CHAPTER IV

METHOD AND PROCEDURE

In this chapter, the method and procedure employed in the study have been described. The present study was designed to study the effectiveness of self-learning modules on acquisition of process skills among class IX students in relation to their cognitive styles and study habits. The nature of the study led the investigator to design the experiment so the present study is experimental in nature.

4.1 DESIGN OF THE STUDY

A research design is a detailed plan of the investigation in fact, it is the detailed procedure of testing the hypotheses and analyzing the obtained data. The research design thus may be defined as the sequence of those steps taken ahead of time to ensure that the relevant data will be collected in a way that permits objective analysis of different hypotheses formulated with respect to research problems. In every scientific investigation, there is a systematic procedure that is followed. The present investigation is experimental in nature following quasi experimental method with pre-test and post-test non equivalent group design.

This design is often used in class room when experimental and control groups are such naturally assembled groups as intact classes which may be similar. Often in educational research, the researcher is not in a position to assign subjects randomly to treatment, while
school principals may be willing to make two classes available for testing, they are not likely to permit researchers to break the classes up and reconstitute them; rather, they intend them to be kept as intact groups. Under these circumstances, therefore an experimenter may use pre-assembled groups, such as intact classes, for framing experimental and control groups. However this design mandates the use of a pre-test to demonstrate initial equivalence of the intact groups on the dependent variables. If the pre-tests scores of the groups are not equivalent, the experimenter may proceed with the conduct of experiment by using the technique of analysis of co-variance to compensate for this lack of equivalency between the groups.

The study involved three independent variables namely, Teaching strategies, Cognitive styles and study habits and one dependent variable i.e. acquisition of process skills. To study the main effects and interaction effects of independent variables of Teaching strategies, Cognitive styles and study habits on dependent variable of acquisition of process skills technique of analysis of variance was employed. The efforts here were directed to the question, “In what way and to what extent teaching strategies, Cognitive styles and study habits with the cross classifications interact in affecting acquisition of process skills”. The answer to this question had been sought through the factorial design of 2x2x2 analysis of variance.

As a requisite of factorial design of 2x2x2 analysis of variance, Incorporating independent variables of Teaching
strategies, Cognitive styles and study habits, the variables of teaching strategies was varied at two levels i.e. traditional (Lecture) method of teaching and teaching with the help of self-learning modules. Furthermore from each of these two levels the groups having poor and good study habits were identified on the basis of median scores. Again from each of the four groups thus formed Field dependents and Field independents were identified. The layout of the factorial design used in the present study is given in Fig. 4.1

**Figure 4.1**
Layout of 2x2x2 ANOVA

**TEACHING STRATEGIES**

A1
(Traditional Method)

B1
(B = Poor study Habits)

B2
(B = Good Study Habits)

C1
(C = field Dependent cognitive styles)

C2
(C = field independent Cognitive Styles)

A2
(Self Learning Modules)

B1

B2

C1

C2

B1=Poor study Habits
B2=Good Study Habits
C1=field Dependent cognitive styles
C2=field independent Cognitive Styles

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It is clear from the above table that treatment variable of teaching strategies has been designated as A and its two strategies, traditional method of teaching and teaching with self learning modules as $A_1$ and $A_2$ respectively.

The factor of study habits is designated as B and its levels as $B_1$ and $B_2$ corresponding to poor and good study habits.

The factor of cognitive styles is designated as C and its levels as $C_1$ and $C_2$ corresponding to Field dependents and Field independents.

The total number of combinations came out to be $2 \times 2 \times 2 = 8$ as shown in Fig. 4.2
4.2 SAMPLE

In every research investigator prepares and selects tools to collect data. Since, the population under study is very large. Hence, it is not possible for the investigator to collect data from the total population. Sampling is a procedure, which helps the investigator to collect data from a limited number of subjects chosen from the population.
There are several methods of sampling, in the present study random cluster sampling technique was used.

In the present study samples was drawn from the population of all IX class students studying in Government Model Senior Secondary Schools of Union Territory of Chandigarh in session 2003-04. Sample was raised through random cluster sampling technique. First of all two schools namely, Government Model senior Secondary school Sector 37 and Government Model Senior secondary School sector 46 were randomly selected from the total population of schools. From each school two sections were randomly selected. Each of these sections was randomly assigned to group I and group II. Initially the sample consisted of 213 subjects, which was gradually reduced to 200 students because 13 students did not take part in the complete experiment. Among the sample of 200 students Group 1 comprised of 100 and group II also comprised of 100 students.

