectives mentioned in chapter-1, scientific methods and procedure were followed. This chapter contains relevant information pertaining to materials and techniques used and other methodological aspects of study. The methodological aspects of the study are as given below:

1. Research Design
2. Sample
3. Tools used
4. Treatment Employed
5. Identification of variables
6. Experimental Controls Used
7. Procedure of Experimentation
8. Data collection
9. Statistical Analysis

3.1.0 Research Design

In Order to study the effectiveness of Six Thinking Hats Strategy on parallel thinking, lateral thinking, general creativity and argumentativeness of students, Nesting-cum-Crossing design was followed. It was nested in the sense that two different groups were taken i.e. the experimental group and the control group. The treatments were assigned to these groups randomly. Further, in each of the sections, students belonging to three levels of intelligence viz., high, middle and low, were present. In this way, different levels of intelligence were nested in different treatments. All these categories of the students were different from each other which is the main characteristics of the nesting design. The design was crossing because all the groups of the students were pre-tested as well as post-tested for the dependent variables (parallel thinking, lateral thinking, general creativity and argumentativeness). Here the same students were pre-tested and post-tested, which is one of the characteristic of crossing design. In this way, the experimental design was nesting-cum crossing (as per Lewis, 1968)
The experiment resembled three-way factorial (2X3X2) nesting-cum-crossing design. As already has been specified, herein, two treatments were involved viz., Six Thinking Hats strategy (A₁) for experimental group and Conventional method of teaching (A₂) for control group; three levels of intelligence viz., high (B₁), middle(B₂) and low(B₃); and two occasions of testing were viz., pre-test (C₁) and post-test (C₂), for the dependent variables such as parallel thinking, lateral thinking, general creativity and argumentativeness. There were, thus, 2X3X2=12 (twelve) combinations. The notations for the treatment combinations are illustrated in Table 3.1

Table 3.1
Notations for (2X3X2) factorial Nesting-cum-Crossing design

<table>
<thead>
<tr>
<th>M₁I₁O₁</th>
<th>M₂I₂O₂</th>
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<tbody>
<tr>
<td>M₁I₂O₁</td>
<td>M₂I₁O₂</td>
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<tr>
<td>M₁I₂O₂</td>
<td>M₂I₂O₂</td>
</tr>
<tr>
<td>M₁I₃O₂</td>
<td>M₂I₃O₂</td>
</tr>
</tbody>
</table>

M₁- Experimental Group  
M₂- Control Group  
I₁- High intelligence  
I₂- Middle intelligence  
I₃- Low intelligence  
O₁- Pre-test  
O₂- Post-test

The schematic presentation of design for the treatment combinations are illustrated in Figure 3.1
SCHEMATIC PRESENTATION OF DESIGN WITH NESTING - CUM- CROSSING (2X3X2)

Total Students 96

M₁
48 Students

M₂
48 Students

I₁
16 Students

I₂
16 Students

I₃
16 Students

O₁
O₁

O₂
O₂

O₃
O₃

O₄
O₄

O₅
O₅

O₆
O₆
3.2.0 Sample
The sample in the present experimental study was selected with three considerations. Firstly the students matched with each other in their qualifications, school environment, general home environment, physical conditions, sex etc. Secondly, the students who formed the particular group in the experiment should belong to different levels of independent variables. Thirdly, the extraneous variables which were concomitant to the dependent variable and correlated with that, may not introduce systematic bias in the results. Such variables could be those the specifications of which might not have entered into the purview of the experiment.

