CHAPTER - III
METHODS AND
PROCEDURES
CHAPTER-III
METHODS AND PROCEDURE

In the previous chapters, the introduction to different variables under study, the review of the related literature, objectives and hypotheses were discussed. This chapter presents the description of the design of the study related to experimental design, sample-selection, tools used, instructional procedure, data collection and statistical techniques employed for analysis of data.

3.1 DESIGN OF THE STUDY

Since the present study aims at finding the effectiveness of concept mapping and concept attainment models in acquisition of science concepts in relation to style of learning and thinking and study habits, pre-test, post-test (3x3x2) factorial design was employed. Instructional strategies were studied at three levels, viz; traditional teaching method, concept mapping and concept attainment model. The classifying variables were Style of Learning and Thinking by Dr. E. Paul Torrance to classify the students into left brained, right brained and whole brained and study habits by M. Mukhopadyay and D.N. Sansanwal inventory to reveal study habits for better learning in the subject of science in school and at home.

In this study, criterion was the scores of achievement test. The gain achievement scores of the three groups were subjected to statistical treatment as per the statistical design for the study of description.

3.2 DIMENSION OF THE FACTORIAL DESIGN

The factorial design was used as it permits to evaluate the combined effect of two or more independent variables simultaneously. The dimensions of
factorial design refer to the number of levels of each factor. The lay out of the factorial design used in the present study is given in Fig. 3.1.

**Figure 3.1 Teaching Strategies**

Schematic layout of 3x3x2 factorial design for mean gain on achievement scores

\[
\begin{align*}
C_1 &= A_1 B_1 C_1 \\
C_2 &= A_1 B_1 C_2 \\
B_1 &= C_1 = A_1 B_2 C_1 \\
B_2 &= C_2 = A_1 B_2 C_2 \\
B_3 &= C_1 = A_1 B_3 C_1 \\
B_2 &= C_2 = A_1 B_3 C_2 \\
A_1 &= C_1 = A_2 B_1 C_1 \\
A_2 &= C_2 = A_2 B_1 C_2 \\
A_3 &= C_1 = A_2 B_2 C_1 \\
A_2 &= C_2 = A_2 B_2 C_2 \\
A_3 &= C_1 = A_2 B_3 C_1 \\
A_2 &= C_2 = A_2 B_3 C_2 \\
A_3 &= C_1 = A_3 B_1 C_1 \\
A_2 &= C_2 = A_3 B_1 C_2 \\
A_3 &= C_1 = A_3 B_2 C_1 \\
A_3 &= C_2 = A_3 B_2 C_2 \\
A_3 &= C_1 = A_3 B_3 C_1 \\
A_3 &= C_2 = A_3 B_3 C_2 \\
B_1 &= C_1 = A_3 B_1 C_1 \\
B_2 &= C_2 = A_3 B_1 C_2 \\
B_3 &= C_1 = A_3 B_2 C_1 \\
B_3 &= C_2 = A_3 B_2 C_2 \\
B_3 &= C_1 = A_3 B_3 C_1 \\
B_3 &= C_2 = A_3 B_3 C_2
\end{align*}
\]

\(A_1, A_2, A_3\) depicts instructional Strategies

\(B_1\) stands for left brained dominance

\(B_2\) stands for right brained dominance

\(B_3\) stands for whole brained dominance

\(C_1\) stands for good study habit

\(C_2\) stands for poor study habit
Figure 3.1 depicts teaching strategies designated as A and its three strategies viz., concept mapping, concept attainment model and traditional method as A₁, A₂ and A₃ respectively. Cerebral dominance is designed as B and its three levels B₁ (left-brain), B₂ (right brain) and B₃ (whole brain) respectively. Third variable is study habits and is designated as C and has two levels C₁ and C₂ representing good and poor study habits respectively. The total number of combinations came out to be $3 \times 3 \times 2 = 18$.

3.3 SAMPLING

It is not possible to study whole of the population for a particular problem under investigation, so the research design has to resort to sampling. Sampling procedures provide generalization based on relatively small proportion of the population. Two samples were chosen, one for validation of achievement test and other for conducting the experiment. For validation of achievement test, samples of 100 students were raised from one school of Chandigarh. The experiment study was conducted on a sample of 450 students selected from five different schools. Purposive-cum-randomized sampling technique was employed to select students for three experimental group’s viz., concept mapping, concept attainment model and traditional teaching.