All these students were pursuing the same course of study under Central Board Of Secondary Examination, New Delhi with the same official medium of instruction as English. They also belonged to nearly similar socio-economic status and came from middle income group families.

All of them were domiciles of Chandigarh; they were urban students. The school environment and school resources were also same for both the groups as all the
subjects for study were selected from the Government Model senior secondary schools of Union territory of Chandigarh.

Randomization in selection of the sample, condition of a true experimental design, could not be met, as is there in educational researches involving so many human beings. It is not desirable to disturb the classes because changing the placement in different sections would create other difficulties. Besides thus, during the experiment students should not be subjected to a new or changed condition(s) as that may in any way effect them psychologically. Making the children conscious too can effect environmental conditions. Thus, the placement of students is rather kept intact. Keeping in view the availability, feasibility and objectives of the experiment intact sections of class IX were selected for the study in natural settings

4.3 TOOLS USED

As per objectives of the study, to measure the subjects during pre-test and post-test on dependent variable and independent variable following tools were used

1. Group embedded figure test (Philip K. Ottman, Herman A. Witkin and Elyn Ruskin – 1971) was used to measure cognitive styles
2. Study Habit Inventory by N.S Yadav was employed to measure study habits
3. Criterion tests in the self-learning modules developed by the investigator.
4. An achievement test to measure acquisition of process skills developed by the investigator was used as pre-test and post test.

4.4 DESCRIPTION OF THE TOOLS

4.4.1 Group Embedded Figure Test (GEFT)

Witkin's GEFT was used to assess broad dimension of personal functions that comes from cognitive styles which included the characteristics, self consistent modes of functioning, which individuals show in their perceptual and intellectual activities. The GEFT contains three sections: the first section, which contains very simple items and is primarily for practice; and second and third sections each of which contain 9 more difficult items. The time limit of 5 minutes each for second and third section was set. The test was administered strictly in accordance with instructions given in the manual. The author refers to reliability as 0.82 found by correlation scores of 9 items of second section and 9 items of third section. The validity of GEFT has been assessed in several ways. One of the measure for evaluating GEFT validity is to correlate with the EFT as criterion measure. In one study, subjects were administered the second section in its group form and the third section as an individually administered test using the items in their original colored form. Another group was given the second section individually and third section as a group test. The correlations, corrected for reduced test length and combined for two groups have been reported in the following table.
### Table 4.1

**Validity coefficients of GEFT**

<table>
<thead>
<tr>
<th>Population</th>
<th>N</th>
<th>Criterion Variable</th>
<th>r with GEFT Score*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Undergraduates</td>
<td>73</td>
<td>Individual Solution time</td>
<td>-0.82</td>
</tr>
<tr>
<td>Female Undergraduates</td>
<td>68</td>
<td>Individual 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 EFT or PRFT should be negative because the tests are scored in reverse fashion.

#### 4.4.2 Study Habits Inventory

To measure the study habits of the students, a study habits inventory by N.S. Yadav was used. The inventory measures study habits in the following five areas: (i) Planning habits, (ii) Reading habits, (iii) Note-taking, (iv) Revision, (v) Examination habits.

The test comprises of 125 items having 25 items in each area. The items are scored on the basis of responses given by the student in the form of always, sometimes and
never. The standardization sample comprise of 1060 Higher secondary students from class IX to XII in age group of 14 to 20.

The reliability of inventory was calculated by split half as well as test retest method. In split half method the items were splitted on odd-even basis. Total scores of 425 students were taken into consideration on odd and even items and Pearson Product Movement. Coefficient of Correlation was computed applying Spearman Brown Prophecy formula which gave relative coefficient on test as .93. To find test retest reliability the inventory was administered on 225 students after a gap of two months which gave coefficient of 0.89.

Validity of the inventory was determined by following criteria

1. Annual examination marks of class IX and XI and public examination marks of class X and XII students. Total scores in terms of percentage were taken into account for finding validity which was 0.59

2. The judgement of class teachers of 425 students on their performance in school subjects was obtained using five point scale having very high, high, average, low and very low categories. These categories were assigned values of 5,4,3,2,1 respectively. The validity thus found was 0.53.
4.4.3 Acquisition of Process Skills Test

Acquisition of process skills test developed by investigator was used to measure process skills objective. The test consists of 60 items related to the process skill. The test has test-retest reliability of 0.91 and it has content validity.

4.5 PROCEDURE

The following procedure was adopted to conduct the experiment:

Phase – I (Pre Test Phase)

In this phase process skills test, study habits and cognitive styles test were administered to the whole sample. Both these groups were administered these tests one by one. The administration of these tests was carried one by one as per norms and instructions contained in their manuals.

