CHAPTER III

PLAN AND PROCEDURE

3.1 Introduction

Plan and procedure employed in an investigation determines its destiny. It constitutes an important part of research. No research project can be undertaken successfully without proper thinking and planning. It is the character of the technique of the research on which the degrees of prediction, objectivity and tools are dependent. This must be handled with every caution, care and profound consideration in respect of the time, cost, ability, experience and the need of investigation procedure for any study is decided upon before starting the project.

There are many methods of collecting analyzing and reporting research data. The decision about the method depends upon the nature of the problem and objectives to be achieved.

Research is purposive, scientific and pointed deliberation. After the selection, definition and delimitation of the problem, the adoption of suitable measures become very imperative. Since research is not a haphazard task. It requires proceeding in a definite direction along with well-defined line. Collection of more bit of information is not research. Planning and
procedure for study is deemed essential for saving it from becoming a heap of jumbled idea gathered from here and there. It goes without saying that ultimate success of a research project generally depends upon the methods employed in it.

Once a research problem is identified and the available research evidences pertaining to the research problem are reviewed, the next step of researcher is to develop a research design. The plan and procedure employed in an investigation determines the design. It is the research on which the degree of precision, objectivity, reliability and validity of result depends. The most requisite in any research is the data. Data are like raw material without which production is not possible.

Method and procedure employed in an investigation determined its destiny. It is the character of techniques of research, on which the degree of precision, objectivity, reliability and validity of finding depends.

3.2 Methods of Research

3.2.1. Historical Method

Historical method is a method of investigation to discover, describe and interpret the past events and facts.
This method is used to establish connection and relationship among past events and facts and arriving at conclusion concerning them. The purpose of historical research is the development of full and complete understanding of the past event so as to interpret present day happening.

3.2.2. Descriptive Method

Descriptive research, sometimes known as Normative Survey method, deals with the relationship between the variables, the testing of hypotheses and the development of generalizations, principles or relationships that have universal validity. It is concerned with the functional relationships. This method of research is related to gathering of evidences in the existing situations. It collects three types information-what exists, what we want and how to get the goals.

Normative survey investigations may be variously classified on the basis of the fields of study, the purposes they achieve, the geographical areas they cover or the techniques they employ. Under this method, school surveys, achievement testing, intelligence testing, personality testing etc. are studies. In this type of study, the variables cannot be manipulated.
3.2.3. Experimental Method

Scientific problem can be resolved only on the basis of data and major responsibilities of the scientist is to set up a research design capable of providing data necessary to the solution of his problem. While the unit of research makes it impossible to say that one aspect is more crucial than another. Nature of the problem, objective of the study, time factor and the cost and availability of resources largely determines the selection of technique and devices for an investigation. Thus a major responsibility of the investigator is to figure a research design regarding the problem.

This method is most classical method borrowed from different sciences i.e. social science, physical science and life science. It is the most exciting and also the most important from the strictly scientific point of view because it derives the basic relationship among phenomenon under controlled conditions or more simple to identify the conditions underlying the occurrence of the given phenomenon.

According to Aggarwal (2007), Fisher introduced experimental concepts and designs of far-reaching applications and is said to be the father of modern experimental methods. His major
contributions lay in “achieving the pre-experimental equivalence of groups through randomization.”

3.3 Methodology

The choice of the methods depends upon the purpose of the study and the nature of the problem. The present study is aimed to study the effect of smart classroom teaching on the achievement, retention and creativity of high secondary school students of commerce. Keeping in view the nature and objectives of the study, experimental method (pre-test post-test experimental design) of research was used by the investigator. Experimental research describes what will be when certain variable are carefully controlled or manipulated.

3.4. Population and Sample

The term population is used in research to describe any group of people or observation in which the investigator is interested. The main purpose of the research is to discover principles that have universal application, but to study the whole population would be impracticable and not possible to test each unit of the population under controlled conditions in order to arrive at principles having universal validity. Some populations are so large that their study would be expensive in term of time, money, effort and manpower (Koul, 2001). In the present study all XI class students, studying in
recognized secondary schools having smart classroom facility affiliated to CBSE opted Commerce stream, in Kurukshetra district comprise population of the present study.