Keeping these conditions in view, only one school was selected from the urban area of Nangloi District. There were 452 students in the school studying in IX standard under eight sections. Out of these, 20 students were selected randomly from each section making for 160 students in all. The students were matched on socio-economic status test and the scores proposed that majority of students belonged to the same i.e. average to below socio-economic status. Now the sample students were administered the Raven’s Progressive matrices. On the basis of mean and standard deviation, students were divided in three parallel groups; high intelligent, middle intelligent and low intelligent. Now 40 students were selected from each category of intelligence randomly, making for 120 students in total. These students were further divided into two groups randomly in such a way that there were 20 students of each intelligence level in all the categories. As the number of students relating to three different intelligence levels were same in both the groups, so the groups were homogeneous with respect to intelligence. The students who were non-serious or unable to be present throughout the experiment were labeled under sample death. Initially the number of students was kept 120 for the fear of sample death; only 96 were retained for data analysis. Therefore, for the analysis there were 16 students in each category. The number of students belonging to different categories has been shown in Figure 3.2
3.3.0 Tools Used
The study, being an experimental one, necessitated two types of tools to be used-one being the treatment tools and the other were measuring tools. The treatment tools were used to impart instruction to students. The measuring tools were employed to measure changes in students’ abilities viz., parallel thinking, lateral thinking, general ability and argumentativeness in the classroom.
3.3.1 Treatment Tools

Treatment tools, as have been laid out, were those which were used to impart instructions to the students. The instructions varied in two ways viz., Six Thinking Hats strategy and Conventional method. For all these instructional variations, tools consisted of lesson plans, lesson plan formats and work-sheets which were prepared according to assumptions, objectives and formats of the instructional procedure.

(a) Lesson Plan Format: It is a design of the lesson plan that adheres to intricacies of the teaching strategy as per its assumptions, objectives etc. For each of the treatment procedure, one lesson plan format was prepared. Thus, in all two lesson plan formats were prepared- one for six thinking hats strategy and one for conventional method. Lesson Plan format for Six Thinking Hats strategy has been divided into four parts. The first part consisted of instructional objectives. In the next part, stretching exercise is given, identifying teachers’ role and students’ role. The third part, expository format, is concerned with the Six Thinking Hats process. This part further consisted of six sub-parts, based on Six Thinking Hats strategy viz. White, Red, Black, Yellow, Green and Blue Hat. The last part devoted to evaluate the amount of new dimensions presented by the students.

In case of lesson plan format for conventional method also the format has been divided into four parts. Again during planning, the lessons are written according to the systematization of the teaching strategy. The details regarding the development of these lesson plan formats are given in Chapter 4.

(b) Lesson Plans: It is a planned guide to impart instructions according to pre-laid procedure. A set of 30 lesson plans for each treatment group was prepared as per the phases of the teaching method and lesson plan format. Thus, in all, 60 lesson plans were prepared keeping in mind the syllabus, age level and grade level of the students. However, for the different treatment groups, the topics were similar.

(c) Worksheets: Worksheet is a data recording sheet used by the pupils during the instructional process. The purpose of the worksheet is to record information that originated as classroom interaction along with the name of pupil, class, the date of the session, subject and topic, etc. The procedure of imparting instructions in both the treatments (Six Thinking Hats and Conventional method) was different. For each of the treatment procedure, one format of worksheet was prepared. Thus, two worksheets
were prepared—one each for Six Thinking Hats and Conventional method. The details of the development of format of these worksheets have been given in Chapter 4.

3.3.2 Measuring Tools

The measuring tools included the Parallel Thinking Test, the Lateral Thinking Test, the Baquer Mehdi’s Verbal Test of Creative Thinking, the Infante and Rancer’s Argumentativeness Scale, the Raven’s Progressive Matrices, and the Kalia and Sahu’s Socio-Economic Status Scale.

a) The Parallel Thinking Test

Parallel thinking test was developed by the investigator herself to measure the parallel thinking of the students. There were overall twenty four items. All the items were verbal in nature and can be administered in a group or individually. The questions were followed by the one obvious answer. The students were directed to express their own answers in the prescribed direction. The idea or answer in the test which is not according to the given direction was assumed wrong. This test is concerned with measuring the capability of an individual to think in a parallel way. Therefore, the scoring in the test mainly centered on thinking in the same and specific direction, one mark for each relevant response was given. Relevancy means the response which is according to prescribed direction in the items. The test has six parts and every part consists of 4 items.

- The first parts deals with facts and information about the given statements.
- The second part is concerned with intuitions and emotional point of view of the students.
- The third part judges the capacity to look positive aspects in an idea and optimistic approach of students.
- The fourth part considers the ability to look weaknesses and negative aspects in an idea/problem.
- The fifth part takes into account creative and innovative approach of the students.
- The sixth part deals with evaluative and concluding approach of the students.

