CHAPTER III
PLAN AND PROCEDURE
Chapter –III

PLAN AND PROCEDURE

“Research Methodology is a way to systematically solve the research problem. It is a science that deals with the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them. The truth is that, successful completion of a research work without proper planning becomes not only difficult, but will nigh impossible. The planning includes the measures are to be adopted for collecting the relevant data, the sample to be taken, what controls are to be employed, and which would be the pertinent data that would be analysed.”

Kothari (1996)

Plan and procedure employed in an investigation determine 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 research on which the degrees of prediction, objectivity and validity of results depend. The selection of adequate methods, tools and technique is a very difficult problem and must be handled with every caution, care and profound consideration in respect of time, cost, ability, and experience. The investigation procedure for any study is decided upon before starting the project.

In this chapter, the plan and procedure adopted for the study have been discussed. It depicts the true picture of what must be done, how it will be done, what data will be needed, what data gathering devices will be employed, how the sources of data will be selected and how data will be analyzed? In the words of Mouley (1964) - "Scientific problems can be resolved only on the basis of data and a major responsibility of the scientific study is to set off a research capable of providing data necessary to the solution of the problem. It is impossible to say that one aspect is more crucial than another".

In the preceding chapters, the problem, its statement and related literature were discussed. This ongoing chapter treats the methods and procedures employed in this study. It includes design of the study, sampling techniques, description of tools, data collection procedure, scoring procedure, and statistical techniques used for analysis of data.
3.1 DESIGN OF THE STUDY

For carrying out any kind of research, it is important to chalk out a design. According to Best (1963), all research involves the elements of observation, description and the analysis of what happens under certain circumstances. A systematic procedure is a must to collect the necessary data, which helps to attain the objectives and to test the hypotheses formulated for the study.

The present research was designed to study the effect of Modular and Multimedia Instructional Strategies on Achievement of students in relation to Cognitive Styles and Achievement Motivation. For the purpose of investigation, experimental method was employed in the form of pre-test and post-test factorial design by involving two experimental groups and one control group.

The study was experimental in nature in which (3 x 2 x 2) factorial design was used to find out the effect of independent variables (Instructional Strategies, Cognitive Styles and Achievement Motivation) on the dependent variable of Achievement. The three levels of Instructional Strategies and two levels of each of the variables of Cognitive Styles and Achievement Motivation given below:

a) Instructional Strategies (I)
   i.) Modular Instructional Strategies (I1)
   ii.) Multimedia Instructional Strategies (I2)
   iii.) Control Group - (No Teaching I0)

b) Cognitive Styles (C)
   i.) Field Independent (C1)
   ii.) Field Dependent (C2)

c) Achievement Motivation (A)
   i.) High Achievement Motivation (A1)
   ii.) Low Achievement Motivation (A2)
In the study Instructional Strategies remained the treatment variable Cognitive Styles and Achievement Motivation were used as classifying variables and Achievement in English acted as dependent variable.

### 3.1.1 Treatment Combinations of Factorial Design

The total number of different combinations came out to be $3 \times 2 \times 2 = 12$ as shown in Table:-3.1 below:

<table>
<thead>
<tr>
<th>Groups I</th>
<th>Cognitive Styles C</th>
<th>Achievement Motivation A</th>
<th>Treatment Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Group -I</strong></td>
<td>C1</td>
<td>A1</td>
<td>I1 C1 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2</td>
<td>I1 C1 A2</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>A1</td>
<td>I1 C2 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2</td>
<td>I1 C2 A2</td>
</tr>
<tr>
<td><strong>Experimental Group -II</strong></td>
<td>C1</td>
<td>A1</td>
<td>I2 C1 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2</td>
<td>I2 C1 A2</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>A1</td>
<td>I2 C2 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2</td>
<td>I2 C2 A2</td>
</tr>
<tr>
<td><strong>Control Group -III</strong></td>
<td>C1</td>
<td>A1</td>
<td>I0 C1 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2</td>
<td>I0 C1 A2</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>A1</td>
<td>I0 C2 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2</td>
<td>I0 C2 A2</td>
</tr>
</tbody>
</table>

The Treatment combinations are detailed below:

1.) I1 C1 A1 Modular Instructional Strategy with Field Independent and High Achievement Motivation.
2.) I1 C1 A2 Modular Instructional Strategy with Field Independent and Low Achievement Motivation.
3. ) 11 C2 A1 Modular Instructional Strategy with Field Dependent and High Achievement Motivation.
4. ) 11 C2 A2 Modular Instructional Strategy with Field Dependent and Low Achievement Motivation.
5. ) 12 C1 A1 Multimedia Instructional Strategy with Field Independent and High Achievement Motivation.
6. ) 12 C1 A2 Multimedia Instructional Strategy with Field Independent and Low Achievement Motivation.
8. ) 12 C2 A2 Multimedia Instructional Strategy with Field Dependent and Low Achievement Motivation.
9. ) Io C1 A1 Control Group with Field Independent and High Achievement Motivation.
10. ) Io C1 A2 Control Group with Field Independent and Low Achievement Motivation.
11. ) Io C2 A1 Control Group with Field Dependent and High Achievement Motivation.
12. ) Io C2 A2 Control Group with Field Dependent and Low Achievement Motivation.

3.2 SAMPLE OF THE STUDY

The primary purpose of research is to discover principles that have universal applications, but to study a whole population in order to arrive at generalizations would be impracticable, if not impossible. Hence, sampling is a technique of the research studies. Sampling is the process by which a relatively small number of individuals, objects or events is selected and analysed in order to find out something about the entire population from which it is selected. The study of total population is not possible and it is impracticable.

A sample is a small proportion of a population selected for observation and analysis. By observing the characteristics of the sample, one can make certain inferences about the characteristics of the population from which it is
drawn. Contrary to some popular opinion, sample is not selected haphazardly; may be chosen randomly in a systematic way, so that chance or the operation of probability can be utilized. A good sample ensures three things freedom from bias; representativeness of population characteristics and adequacy in terms of population qualities.

There are several methods of sampling. Random sampling being considered the best because it is unbiased. The investigator has used the random sample in the present study. Random Sample is one in which every member has equal chance of being selected and the member is fairly representative and possesses all the common traits which exist in the population.

A sample pool of 500 students was drawn from the students of class IX of C.B.S.E. affiliated schools of Chandigarh. It consisted of both male and female students. The sample was random in nature and the technique of multistage sampling was employed to carve out the treatment combinations as per the requirements of $3 \times 2 \times 2$ factorial design described under the caption 3.1

The sample was selected with an assumption that the "other things being equal, the larger the sample, the greater the precision and accuracy of the data" (Mouly, 1964).

In the first stage, 5 schools were randomly selected out of the total number of Secondary and Senior Secondary Schools of Chandigarh.

In the second stage, the tool of Cognitive Styles was administered to the students and two groups belonging to field independent and field dependent categories were formulated in accordance with Kelly’s (1939) consideration of taking up Top and Bottom 27% groups.

In the third stage, the tool of Achievement Motivation was administered and two groups (High and Low Achievement Motivation) were formulated on the basis of Kelly’s (1939) consideration given above.
Thus four treatment groups were formed. Each of the four groups mentioned in the stage three above was further distributed into three equal groups (Two Experimental Groups and One control Group).

The sample size consisted of 12 students in each group. Thus in twelve groups of the sample for application of ANOVA 144 (12*12) cases were selected.

For Intercorrelation, the entire sample of 500 students was taken into consideration for computing relationship among the variables of Cognitive Styles, Achievement Motivation, Instructional Strategies and Achievement. The structure of the sample in respect of the schools taken for the experiment is presented in table - 3.2

Table: - 3.2
Sample Structure

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name of the School</th>
<th>Type of School</th>
<th>Total Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>1</td>
<td>Govt. Model Sr. Sec. School Sector-44, Chandigarh</td>
<td>Co-Edu</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>Govt. Model Sr. Sec. School Sector-42, Chandigarh</td>
<td>Co-Edu</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>Govt. High School Sector-53 Chandigarh</td>
<td>Co-Edu</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>Govt. Model High School Sector-41 D, Chandigarh</td>
<td>Co-Edu</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Govt. High School Sector-41 A, Chandigarh</td>
<td>Co-Edu</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>245</td>
</tr>
</tbody>
</table>
3.3 TOOLS USED

Selection of tools was done keeping in mind the relevance of tools in accordance with the objectives of the study, the reliability, validity and norms of tools. The following tools were used to conduct the present study:

1. Group Embedded Figure Test (GEFT) by Philip, I. K. Ottman, Evelyn R. and Herman, A. Witkin (1971) was used to identify the Cognitive Style of the students.