Sampling is a technique by which a relatively small number of individuals or measures of individuals, objects or events are selected and analyzed in order to find out the characteristics of the entire population from which it is selected.

In all types of researches, there are some inferences regarding a well specified and identifiable group, known as population and the selected number of persons or objects is known as sample. Sample is the representative of the population.

Sampling technique reduces the expenditure, saves time and energy, permit measurement of greater scope or produces greater precision and accuracy. It is not possible to collect data from all the segments of a population, so the investigator resorted to sampling technique. The researcher selected each unit opted for random sampling technique.

As it is not possible to encompass the entire population, research is conducted by the means of sample drawn from the target population on the basis of which generalization are drawn and made applicable to the population as whole.
The investigator visited various public schools of Kurukshetra district (D.A.V. Public school, B.R. International Public School, Geeta Niketan, Green field public school etc.) affiliated to CBSE which had functional smart classrooms in their campus and discussed about the study and its purpose with their respective principals. Out of three schools, one was selected randomly and from there the investigator got positive response for conducting the study where the conditions were also quite suitable for the experiment. The name of the school from which the sample was taken was B.R. International Public School, Kurukshetra. The school was selected on the basis of random sampling technique.

From the above selected school, the investigator selected all students of class XI opted stream commerce. All the students of commerce were tested by Non Verbal Group Intelligence Test (NVGIT) by Imtisungba Ao (2005) to match their level of intelligence. The results of the test were matched equally and the students were divided into two groups i.e. Experimental Group and Control group, having 40 students each, were taken as sample for the experiment. In control group there were 19 girls and 21 boys, while in Experimental group there were 20 girls and 20 boys.
3.5 Design of the Study

For the present venture, pre-test and post-test experimental design was used. After taking the control factors i.e. firstly Socio-economic status for which single school was selected to control the socio economic status. Secondly grade level for which only High secondary (11\textsuperscript{th}) school students worked as the sample, intelligence variable was controlled during the process of section of sample. Students were divided in two groups on the basis of the results of Non Verbal Group Intelligence Test (NVGIT) by Imtisungba Ao (2005), thirdly prior knowledge about the subject was controlled by achievement test administered as pre-test on the subject in both treatment groups prior to experimentation and the scores on the pre-test were taken in to consideration during the analysis of the data, fourthly Mode of treatment as there were two modes of treatment i.e. treatment in Smart classroom and in Conventional classroom. In order to bring equality in the treatment process, both classrooms were arranged. Finally the Contamination Effect can be due to receiving tuitions beyond instructions in the classrooms. For controlling this, the researcher conducted the experiment in the beginning of the session i.e. in the months of April. During which it is considered that classes of secondary level
are likely to be started and students are less involved in taking private tuitions. Every possible attempt was made to control those factors, which could create biasness. The researcher himself provided treatments to both the groups. It is generally believed that the competence and attitude of a researcher may affect the treatment effects. Therefore to control the inter-group variation the researcher himself taught for the experiment in both the groups. The researcher tried to maintain encouraging environment for both the groups in order to make conducive environment during the experiment. The measuring devices were based on behavioural objectives so that the devices could not be the source of bias. Every effort was made to maintain the experimental conditions similar in both the groups. The students of both the groups were requested to maintain good attendance for the experimental period. Also they were requested to remain honest while going through the programme.

On the basis of intelligence Non Verbal Group Intelligence Test (NVGIT), developed by Imtisungba Ao (2005) to match their level of intelligence, the students were distributed in two groups named as experimental group and control group. Both the groups were pre-tested with Non Verbal Test of Creative Thinking developed by Baqer Mehdi (2005) to measure the Creativity. An Achievement test for each unit of Commerce
(Business Studies) was developed by investigator himself, which they have not learnt beforehand. The Experimental group was taught in Smart classroom and control group was taught with same lesson plan in Conventional classroom for twenty five days one lesson in each group for 45 minutes. After the experiment both the groups were post tested with Achievement test in commerce to measure their Learning. Then the scores of Achievement test were compared in order to assess the effectiveness of two types of classrooms. After the complete treatment the groups were post tested with test of Creativity to assess the change in creative thinking of both groups.