So, the maximum score an item can earn will be as many relevant responses are there. Accordingly a scoring key was prepared to make scoring easier. The total score of all
the test items is considered as the score on parallel thinking test. The test-retest reliability of the test was 0.79. The test was also found to be valid.

The construction, standardization and other details of the test are given in chapter-4.

**b) The Lateral Thinking Test**

In order to measure the lateral thinking of the students, the lateral thinking test developed and standardized by Sucheta and Aggarwal (2012) was used.

- It is a standardized verbal test.

- This test can easily and economically be administered over a wide range of sample above age 12.

- The instructions are easy and simple. It helps in economizing the time of the subjects as well as of the investigator.

- This test encourages free play of imaginations.

The test has four parts. The first part (2 items) includes some geometrical figures. The second part (5 items) has some situational questions. The third part (3 items) has some incomplete sentences and the fourth part (14 items) has some statements on which views are to be given with reason.

The test pertains to four factors. There are Vertical Thinking, Escape, Novelty and Outrageousness. Total time required for administering the test is 25 minutes. The test-retest reliability of the test was 0.74.

Scoring of this test is done on four dimensions (factors) viz., vertical thinking, escape, novelty and outrageousness. In order to measure the dimensions of vertical thinking—one mark for each answer selected by the students out of the given three choices. To measure the factor of escape- two marks are given only if someone avoids these (three most obvious) answers and gives some other answer. To measure novelty or originality of the thoughts- three marks are given to only those answers which were given by less than 5% of population. For outrageous, four marks are given for the ideas that are totally different or are opposite to the conventional thought process.
c) The Baquer Mehdi Verbal Test of Creative Thinking

For measuring the general creativity, Baquer Mehdi’s verbal test of creative thinking was employed. This test was selected in comparison to other due to the reasons that:

1) This test is standardized verbal test that can be administered with ease.

2) This test is not culturally loaded. It can be used as such with different types of students belonging to different cultures.

3) This test battery can easily and economically be administered over a wide range of sample starting from middle school and going up to graduate level. In other words, it can be safely used for identifying creative talent at a relatively young age.

4) It helps in economizing the time of the subjects as well as of the investigator.

5) This test encourages free play of imagination.

6) It satisfies the criterion laid down by the new relationship concept for creativity.

The test has four sub-tests namely, consequence test (3 items), unusual uses test (3 items), similarity test (3 items) and product improvement test (1 item). The tests pertain to three factors of creative thinking are fluency, flexibility and originality. Total time required for administering the test is 48 minutes.

The test has a test-retest reliability of the factor scores and also the total scores ranging from .89 to .96. The correlation between the factors of creativity and total creativity scores range from .77 to .96.

Scoring of this test is done on three dimensions (factors) viz., fluency, flexibility and originality. In order to measure the dimensions of fluency—one mark for each relevant and unrepeated response is given. To measure flexibility, one mark is given for each category in which responses are categorized. For originality, a five point scale from 5 to 1 is prepared; responses given by 5% down 4% testees are given a weightage of one mark, 4% down to 3% testees are given a weightage of 2 marks, 3% down to 2% testees are given a weightage of 3 marks, 2% down to 1% testees are given a weightage of 4 marks, and 1% down testees are given a weightage of 5 marks. The total scores for originality are determined by summing up the different weighed
scores. The summated scores of fluency, flexibility and originality yield an estimate of total creativity.

d) The Infante and Rancer’s Argumentativeness Scale:
In order to measure the argumentativeness of the students, the Infanet and Rancer’s argumentativeness scale was used.