2. Achievement Motivation (n- Ach) Scale by Deo, P. and Mohan, A. (1985) to test the Achievement Motivation.

3. Modular and Multimedia Instructional Strategies (Developed by the Investigator)

4. Achievement Test (Developed by the Investigator)
3.4 DESCRIPTION OF THE TOOLS

The tools used for the present investigation has been described below:

3.4.1 Group Embedded Figure Test (GEFT)

Group Embedded Figure Test (GEFT) by Philip I K. Ottman, Evelyn R. and Herman, A. Witkin (1971), an adaptation of the original individually administered Embedded Figure Test (EFT) was preferred as a suitable instrument to measure the cognitive style dimension of field-independence/dependence of the sample primarily because it makes group testing possible and scores for a large number of individual can be conveniently obtained in a single test session of 20 minutes. It consists of one format and has 18 complex figures, 17 of which are taken from EFT.

GEFT required the subjects to locate a simple visual figure embedded within a more complex one. Besides the seven simple forms (A, B, C, D, E, F, G) that have to be located, the test has three sections, first section comprising a seven-item practice set which served the purpose of providing practice to the subjects and is not to be scored, second and third sections comprising of nine difficult figures which are arranged in ascending order of difficulty within each section.

Thus, the test has a scored set of 18 items administered in two equal parts and for which subjects are allowed a time limit of 5 minutes each whereas for the practice set only two minutes are to be allowed.

Scoring Procedure of GEFT

The total number of simple forms correctly traced in 2nd and 3rd sections combined is the individual score, since the items in practice set are not scored but merely scanned to ensure that the instructions have been understood properly by the subjects.

Omitted items are scored as incorrect. In order to receive credit for an item, all lines of the sample forms must be traced. All incorrect lines must be crossed. No extra lines are added.

The students getting above eight marks are indicative of field-independence while the students getting eight or below marks are denoted as field-dependent.
Reliability of the Scale

Since GEFT is a speed test, an appropriate method of estimating reliability is the correlation coefficient between parallel forms with identical time limit. Correlation between the 2nd and 3rd sections was calculated by Spearman Brown formula, producing a reliability of 0.82 for both males (N=80) and females (N=97) from an eastern liberal arts college (as reported in GEFT Manual, 1971).

Moreover, the value of Pearson's product moment coefficient of correlation between scores obtained on two administrations of GEFT (as reported by Vasesi, 1985) on a representative sample of the school students (Classes 9th and 10th, N=50) is 0.86 indicating a high reliability of the test.

Validity of the Scale

Validity of a test refers to the degree to which it measures what it intends to measure. Mouley (1970) remarked, "The validity of a test must be established prior to its use. Validation is an aspect of its development, not of its use in the solution of the problem". The validity of GEFT was assessed by criterion measure. The validity coefficients are presented in Table 3.3

<table>
<thead>
<tr>
<th>Population</th>
<th>N</th>
<th>Criterion Variable</th>
<th>r with GEFT scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male undergraduates</td>
<td>73</td>
<td>Individual EFT solution time</td>
<td>-0.82</td>
</tr>
<tr>
<td>Female undergraduates</td>
<td>68</td>
<td>Individual EFT solution time</td>
<td>-0.63</td>
</tr>
<tr>
<td>Male undergraduates</td>
<td>55</td>
<td>PRFT, error</td>
<td>-0.39</td>
</tr>
<tr>
<td>Female undergraduates</td>
<td>68</td>
<td>PRFT, error</td>
<td>-0.34</td>
</tr>
<tr>
<td>Male undergraduates</td>
<td>55</td>
<td>ABC, degree of body articulation</td>
<td>0.71</td>
</tr>
<tr>
<td>Female undergraduates</td>
<td>68</td>
<td>ABC, degree of body articulation</td>
<td>0.55</td>
</tr>
</tbody>
</table>

* r ’s with the EFT or the PRFT should be negative because the tests are scored in reverse fashion. The combined evidence suggests that the GEFT may prove to be a useful substitute for EFT when individual testing is impractical.
3.4.2 ACHIEVEMENT MOTIVATION SCALE

Achievement Motivation Scale constructed and standardized by Deo P. and Mohan A. (1985) is standard verbal measure of achievement motivation in general. The preliminary draft of the present scale was prepared with 115 items. For item analysis and item discrimination values, Johnson’s U.L.I. Method (Guilford, 1954) was applied, taking 27% upper and 27% lower achievers out of a group of 46 boys and girls. Out of 115 items, those which yielded negative or zero values were rejected outright. Finally, the scale consists of 50 items and 15 areas/dimensions of needs as given in Table 3.4.