After a period of two months, same achievement test was taken as post-test which was administered on each group for each unit to measure the retention of the students. Retention Scores obtained by the two groups on the retention test were compared in order to assess the effectiveness of teaching in both types of classrooms.
Figure 3.1

Sample and Research Design

Sample of 100 Students
Tested by (NVGIT) by Imtisungba Ao and results matched to make

Control Group of 40 students
(19 Girls and 21 Boys)

Pre-test
1. Achievement test
   (Business Study)
2. Test of Creativity

Taught in Conventional Classroom

Experiment for one month

Post-test
1. Achievement test
   (Business Study)
2. Test of Creativity

After Two Months

Retention Test

Experimental Group of 40 students
(20 Girls and 20 Boys)

Pre-test
1. Achievement test
   (Business Study)
2. Test of Creativity

Taught in Smart Classroom
3.6 Identification of Variables

In the present study there were three types of variables:

3.6.1 Independent Variables

Teaching in Smart classroom was independent variable.

3.6.2 Dependent Variables

Achievement, Retention and Creativity, were the dependent variables for the present study.

3.6.3 Controlled Variable

These are the variables which can affect the experiment if not controlled or measured and may affect the results. Those variable and the steps to control them are given below:

a. Socio-economic status

Single school was selected to control the socio economic status. It is assumed that the students who get admission in such public school generally belong to middle income groups.

b. Grade level

Only High secondary school students studying in class (11th) worked as the sample for the present study.
c. Intelligence

This variable was controlled during the process of section of sample. Students were divided in two groups on the basis of the results of Intelligence Test (NVGIT) by Imtisungba Ao.

d. Prior knowledge about the subject

For controlling this, an achievement test was administered as pre-test on the subject in both treatment groups prior to experimentation. And the scores on the pre-test were taken into consideration during the analysis of the data.

e. Mode of treatment

In the present study, there were two modes of treatment i.e. treatment in Smart classroom and treatment in Conventional classroom. In order to bring equality in the treatment process, both classrooms were arranged logically on the basis of the results of Intelligence Test (NVGIT) by Imtisungba Ao.

f. Contamination Effect

Contamination effect is the difference between the performances created due to receiving tuitions beyond instructions in the classrooms. For controlling this, the researcher conducted the experiment in the beginning of the session i.e. in the months of April. During which it was
considered that classes of XI at high secondary level are likely to be started and students are less involved in taking private tuitions.

Every possible attempt was made to control those factors during experiment, which could create biasness during the experiment.

Firstly, the researcher himself provided treatments to both the groups. It is generally believed that the competence and attitude of a researcher may affect the treatment effects. It was, therefore, to control the inter-group variation that the researcher himself performed the experiment in both the groups.

Secondly, the measuring devices were based on behavioural objectives so that the devices could not be the source of bias.

Thirdly, every effort was made to maintain the experimental conditions similar in both the groups.

Fourthly, the students of both the groups were requested to maintain good attendance for the experimental period. Also they were requested to remain honest while going through the programme.
3.7 Tools Used

Like the tools in the carpenter’s box, each research tool is appropriate in a given situation to accomplish a particular purpose (Best, 1986).

“The right tools are essential to doing a job well, and yet every day, people are asked to accomplish their tasks with tools that are ill conceived, ill designed and inadequate. The only tools worth having are those that create and enhance value” (Schrage, 1990).

3.7.1 Instructional tools

Instructional tools mean the tools that were used to impart instructions to the students. The researcher used following instructional tools:

a) A smart class room having
   - Projector and screen
   - Laptop having internet connection
   - Computer with networking, complete with monitor, keyboard, mouse, webcam and other accessories
   - Control devices such as switchers and remotes

b) Preparation of Lesson plans to teach in Smart Classroom and in Conventional classroom.
3.7.2 Measuring tools

In the present study, measuring tools means the tools that were used to measure the changes in the achievement of students in commerce, their Retention and Creativity.