- It is a standardized self-report scale that can be administered with ease on subjects.
- The internal consistency and test-retest reliabilities of the scale were high.
- Scoring is very easy

The scale has 20 statements about arguing controversial issues. It consists two types of approaches namely argumentative approach (10 items) and argumentative avoid (10 items). The reliability co-efficient for each approach was .91 and .86 respectively. The scoring was basis on these two approaches. To find Argumentativeness trait ($\text{Arg}_{gt}$) subtract the total of the 10 tendency to avoid items ($\text{Arg}_{av}$) from the total of the 10 tendency to approach items ($\text{Arg}_{ap}$).

e) The Raven’s Progressive Matrices:
In order to measure the intelligence of the students, Raven’s progressive matrices was used. This test was selected in comparison due to the following reasons:

1) It is a standardized non-verbal test that can be administered with ease on subjects of any language.

2) The problems are so interesting and absorbing that these provide necessary motivation to students.

3) It does not require separate instructions and time for sub-tests or sub-groups.

4) The test does not require any elaborate arrangements be made and can be administered under normal classroom conditions.

5) The instructions are simple and easy.

6) It is a powerful test aimed at testing ability rather than efficiency. This last factor of the Progressive Matrices test is that it minimizes the possibility of any extraneous error of omission or commission due to anxiety about any time limit.
Speed test imposes on the students a certain amount of stress and strain of having to work under time limitations. This test permits the subjects to proceed at their own pace which increases the reliability of the test.

This test consisted of sixty problems divided in to five sets (A, B, C, D and E) of twelve each. Every problem in the test is readily the source of thought for the next. The problem which follows, becomes progressively more difficult, hence the name “Progressive Matrices”. The order of the test provides standard training in the method of doing work. The five sets provided five opportunities for grasping the method and five progressive assessments of person’s capacity for intellectual activity.

The figures in each problem are boldly printed, accurately drawn and as far as possible pleasing to look at, to ensure interest and freedom from fatigue. This test is useful for the persons of all ages from 8 to 65 years. The scale has a test-retest reliability varying with age from 0.83 to 0.86 with “Terman Merrill Scale of Intelligence”.

f) Socio-Economic Status Scale

In order to measure the socio-economic status of students, Kalia.and Sahu’s Socio-Economic Status Scale (Urban 2012) was used. The scale was selected due to the following reasons.

i. The scale was very comprehensive and up to date based on sixth pay commission’s recommendations.

ii. The test was a standardized verbal test which can be administered in group with ease.

iii. The test divided in five parts and consisted of 40 items. The first part includes socio-cultural component and the second part includes economic component. The third part deals with possession of goods and services whereas fourth part deals with health component. Fifth part deals with educational component.

iv. The scores could be further categorized in three categories ranging from low (44 or below), middle (45 to 77) and high (78 and above).

v. The test was high test-retest reliability (0.86) and was found to be sufficiently valid.
3.4.0 Treatment employed

There were two groups of students in the study, who were given two different types of treatments that lasted for two months. One of the groups was taught through Six Thinking Hats strategy. This group was designated as A₁ i.e. experimental group. The second group was designated as A₂ i.e. control group and was taught through expositional method. The subject matter for the both groups was similar. The treatment given to each of the two groups has been detailed out in the captions to follow:

3.4.1 Treatment 1

The experimental group was taught through six thinking hats strategy. First of all, the orientation was given to students regarding the proper use of strategy with the help of six colored hats. The students were guided to put on particular hat in each phase and think accordingly. Some topics were selected and discussed among the students. Those topics were selected that lend itself to being analyzed from multiple view points. The list of these topics has been given in Appendix- B.

The main points under all phases are written on the worksheets provided to students. The researcher has also noted the main points related to all phases on Chalk Board during class room teaching through Six Thinking Hats strategy. However, the treatment followed six phases under six different thinking hats.

- **Phase I** – White Hat Thinking
- **Phase II** – Red Hat Thinking
- **Phase III** – Black Hat Thinking
- **Phase IV** – Yellow Hat Thinking
- **Phase V** – Green Hat Thinking
- **Phase VI** – Blue Hat Thinking

**Phase I** – In this phase, after announcement of the topic the students were asked to call out ideas or information related to topic. This phase covered facts, figures and necessary information about the topic/idea. The students were provoked by asking the questions related to ‘White Hat’ thinking like: What information do you have? and What information do you need? for elaboration the topic. The main points were written on the chalk board.
**Phase II** – This phase included intuitions, feelings, hunches and emotions of students related to topic/idea without having to explain or justify these. The students were provoked by asking questions based on ‘Red Hat’ thinking like: What do you feel about this matter right now?