Table: 3.4

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Factors</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Academic Motivation</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Need for Achievement</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Academic Challenge</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Achievement Anxiety</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Importance of Grades/Marks</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Meaningfulness of Tasks</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Relevance of School / College to Future Goals</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Attitude Towards Education</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Work Methods</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>Attitude Towards Teachers</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Interpersonal Relations</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>General Interest</td>
<td>4</td>
</tr>
<tr>
<td>13.</td>
<td>Dramatics</td>
<td>2</td>
</tr>
<tr>
<td>14.</td>
<td>Sports etc.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

In the final scale, out of 50 items 13 are negative and 37 are positive items. The positive items carried the weightage of 4, 3, 2, 1 and 0 respectively for the categories of Always, Frequently, Sometimes, Rarely and Never.
The negative items carried the weightage of 0, 1, 2, 3 and 4 for the same categories respectively. The Scale was published in English as well as in Hindi, for the present study, English version of the scale was used.

**Age Range:**

The age range for the subjects is between 13 years to 20 years for the test but can be used for other age groups also.

**Scoring Procedure**

Two stencil keys are used for scoring - one for positive items and the other for negative items. A positive item carries the weights of 4,3,2,1 and 0 respectively for the categories of Always, Frequently, Sometimes, Rarely and Never. The negative item is to be scored 0,1,2,3 and 4 for the same categories respectively that are given above. The total score is the summation of all the positive and negative items scores. The minimum scores obtained can be 0 and maximum can be 200, other scores ranging in between.

**Reliability of the Scale**

Test-retest method was applied to obtain the reliability coefficient of the scale on different sets of sample. The reliability coefficients of scale are entered in Table 3.5.

<table>
<thead>
<tr>
<th>Sample</th>
<th>N</th>
<th>Interval</th>
<th>r</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Group</td>
<td>51</td>
<td>4 weeks</td>
<td>0.69</td>
<td>0.01 Level</td>
</tr>
<tr>
<td>Males</td>
<td>33</td>
<td>5-6 weeks</td>
<td>0.67</td>
<td>0.01 Level</td>
</tr>
<tr>
<td>Females</td>
<td>50</td>
<td>5-6 weeks</td>
<td>0.78</td>
<td>0.01 Level</td>
</tr>
</tbody>
</table>

These coefficients of reliability for the total group as well as for the separate male and female groups are sufficiently high and the scale can be considered very satisfactory and taken as reliable for use.

**Validity of the Scale**

As far as the validity of the scale is concerned, the item validity established by the high-low discrimination method was accepted as the validity for the whole measure. Concurrent validity of the scale was found by coefficient of correlation between the scale and the projective test which was
0.54 and the scale correlated with the Aberdeen Academic Motivation Inventory of Entwistle, N. J. (1968) yielding a coefficient of correlation as 0.75 which supports the results of the present scale of achievement motivation to be sufficiently valid for use for measuring achievement motivation.

3.4.3 Development of Instructional Strategies:
This has been described in details in Chapter- IV

3.4.4 Development of Achievement Test:
The procedure of development of the Achievement Test is described in Chapter-IV

3.5 PROCEDURE OF THE STUDY

The Study was conducted in four phases. The following procedure was adopted for each topic to conduct the experiment.

Phase: I
- Cognitive Styles and Achievement Motivation Scale were administered to the sample strictly in accordance to the instructions given in the respective manuals.
- Achievement Test as Pre Test was administered to the students to explore their entering behaviour.

Phase: II
- The students were randomly distributed into two Experimental Groups and one Control Group for treatment on the basis of Instructional Strategies in the respective groups as given below:
  i) Experimental Group: - I Taught through Modular Instructional Strategy (Ii)
  ii) Experimental Group: - II Taught through Multimedia Instructional Strategy (Ii)
  iii) Control Group: - III No Teaching (Mo)
- The teaching was carried out for a period of 4 weeks (5 periods per week, 2 periods per day). Teaching for one period for each of the two Experimental Groups was done in each of the sampling schools.

Phase: III
After the Teaching Programme of 4-weeks, again same Achievement Test (as Post Test) was administered to the students of two treatment groups and one control group to get a measure of their final Achievement. The answer sheets were scored with the help of scoring key. The time limit for test was 1 Hour and 30 Minutes.
Phase: IV

The data were statistically analysed, interpreted and discussed in the context of the hypotheses of the study and the prior fund of research work.