3.7.2.1 Non Verbal Group Intelligence Test (NVGIT) by Imtisungba Ao (2005)

Non Verbal Group Intelligence Test was also used to measure intelligence of the students on the basis of which students were matched for selection of the group. This test was used to control one of the intervening variable intelligence of the both group. This test was selected in comparison to others due to the following reasons:

i) It was a standardized non-verbal test that could be administered with ease irrespective of language of the students.

ii) The problems were very interesting and absorbing.

iii) The instructions were simple and easy.

iv) The test could be administered in general classroom situations and hence, does not require any elaborate arrangement to be made.

The test was consists of 78 items to be tested on the age group of 13+ to 17+ years of pupils. It tests the students on
the following ten subtests (i) Arithmetic reasoning (ii) Number Series (iii) Matrices (iv) Classification (v) Picture completion (vi) Figure analogy (vii) similarities (viii) Quantitative reasoning (ix) synonyms (x) Opposites.

a) **Scoring** of the test is very simple. For one correct answer is regarded as one point, or one mark, and no mark or consideration for any wrong answer.

b) **Reliability** of the test is 0.94 by spilt half and test retest method and 0.87 by Kuder-Richardson Formula.

c) **Validity** of the test was found +0.88 when compared to established criterion test “Group test of General mental ability: by S. Jalota” after administering it on 500 students.

### 3.7.2.2 Achievement Test to measure achievement of the students.

‘Achievement Testing’ refers to the assessment of the outcomes of formal instruction in cognitive domain (Dwyer, 1982). It can also be thought of as a sample of indicator of a student’s knowledge taken at a particular point of time or achievement test may mean a sample of behaviour that provides opportunity for comparison with performance standard, as in criterion referenced testing it aids both the
teacher and the students in assessing learning readiness, monitoring learning outcomes (Gronlund, 1977).

“A Test of Educational Achievement is designed to measure knowledge, understanding or skills in a specified subject or group of subjects” (Freeman. 1965).

“The achievement test measures the present ability of the child or the extent of his knowledge in a specific content area” (Gerber 1996).

When we use an achievement test, we are interested in determine what a person has learned after he has been exposed to specific kind of instruction. The change in the level of learning indicates the level of achievement of an individual as an effect of a particular type of instruction. The scores of a test indicate the level of achievement of an individual on a particular time and the difference in the scores of achievement before and after treatment shows the effect of the treatment imposed on.

**Objectives of Achievement Test**

The objective of Achievement test is to measure the acquired knowledge, skill, capacity and ability of an individual. The main objectives of achievement test are as follows:

i) To evaluate the curricular achievement of the student.
ii) To evaluate teaching skills of the teachers.

iii) To classify the students according to their abilities.

iv) To motivate the students for further studies on the basis of marks obtained.

v) To change the curriculum on the bases data obtained.

vi) To assess the success of methods to teaching.

vii) To achieve educational objectives on the basis of test.

viii) To give promotion to the students.

ix) To manage teaching on the basis of individual difference.

x) To help in problem solving.

**Types of Achievement Test**

Achievement tests may be classified on these bases
The researcher made a thorough survey of Achievement Tests in the current available literature for XI grade but could not locate an appropriate and suitable standardized achievement test according to the requirement of the study. Therefore, it was decided to develop an achievement test in Commerce to evaluate the pupils' knowledge, comprehension, application and skills on the six topics from Part A of the book selected for treatment. A study of research and non-research literature motivated and helped the researcher to reflect on the use of multimedia. The professional experience and expert opinion helped to develop the Achievement Test.