**Phase III** – In this phase the main focus is on to look weaknesses/drawbacks/negative aspects in any idea/views in critical and logical manner. The students were guided to express their views and suggestions for analysis the topic by using black hat thinking. Thus the provoking questions related to ‘Black Hat’ thinking is used in this phase like: Does this fit the facts? Will it work here? and What are the risks? The responses of the students were written on the chalk board.

**Phase IV** – This phase includes optimistic views and positive ideas related to topic. The students were asked to look for the values and benefits in any idea related to topic in a logical way. Provoking questions related with ‘Yellow Hat’ thinking is used here like: Why it can be done? Why there are benefits? and Why it is a good thing to do? The responses of the students were written on the chalk board.

**Phase V** – This phase has additional value. Here, the students are provoked for creativity, alternative ideas/solution/proposals for any problem or topic. The students were provoked by asking questions based on ‘Green Hat’ thinking like: What can you do here? Are there some different ideas? The alternate and innovative responses of the students were written on the chalk board.

**Phase VI** – This phase is related with conclusion and organization of thinking. The students were asked to overview all main points regarding the topic under all above phases. Here the students were provoked with the questions related to ‘Blue Hat’ thinking like: What is the outcome here? and What are you thinking about the topic now? The common concluding points related with topic/subject matter were discussed in this phase.

The students were guided to write the main points and responses under each phases on their worksheets gained during Six Thinking Hats strategy.

After this the students were guided to write concluding points related to topic in their worksheets under the heading ‘Re-examination of original task’ using the knowledge gained through Six Thinking Hats strategy.
3.4.2 Treatment 2
The second group designated as A₂ was taught through conventional method called as expositional method. This method followed three phases. In the first phase, the students were explained the subject-matter. All the pros and cons of the particular topic were detailed out. In the second phase, major points were written on the chalk board. Students were provoked to explain every point collectively. In the third phase, students wrote the main points in their worksheets on their own. Later on concluding points related to topic were asked and feedback was given to them.

3.5.0 Identification of Variables
In the present study, three types of variables were taken into consideration. These variables were independent variables, dependent variables and intervening variables. Different variables in each of these categories have been detailed out.

3.5.1 Independent Variables
There were the variables which were manipulated in order to see their effect on the thinking outcome of the students. These variables were independent variables. These included (1) Two methods of Teaching (Six Thinking Hats and Conventional) (2) Three levels of intelligence (high, medium and low) and (3) Two testing occasions (pre-test and post-test)

Methods of teaching: - Method of teaching was an independent variable wherein the students were classified into two treatment groups. One group was taught in a conventional manner and was termed as the control group. The other group was taught through Six Thinking Hats strategy was termed as the experimental group. However, the topics for both the groups were same.

Levels of Intelligence: - Osten and Fiven (1961) suggested the need for systematic variation of instruction for different levels of ability. Keeping this in view and to experimentally control the effect of their prominent variable, students were classified on the basis of their scores on intelligence test. There were three categories of students in each of the treatment groups. These categories were as high intelligence, meddle intelligence and low intelligence. These classification were made on the basis of mean and S.D. of the total sample of the students.

Testing Occasions: - The effect of treatment was assessed on two different occasions. One was before giving treatment called pre-test and the other was after giving treatment called post-test. In this way, each of the students of each treatment group
was tested on two occasions viz., pre-test and post-test for different criterion variables.

3.5.2 Dependent Variables
These were the variables which acted as a criterion to test the effect of different independent variables. The change in the level of these variables was attributed to the effect of independent variables. In the present study scores on parallel thinking test, lateral thinking test, general creativity test, and the scores on argumentativeness test were the depended variables. These have been enumerated as follows:

1) **Parallel Thinking:** This was the criterion variable taken as resultant of instructional effect of treatment. The objective of taking this variable was to find out the change in parallel thinking of the students because of the treatment. The variable was measured by administering the parallel thinking test on two occasions one before the treatment and the other after the treatment. The scores consequently were termed as pre-test parallel thinking scores and post-test parallel thinking scores.