Phase – II (Experimental Phase)

In this phase, assignment of strategy of instruction was done randomly Group I was taught through traditional method i.e. lecture method and Group II through self-learning modules. The lessons based on these methods of teaching were planned from their course of study in science at class IX level. Often the importance of content matter or the subject is underplayed in research, yet it is not to be lost sight of. The content dealt with during teaching learning process is of central importance. Hence, care was taken of this fact also. Same topics were taught to both groups. The
treatment was conducted by the investigator herself in both the groups so as to avoid teacher variable and to maximise precision.

*Phase – III (Post Test Phase)*

Immediately after the treatment was over the subjects were administered the acquisition of process skills test (which was used in pre test) as posttest.

The scheme of procedure is given in table 4.2.

**Table 4.2**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Stage</th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-test</td>
<td>Group Embedded Figure Test Study Habits Inventory Acquisition of process skills Test</td>
<td>Group Embedded Figure Test Study Habits Inventory Acquisition of process skills Test</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>Instructions through Lecture method</td>
<td>Instructions through self learning modules</td>
</tr>
<tr>
<td>3</td>
<td>Post-test</td>
<td>Acquisition of process skills Test</td>
<td>Acquisition of process skills Test</td>
</tr>
</tbody>
</table>

**4.6 DATA COLLECTION**

The tools mentioned under caption 4.3 were employed for data collection

First of all Group Embedded Figure Test was administered however before the actual administration of
the test instructions were read out to students as given in the manual. Since this is a speed test so time limit of the test was taken care of with the help of stopwatch

Test of acquisition of process skills developed by the investigator was administered twice as pre test and post test to measure the acquisition of process skills

Study habits inventory constructed by N.S.Yadav was administered to whole sample to measure the study habits of the subjects

The data thus collected comprised the following sets of scores:

- Cognitive styles raw scores
- Study habits raw scores
- Pre-test scores of acquisition of process skills
- Post-test scores of acquisition of process skills

4.7 SCORING OF TESTS

4.7.1 Scoring of GEFT

The scoring of GEFT was done according to the manual. The score is the total number of simple forms correctly placed in second and third sections combined. Omitted items are scored as incorrect. The items in the first section are not included in the total score. It was made sure that no extra lines have been added by the subject and that all incorrect lines have been erased. The raw scores were used to classify the students of each group into two groups
i.e. Field dependent and field independent by applying formula based on median scores of cognitive styles of the group

**4.7.2 Scoring of Study Habits Inventory**

Scoring of inventory is done manually. There are three scoring keys. These are marked as NO. 1, No. 2 and No.3, which give weightage scores of 3, 2 and 1 respectively. Before applying these keys it is made sure that out of three choices in item only one is marked by the subject. The procedure of scoring is to take key No. 1 and place it over answer sheet in such a way that four stars of the answer sheet fit in the holes of key. Then count through the small hole, the total number of responses, which have been marked by the subject. Multiply total number of responses by 3. The score thus obtained is part score of inventory. Follow the above same procedure for applying key No. 2 and 3 and give them weightage of 2 and 1 respectively. Then add up all the scores obtained through applying keys. The overall total of weighted scores is the individual scores on inventory.

**4.7.3 Scoring of acquisition of Process skills test**

A handmade scoring key was prepared for scoring the responses on acquisition of Process skills test. The total number of right responses were taken as the total score of the students.
4.8 PRECAUTIONS OBSERVED

Following precautions were observed during the course of the experiment (pre test- treatment –post test) for ensuring effectiveness and high precision in experiment conditions, which may have contributed to results:

1. All the subjects were oriented to the tests and respective methods of teaching as per their treatment in the beginning of the experiment

2. 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.

3. Testing as well as teaching was simultaneous in the two groups to avoid inter group interaction.

4. All the subjects were taught by the investigator herself to avoid any variation in teacher variable.

5. 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.

6. 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.
7. Care was taken not to undermine the importance of the content matter or subject matter

8. 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

4.9 STATISTICAL ANALYSIS OF DATA

The following statistical techniques were used to analyse the data

1. Descriptive statistics such as mean, median and standard deviation, skewness and Kurtosis were worked out to ascertain the nature of distribution of scores on dependent variable of acquisition of process skills test and independent variables of study habits and cognitive styles

2. t-test was employed to see the individual effectiveness of methods of teaching on acquisition of process skills.

3. Analysis of variance (2X2X2) was employed to study the main effects as well as interaction effects

4. t-ratios were also calculated in those cases where F-ratios were found to be significant

5. Graphical representations wherever necessary were done.