Achievement Test was prepared for commerce consisting of 75 multiple choice questions in total. Then a try-out was made on twenty five students of Geeta Niketan Public School. After doing Item Analysis and difficulty index five easiest and the most difficult questions were dropped out and the final draft had 70 questions. Achievement test covered all the important aspects of the lessons taught in the grade by the teachers to the control group and experimental group both. Four options were given for every question and only one option was correct. The students had to mark the correct option and on the basis of their answers the marks were allotted.
The following steps were followed for developing the achievement tests:

**A) Planning of the Test:**

Planning stage of the test tries to answer what content area is to be covered by the Test? What type of items are to be included in the test and what are the objectives that are going to be tested? The planning stage of a test should include the nature of the test items and the statement of conditions under which it will be administered. The achievement test was planned with the objective of measuring Achievement in Commerce of XI grade students on selected topics. For the planning of Achievement Test following points were taken into account:

(a) Determining the purpose of Test;
(b) Identification and defining the intended learning outcomes;
(c) Preparing the test specifications; and
(d) Constructing relevant test items.

**B) Objectives of the Test:**

For the purpose of constructing Achievement Test, objectives were defined in behavioural terms from selected units of Commerce (Business Studies) Textbooks of XI grade
prescribed by CBSE. Since the major concern was to test the academic achievement, accordingly, it was decided to test the three major areas of cognitive domain, i.e. knowledge, understanding and application. After determining objectives, the learning outcomes were stated as observable terminal performance. In order to make sure that achievement test measures a desired behaviour, test specifications were developed covering the objectives and subject-matter selected to be taught during the experiment.

C) Content of the Test:

The test covered the content of the following six topics of Commerce (Business Studies):

1. Nature and Purpose of Business
2. Forms of Business Organisation
3. Private, Public and Global Enterprises
4. Business Services
5. Emerging Modes of Business
6. Social Responsibility and Business Ethics

Expert opinions of the Commerce Teachers, Language experts and research experts were taken into considerations to decide the weightage to be given to different content area, objectives and different forms of questions in the achievement test.
D) Preparation of the Test Items

Initially, 75 objective type test items (Multiple choice questions with four options) with wide range of difficulty were constructed from six topics of Commerce (Business Studies) syllabus prescribed by Central Board of Secondary Education for XI grade, covering Part A- Foundations of Business as the content areas. Items were prepared in conformity with proper care. While constructing items, it was ensured that no objective remained untested and language of the test items was understandable and unambiguous and the instructions were clear. The test items were arranged in the order of difficulty. The test items were arranged properly and assembled into the test. Easy items were given a place in the beginning and difficult items towards the end. The preliminary draft in Achievement Test was given to experts in education, which included experts in measurement and evaluation. Further it was given to experienced Commerce teachers and language experts. They were requested to give their opinion about the correctness of the language and appropriateness of the items. Only those items were selected which were having 80% unanimity on the basis of item analysis. Items that were having difficult language were modified to simple language. After it 70 items constituted the Achievement Test.
E) **Preparations of Directions to Test Items**

Appropriate directions to test items were prepared. The directions were clear and concise so that the students could understand them easily. For multiple choice questions given in achievement test both the control group students and experimental group students were instructed, while administering the test separately, to write the correct response in the given answer sheet.

F) **Preparation of Directions for Administration**

A clear and detailed direction about the procedure of the test to be administered was prepared and provided on the front page of the test booklet.

G) **Preparation of Directions for Scoring**

To make the evaluation objective, scoring keys were prepared for all six topics of Multiple Choice Questions.

H) **First Try-Out**

The test was administered to 25 commerce students of XI grade. Discriminating Power (DP) was computed for each item after forming top 27 percent and bottom 27 percent group from the total subjects as suggested by Kelley (1939). The blueprint of the first draft of Achievement Test and
distribution of discriminating powers (DP) was as seen in Table 3.1 and 3.2