2) **Lateral Thinking:** Another instructional effect variable taken in the present study was lateral thinking. This was measured by the Sucheta and Aggarwal’s test of lateral thinking. This test was also administered at two stages, namely before and after the treatment. Consequently, the scores on this test were termed as pre-test lateral thinking scores and post-test lateral thinking scores.

3) **General Creativity:** Another instructional effect variable taken in the present study was general creativity. This was measured by the Baquer Mehdi’s verbal test of creative thinking. This test was also administered at two stages, namely before and after the treatment. Consequently, the scores on this test were termed as pre-test and post-test scores of general creative capacity. The scores on this test were categorized as fluency, flexibility and originality scores. The sum of the scores of these three sets was taken as scores for total creativity. In the present study, total creativity scores were taken into consideration.

4) **Argumentativeness:** It was the nurturant effect variable where change in argumentativeness scores were taken as the indirect effect of the treatment. This was measured by Infante and Rancer’s argumentativeness scale. The measurement was also done at two stages, namely before and after the treatment. Consequently, the scores on this scale were termed as pre-test and post-test scores of argumentation ability.
3.5.3 Intervening Variables
There is another category of variables which cannot be measured directly but may have an effect on the outcome of the treatment. This category of variables is called intervening variables. In the experimental study like this, there are many intervening variables that can be considered e.g., socio-economic status, grade level, existing abilities, teacher behavior, other pupil variables, school variable, physical environment of the classroom, contamination effect, study effect etc. All these variables were either controlled experimentally, statistically or equalized by the ways of controlling them. The steps taken to control the effect of these variables have been given below:

3.6.0 Steps taken to Control Intervening Variables
Before conducting the experiment, it was considered necessary to identify as well as control all those variables that can affect the dependent variables. The intervening variables and the controls employed on them have been discussed in the proceeding paragraphs:
Socio-economic status: It is one of the important variables that affect the activities of the learners, especially the thinking. The same caution was kept in view and attempt was made to control this. The socio-economic status scale was assessed by administrating the socio-economic status scale to the sample subjects. The SES scale developed and standardized by Kalia and Sahu was used. The mean of SES of total sample students was computed. On the basis of mean most of the students belonged to low level on SES.
   i. Sex of the students. It was held constant as the sample in this study was all males.
   ii. Qualification: As all the samples of study included students of IX standards, so we can take this variable also as constant.
   iii. Existing Abilities: The results may be affected by already existing abilities of the students. If some students with high or low mental abilities enter into the sample of the study, the treatment may project falsifying effects. In order to control the variable, all the sample subjects were pre-tested and post-tested for all the criterion variables. While analyzing the data, pre-test and post-test scores were taken into consideration.
   iv. Teacher Behavior: Inter-teacher variations were eliminated because the experiment was controlled by the investigator herself. Both the treatment
groups were taught through teaching method by the investigator. So, the
teacher was same for all the treatment variations. Further, the
administration of various tests was also done by investigator. In this way,
there was similar familiarity with all the treatments for all the groups of
students. Therefore, the possibility of variation due to teacher-competence
could be assumed to be negligible. Again the investigator tried to keep the
level of motivation, mental and physical alertness same throughout the
experiment. In this way, by performing the experimental herself, the
researcher tried to control the effect due to teacher variation.

v. Other Pupil Variable: There could be many other pupil variables which could
interfere with the treatment effect, like pupil caste. This was controlled by
randomization. The groups were randomly selected and treatment was
randomly assigned to the various groups.

vi. School variable: The only one school was selected for experimentation i.e.,
Govt. Sr. Sec. School (Boys). Thus the school environment taken as an
intervening variable was also controlled.

vii. Physical Environment of all Class: The investigator was able to complete the
experiment in the same room during the stay in school. The experiment
was conducted in the months of July and August. The primary variation
due to seasonal conditions, physical environment of the classroom,
ventilation, and light arrangement etc. was more or less same in the school.