3.5.1 Precautions Observed

Following precautions were observed during the course of the experiment for ensuring effectiveness and high precision in experiment conditions, which may have contributed to results:

i) The effectiveness of the experimental treatment was ensured by establishing rapport and liaison in the school, maintaining natural settings, harmonious atmosphere, providing sufficient time for various activities in the experimentation and the like.

ii) No undue stress or control of any kind was imposed on the subjects at any time during the study and the experiment was conducted in the relaxed natural setting.

iii) It was ensured that the topics taught to the students had not been previously taught to the students and not even taught by any other teacher during the experiment to any of the groups.

iv) Care was taken not to undermine the importance of the content matter or subject matter

v) Separate material was provided for every student during experimentation so as to avoid any disturbance or chances of unfair observation. Thus, it was ensured that the material provided to the students for testing, treatment or during experiment was sufficient to meet their demands.

3.6 SCORING OF THE TESTS

The tests were scored strictly in accordance with the instructions given in the respective manuals. The data yielded the following set of scores:

- Pre-test (Achievement Test) Scores
- Cognitive Style Test Scores
- Achievement Motivation Test Scores
- Post-test (Achievement Test) Scores
3.7 STATISTICAL ANALYSIS OF THE DATA

The data were subjected to statistical analysis through descriptive and inferential statistics by using SPSS software. Keeping in view the objectives, design and nature of data following statistical techniques were employed to analyse the data.

- Descriptive statistics such as measures of mean, median, mode, standard deviation and dispersion were used to study the nature and distribution of data. Kurtosis and skewness were computed to find out the normality of distribution.
- Three way analysis of variance on gain scores was computed to find out main effects and interaction effects of the independent variables on the dependent variable. Wherever F-ratios were found to be significant, t-ratios were computed to find out the significance of difference between means of pre test scores and post test scores.
- Pearson’s r was computed to find out the intercorrelation among the variables.

3.8 OPERATIONAL DEFINITIONS OF THE TERMS USED

1. Modular Instructional Strategy: Modular Instructional Strategy Means Self-Learning Modules. A Self-Learning Module is a self-contained unit, designed for a specific purpose, which includes a set of activities intended to facilitate learner's achievement. It is a self-instructional unit, self-paced, employing different types of media and is part of more comprehensive instructional system. Modular approach is an attempt to make the instruction individualized so that the student learns at his own pace according to his interest, capabilities and capacities.

2. Multimedia Instructional Strategy: Multimedia is the use of several media to convey information such as text, audio-graphics, animation and video. Multimedia also refers to computer data storage devices, especially those used to Multimedia content, using sound, pictures and films in addition to text on a screen. Multimedia systems also produce useful devices like DVDs which are widely popular in the sphere of education. As the information is presented in various formats, Multimedia enhances user’s experience and making it easier
and faster to grasp the information. Presenting information in various formats is nothing new, but Multimedia generally implies presenting information in various digital formats.

3. **Cognitive Styles:** Cognitive styles describe how the individual acquires knowledge (cognition) and processes information (conceptualization). Cognitive styles are related to mental behaviors which individuals apply habitually when they are solving problems. Cognitive Styles is a broad dimension of individual differences that extends across both perceptual and intellectual activities. It refers to the way a learner organises, filters, transforms and process information.

4. **Achievement Motivation:** Achievement Motivation is the psychological need and energetic drive that prompts an individual to strive for and work towards mastering his or her environment by the successful accomplishment of a goal or goals accompanied by a sense of satisfaction and self-worth.

Achievement Motivation is the desire to accomplish difficult tasks and overcome obstacles and an individual is not so much concerned with success or failure in given task as with attaining a certain standard set for himself or herself. Achievement Motivation is an important determinant of aspiration, effort and persistence when an individual expects that his performance will be evaluated in relation to some standard of excellence.

5. **Achievement:** Achievement has been considered as an important factor in the educational life of the students. It encourages the students to work hard and learn more. It is the status or levels of a person's learning and his ability to apply what he has learned. Achievement would not only include acquisition of knowledge and skills but also attitudes and values. The word Achievement is a wider term. It includes many dimensions of accomplishment in a given area as well as in different areas in terms of speed, accuracy, quality and levels of difficulty with which an individual can perform tasks to present achievement. So Achievement is the proficiency, accomplishment or performance in a given skill or body of knowledge.