### Table 3.1

**Blue Print of First Draft of Achievement Test**

<table>
<thead>
<tr>
<th>Chapters</th>
<th>Cognitive Levels of Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge</td>
</tr>
<tr>
<td>Nature and Purpose of Business</td>
<td>6</td>
</tr>
<tr>
<td>Forms of Business Organization</td>
<td>10</td>
</tr>
<tr>
<td>Private, Public and Global Enterprises</td>
<td>6</td>
</tr>
<tr>
<td>Business Services</td>
<td>6</td>
</tr>
<tr>
<td>Emerging Modes of Business</td>
<td>6</td>
</tr>
<tr>
<td>Social Responsibility and Business Ethics</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
</tr>
</tbody>
</table>

Distribution of discriminating powers of items was calculated by formula:

\[
Dp = \frac{R_U - R_L}{0.5N}
\]
RU = No. of correct responses in upper group
RL = No. of correct responses in lower group
N = Total No. of correct responses

Table 3.2
Distribution of Discriminating Powers (D.P) of Items of First Draft of Achievement Test

<table>
<thead>
<tr>
<th>Discriminating Powers</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40 and above</td>
<td>38</td>
<td>Very good items</td>
</tr>
<tr>
<td>Between 0.30 and 0.39</td>
<td>23</td>
<td>Reasonably Good</td>
</tr>
<tr>
<td>Between 0.20 and 0.29</td>
<td>11</td>
<td>Needs Improvement</td>
</tr>
<tr>
<td>&lt; 0.19</td>
<td>3</td>
<td>Very poor</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

I) Second Try-Out
The revised version of the achievement test was administered on another group of 25 students of XI grade. Again Discriminating Powers of 72 items were computed. The distribution of discriminating powers can be seen in Table 3.3.
Table 3.3

Distribution of Discriminating Powers (D.P) of items of Final Draft of Achievement Test

<table>
<thead>
<tr>
<th>Discriminating Powers</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40 and above</td>
<td>38</td>
<td>Very good items</td>
</tr>
<tr>
<td>Between 0.30 and 0.39</td>
<td>27</td>
<td>Reasonably Good</td>
</tr>
<tr>
<td>Between 0.20 and 0.29</td>
<td>05</td>
<td>Needs Improvement</td>
</tr>
<tr>
<td>&lt; 0.19</td>
<td>02</td>
<td>Poor Items</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td></td>
</tr>
</tbody>
</table>

In the light of the results as shown in Table 3.3, out of 72 items, 02 items below the discriminating power of 0.20 were dropped and 05 items with DP between 0.20 and 0.29 were improved and finally 70 items were retained. These items were improved with respect to language and description. This led to the preparation of the final draft of the achievement test. This draft of achievement test comprised of 70 items.

J) Standardization of Achievement Test in Commerce

70 items constituted the final form of the Achievement test. The Achievement Test was further standardized by experimental validation of the test that included establishing reliability and validity.
a) **Reliability of the Test**

Reliability is one of the most important pre-requisite of a measuring tool. It is the degree of consistency between two measures of the same test. The reliability of a test refers to the extent to which a test measures consistency from one administration of the test to another. The reliability of the test was measured by split-half method. The co-efficient of the Reliability, was found by split half method and Guttman method calculated with the help of Statistical Package for Social Sciences (SPSS) and the results were shown in Table 3.4

<table>
<thead>
<tr>
<th>Methods Used</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split-half method</td>
<td>0.985</td>
</tr>
<tr>
<td>Guttman method</td>
<td>0.980</td>
</tr>
</tbody>
</table>

This indicates that the test is highly reliable. The reliability co-efficient of the present test was 0.98. Therefore, the achievement test may be considered highly reliable.
b) **Validity of the Test**

Validity is a concern for the relationship between the purpose set to achieve, on the one hand and the efforts made the means employed and what these efforts and means actually achieve, on the other. The validity of the Achievement Test constructed for the study was taken for granted because this is in accordance with Guilford (1971) who said, “There are some measures whose validity is taken for granted, for example, Achievement test Scores”.