viii. Contamination Effect: This effect occurs due to exchange of ideas by the
students in the different treatment groups about the content learnt. The
other reason for the contamination effect may be due to receiving tuition
beyond instructions in the classroom. It occurs if the pupils of the
treatment group exchange ideas about the content learnt and the manner in
which the content was presented. An attempt was made to control this
effect. The students were asked not to talk to their fellow-students or
exchange their class notes. The students did follow these instructions.

ix. Study Habits: Another variable closely connected with the thinking is the
study habits of the students. The hours of study put in by a student may
bring a change in the ability level of the student. This factor was controlled
by requesting the students not to go for extra study hours on the topics
related to thinking.
3.7.0 Experimental Control Used
Every possible attempt was made to control those factors, which could create bias. Firstly, the investigator herself provided treatment to both the groups. It was generally believed that the competence and attitude of the investigator may alter the treatment effects. In order to control the inter-group variation in different treatment groups, the researcher herself provided treatment to both the groups. Secondly, the investigator tried to maintain the sympathetic and encouraging attitude towards both the groups in order to have a constant socio-cultural climate during the experimentation. Thirdly, every effort was made to maintain the experimental conditions similar in both the experimental groups. Fourthly, the experimental process was controlled by keeping experimental situation, classroom environment, duration of experiment and mode of testing same for both the treatment groups. Fifthly, the students of both the treatment groups were requested to maintain a good attendance for experimental period. The students who were irregular or non-serious in any of the teaching groups were kept out of sample.

3.8.0 Procedure of Experimentation
The procedure of this study involves selection of students of IX standards for treatment groups and experimentation.

3.8.1 Selection of Students of for Treatment groups.
Initially out of 452 students of IX standards of a Govt. Sr. Sec. School (Boys), 160 students were selected randomly.

i. **Administration of intelligence test:** All the selected students of IX class were administered Raven’s Standard Progressives Matrices. On the basis of the common mean and SD, three different groups were identified as high intelligence, medium intelligence and low intelligence groups.

ii. **Administration of SES scale:** All the students were also administered SES scale developed and standardized by Kalia and Sahu. The mean of SES scale of the total sample students was computed but as all the students belonged to nearly the same socio-economic status, so the categorization on the basis of SES was dropped by the researcher.

iii. **Random Selection of the Subjects from the groups:**
From the three categories formed on the basis of results of Raven’s Progressive Matrices 40 students were selected randomly in each category. The number of students selected from each category was kept 40 taking into consideration the sample
death during experimentation. So during experimentation only 32 students were retained in the end for analysis of data. Now these students were further divided randomly into two groups one named as control group and the other as experimental group. So the students from each category in both the groups are illustrated below in Table No. 3.3

<table>
<thead>
<tr>
<th></th>
<th>High Intelligent</th>
<th>Middle Intelligent</th>
<th>Low Intelligent</th>
<th>Total Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Group</strong></td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>48</td>
</tr>
<tr>
<td><strong>Control Group</strong></td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>48</td>
</tr>
<tr>
<td><strong>Total Students</strong></td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>96</td>
</tr>
</tbody>
</table>

iv. **Assigning treatments to groups:** All the selected students were given parallel thinking test, lateral thinking test, general creativity test, argumentativeness test termed as pre-test. Now all the control group students were taught the concept in conventional manner where as the experimental groups were taught with the help of Six Thinking Hats strategy. In the end both the groups were given the post test.

**3.8.2 Experimentation**
The experimentation was conducted under three phases. In the first phase the students of each of experimental and control group were administered the Parallel Thinking test, the Lateral Thinking test, the General Creativity test and the Argumentativeness test. These tests were administered not in one sitting, but at the interval of one day each, so that the boredom may not occur. After the administration of the test, the students were provided orientation and instructions about the treatment. These instruction and orientation programming took three days. The purpose for giving such an orientation program was to get over the anxiety and curiosity of the students which may create hindrance to the final outcome of the results. For example, the students of experimental group were given a trial of the strategy that they may be able to follow what they have to do in a particular phase. It was thought that such an orientation will
help in normalization of the students. Similarly, the students of conventional group were made familiar with the objectives etc., so that they may not feel total novelty in the experimental set up. In order to note down the main points according to procedure of treatment in a systematic way, the booklets of worksheets were distributed to the students.