Regarding the method of establishing the validity of the test, stated “At the most elementary level, it is necessary for all the test’ to have content validity, i.e., each question must be related to the topic under investigation, there must be an adequate coverage of the overall topic, the question must be clear, unambiguous etc. The most adequate approach to validation consists of checking the agreement between the responses elicited by the question against the criterion.

c) **Face Validity**

The face validity of the test was fairly high. There was a close agreement among the judges and experts to ensure its face validity.
d) **Content Validity**

The present achievement test was validated against the criterion of validity. Content validity is the most important criterion for the usefulness of the tests, especially of an achievement test. It is a measure of the match between the content of the test and the content of ‘teaching’ that preceded it. The measure is represented subjectively by the researcher after a careful process of inspections comparing the content of the test with the objective of the course of instruction. For the sake of content validity the test was given to the adequate number i.e. ten of subject experts already dealing with senior secondary level students and subject. Judges and experts were in consonance with the view that the content was covered in all the items of the test.

Thorndike (1975) maintained that problem of content validity is parallel to the problem of preparing a Blue Print for a test and then building a test to match the Blue-print. So, the Achievement test was found to possess content validity as there was correspondence between the table of specifications and test items.

e) **Intrinsic Validity**

Intrinsic validity was calculated by using following formula:
Intrinsic validity = $\sqrt{\text{reliability}}$

Which is $= \sqrt{.98} = .9899$

3.7.2.3 Retention Test

Achievement test, which was used to measure the achievement of students, was also used to measure retention of the students.

3.7.2.4 Non Verbal Test of Creative Thinking (NVTCF) developed by Baquer Mehdi to measure the creativity

This test was developed by Baquer Mehdi (2005) and published by National Psychological Corporation, Agra. This test was selected in comparison to others due to the following reasons:

i) It was a standardized non-verbal test that could be administered with ease irrespective of language of the students.

ii) The problems were very interesting and absorbing.

iii) The instructions were simple and easy.

iv) The test could be administered in general classroom situations and hence does not require any elaborate arrangement to be made.
a) **Introduction and Description of Non Verbal Test of Creative Thinking (NVTCF)**

The battery is meant to identify creative talent at all stages of education except pre-primary and Primary. The types of tasks included in the test were chosen so that they could be most easily and economically administered over a wide age range of sample, starting from middle school and going up to the graduate level. The tests are now being extensively used in researches on creativity in all parts of country. Test consists of three types of activities viz. Picture Construction (two), Picture Completion (Ten), and Triangles and Ellipses (Fourteen). The total time required for administering the test is 35 minutes out of which first activity is for ten minutes (five each), second activity is for fifteen minutes and the third activity is for ten minutes. In addition to the time necessary for giving instructions, passing out booklets are collecting them back.

**a. Reliability of the test**

The test-retest reliabilities of the factor scores and also the total score were obtained on a small sample of 50 pupils. The reliabilities of factor scores and also the total creativity score and considerably high, ranging from 0.93 to 0.91. The inter-scorer reliabilities using 34 test-scripts were found to be
0.93, 0.94 and 0.94 for elaboration, originality and total creativity scores respectively.

**b. Validity of the test**

The validity coefficients against the teacher rating for each factor and the total creativity score were 0.34, 0.32, and 0.38 for elaboration, originality and total creativity respectively.

**c. Procedure for scoring**

As there is no right or wrong responses for the test, much care has to be exercised at the time of scoring. The test user has to acquaint him fully with the method of scoring and the use of scoring sheet. The following points have to be kept and were kept in mind while scoring the test. Each item is to be scored for elaboration and originality. Only the items in activity III may be scored for flexibility. **Elaboration** is represented by a person’s ability to add pertinent details (more ideas) to the minimum and primary response to the stimulus figure. The minimum and the primary response to the stimulus figure is that response which gives essential meaning to the picture. The response title often tells what exactly the student is trying to make. The responses which can be reasonably interpreted and identified should be scored. It is important for the scorer to see that the primary and minimum response is meaningful and relevant to the
stimulus before it is scored. If the figure is not relevant and meaningful, it should be ignored. **Originality** is represented by uncommonness of a given response. Responses given only by less than five percent of the group are considered, and are given differential weights. The weights have to be determined on the basis of the following scheme. If a response has been given by 1 percent to .99 percent of the children, then the response will get an originality weight of 5; if a response has been given by 2 percent to 2.9 percent of the children, then the response will get an originality score of 3, if a response has been given by 3 percent to 3.9 percent of the children, then the response will get an originality weight of 2; if the response has been given by 4 percent to 4.9 percent of the children then the response will get an originality weight of 1. Response given by 5 percent or more of the children will get the originality weight of zero. Flexibility is represented by a person’s ability to produce ideas which differ in approach or thought trend. All ideas which differ in approach or thought trend are treated as one for purpose of flexibility scoring. Thus if five ideas are produced, and all belong to only one category of approach or thought trend, the score for flexibility will be one, but if all the five ideas are based on five different approaches or thought trends, then the flexibility score will be five. There would be intermediate score for flexibility,
depending on the number of categories of thought trends to which the responses belong.