In the second phase of the experiment, each of the treatment group was taught with one particular method of teaching. In the experimental group, the students were taught through Six Thinking Hats strategy. During the process of experimentation the procedure of “Six Thinking Hats” strategy will be introduced and followed. In case of control group, the students were taught through expositional method. The teaching in this manner was continued for two months. During the process of treatment, the students wrote on their worksheets according to the given directions.

The third phase was the evaluation phase, where the evaluation of the development of a particular ability was done. After being taught through a particular teaching method, the students were again tested on parallel thinking, lateral thinking, general creativity and argumentativeness. These were post-test scores.

3.9.0 Data collection

In this study, the data was collected keeping in view the objectives of the study. The data to study the effectiveness of the Six Thinking Hats strategy was collected on two occasions. One was pre-test (before the treatment) called as occasion I and the other after the treatment was called occasion II.

**Occasion I:** - The first occasion was the pre-test stage. Before the experiment was conducted, the students of each of the treatment groups were administered the test of parallel thinking, lateral thinking, general creativity and argumentativeness. The scores of these tests were termed as pre-test scores.

**Occasion II:** - Immediately after the treatment the students were administered the same test of parallel thinking, lateral thinking, general creativity and argumentativeness. The scores were treated as post-test scores.
### Table 3.3
**Detailed Description of Experiment**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Phase</th>
<th>Duration</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orientation</td>
<td>30 minutes</td>
<td>General Orientation towards Parallel Thinking Test</td>
<td>General Orientation towards Parallel Thinking Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>General Orientation towards Lateral Thinking Test</td>
<td>General Orientation towards Lateral Thinking Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 minutes</td>
<td>General Orientation towards Parallel Thinking Test</td>
<td>General Orientation towards Parallel Thinking Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>General Orientation towards Lateral Thinking Test</td>
<td>General Orientation towards Lateral Thinking Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 minutes</td>
<td>General Orientation towards General Creativity Test</td>
<td>General Orientation towards General Creativity Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>General Orientation towards General Creativity Test</td>
<td>General Orientation towards General Creativity Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 minutes</td>
<td>General Orientation towards Argumentativeness Test</td>
<td>General Orientation towards Argumentativeness Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>General Orientation towards Argumentativeness Test</td>
<td>General Orientation towards Argumentativeness Test</td>
</tr>
<tr>
<td>2</td>
<td>Pre-test</td>
<td>46 minutes</td>
<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No time limit</td>
<td>No time limit</td>
<td>No time limit</td>
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<td>No time limit</td>
<td>No time limit</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
</tr>
<tr>
<td>3</td>
<td>Presentation</td>
<td>1 hr. daily for two months</td>
<td>Teaching through Six Thinking Hats strategy</td>
<td>Expositional classroom teaching</td>
</tr>
<tr>
<td>4</td>
<td>Post-test</td>
<td>46 minutes</td>
<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
</tr>
<tr>
<td></td>
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<td>No time limit</td>
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<td>Parallel thinking test, Lateral Thinking Test, General Creativity Test and Argumentativeness Test</td>
</tr>
</tbody>
</table>
3.10 Statistical Techniques Used
Keeping in view the objectives and design of the study, the following statistical techniques were employed to analyze the data. The techniques and the rationale for using these are given below:

1) The measures of central tendency and the measures of dispersion such as mean and standard deviations were worked out to know the nature of the data.

2) Multivariate analyses were used to assess the data in order to find out the effect of different groups (i.e. experimental and control), levels of intelligence and testing occasions on parallel thinking, lateral thinking, general creativity and argumentativeness. The parallel thinking test, the lateral thinking test, the general creativity test and the argumentativeness test were employed and three way analyses of variance (2X3X2) factorial design were used.

3) Wherever F-ratio was significant, it was interpreted through mean scores and t-test in order to understand the direction of significance. For deeper understanding, graphs were plotted for interactional effects.