**d. Administration**

Before administering the test, few points should be kept in mind. The place for administrating the test should be such that children may work comfortably and without disturbance. The usual setting for test administration is the class-room. Care should be taken that the classes not over crowded. Secondly the pupils should be properly motivated to take the test. The word “test” however should never be used throughout the session. Rather, it should be presented as a set of interesting tasks which the children would enjoy doing. What is important is to avoid a threatening situation which is frequently associated with testing. Thirdly the language used by the test administrator in going instructions to the children should be as simple as possible so that each one understands what is required of him. The test administrator should see that each child has available with his a pen or a pencil. He should, however, have a stock of pencils with him so that he may meet any emergency situation. Fifth the test administrator should preferably have a stop watch with him for timing each activity. Last but most important administrator must provide instruction in the pupil friendly
to all the students clearly and properly. All the instructions were followed by the investigator during the administration of the test.

3.8 Data Collection

In experimental research, the researcher needs to collect data from the selected sample before and after the treatment. For the present study the data was collected in four stages.

Stage-I - The investigator visited the selected school and met the head of the school. After introducing himself, the researcher stated clearly the purpose of coming over there and sought permission and time from the principal for smart classroom experimental program and administration of the tools. The Principal assured the researcher to provide all possible facilities for conducting the present research work. The investigator reached the institutions a little bit before the scheduled time and met the concerned teachers for the collection of the data for pre-test and to conduct the experiment. The teacher helped the investigator in making the necessary arrangement for the administration of the tool. The investigator visited the classrooms and introduced himself to the students. Before commencing the experiment the investigator established rapport with the students and told them about propose of the visit and gave orientation about
the tools that were to be administered. Students were assured that their responses would be kept confidential and be used for research purpose only.

The investigator administered the Non Verbal Group Intelligence Test (NVGIT), Achievement test in commerce and Non Verbal Test of Creative Thinking (NVTCF). The investigator asked them to give response on each item properly by reading all the necessary instructions given in the tests.

On the basis of results of Non Verbal Group Intelligence Test (NVGIT) investigator made two groups of the students. After matching the scores of Non Verbal Group Intelligence test investigator divided the students in two equal groups.

**Stage II** – The second stage was the treatment stage, where the investigator taught Commerce in smart classroom as well as in the conventional classroom for 25 working days for 45 minutes every day.

The control group was taught on the same 25 working days by the same set of lesion plans in the conventional method for 45 minutes every day by the investigator.

**Stage III** – The Third stage is known as post-test where the achievement of the students again evaluated after the smart
classroom program by administering achievement test of commerce and Non Verbal Test of Creative Thinking (NVTCF). The students gave the responses to all the items by reading each item carefully and handed it over to the researcher.

Stage IV – At the fourth and last stage investigator administered same achievement test after two months of experiment on both the groups to evaluate their level of retention in commerce.

3.9 Statistical Techniques Used

In the present study, the following statistical techniques were used for the analysis of data depending upon the design and objectives of the study.

- Descriptive statistics like measures of central tendency such as Mean and Standard Deviation were calculated to know the nature of the data.

- Differential statistics i.e. t-test was employed to know the significant difference between the mean scores.