Table 3.2: School-wise breakup of the sample

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of School</th>
<th>Number of Students taken for study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GMSSS-23A Chd</td>
<td>126</td>
</tr>
<tr>
<td>2</td>
<td>GMSSS-40 B Chd</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>GMSSS-21A Chd</td>
<td>64</td>
</tr>
<tr>
<td>4</td>
<td>GMSSS-37B Chd</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>GMSSS-8 C Chd</td>
<td>90</td>
</tr>
</tbody>
</table>
During the experiment the tests was administered to determine their most frequently used cerebral hemisphere (left brained, right brained and whole brained) and to determine the sum total of study habits of learners. The data was complete in respect of 432 students, thus leading to experimental mortality of 18 students. A result of the present study was based on raw data of 432 students. Out of 432 students, 144 students each were taught through Concept mapping (group A₁), Concept attainment model (group A₂) and Traditional method (group A₃) respectively.

3.4 TOOLS EMPLOYED

In the present study, the following tools were use for the collection of the relevant data.

1. An achievement test developed and standardized for local use by investigator was used to test the performance of the learners before and after treatment.

2. Lesson plans on concept maps and concept attainment model in selected topics were developed on the same topics by the investigator.

3. Style of learning and thinking SOLAT (1988) by Torrance was used to identify cerebral dominance. (Annexure-5)

4. Study habit inventory developed by M. Mukhpadyay and N. Sansanwal (1992) was used to measure the study habits of learners.

3.4.1 Description of Tools:

3.4.1.1 Achievement test:

To measure knowledge, understanding and application in science, an achievement test was constructed by the investigator. The test consisted of fill in blanks, true/false, multiple choice and short answers type questions. The
details of the development of achievement test are discussed in chapter IV. Each right answer carries one mark. The reliability of the test was calculated by test-retest method and was found to be 80%

3.4.2.2 Concept maps (CM)

Concept maps in selected topics of class 10th science were developed by the investigator. All the concept maps under study are appended at the end.

3.4.3.3 Concept attainment model (CAM)

Lesson plans on concept attainment model in selected topics of class tenth science subject were developed by the investigator. All the concept attainment models under study are appended at the end.

3.4.4.4 Styles of learning and thinking (SOLAT) Youth Form by: E.P Torrance (1988).

Educators have been especially interested in the specialized functioning of the right and left cerebral hemisphere. Dr. E. Paul. Torrance constructed this test assisted by McCarthy and Kolesinski. SOLAT helps to determine the students’ most frequently used cerebral hemisphere. The youth form intended for grades 6 to 12 was administered in classroom groups. Required testing conditions were arranged and maintained through out the test for:

(i) Check the first statement if it describes you.

(ii) Check the second statement if it describes you.

(iii) Check both statements if you are good at both or enjoy both, and if you do not have a strong preference for one over the other.

(iv) Check neither statement if you are not good at either or if you enjoy neither. It is a self-report inventory with 28 questions and Cronbach alphas of 0.77(Left-brain) scales, 0.74(Right brain) scales and 0.47(Whole brain) scales.
The hemispheric dominance is determined, based on the highest scores in three categories of dominance, as far as the group testing or scores is concerned.

**Scoring**

The responses by the students on the test were scored as left, right and whole on the basis of the scoring key given with the SOLOT test. The youth form (Torrance, 1988) has an inventory with 28 items and has a simple response format. A copy of the test and scoring key is given in (Annexure-V)

### 3.5 STUDY HABITS

Study habit inventory (1983) developed by M. Mukhopadhyaya and D.N. Sansanwal was used to identify study habits of students. The study habit has been constituted of a different kind of study behaviors. These are comprehension, concentration, task orientation, interaction, drilling, supports, recording, set and language. There are 52 items in study habit inventory and in each items there are five way to respond i.e. always, frequently, sometime, rarely and never. Learners were asked to state their habits about these items. Scoring of study habits inventory is having positive and negative nature of statements. If the statement is positive scores are given 4,3,2,1,0 respectively and if statement is negatives in nature, then score are given 0,1,2,3,4. Scoring was done with the help of scoring key developed by the authors. The composite score was obtained by adding the total positive and negative scores (Annexure-IV). The reliability of the whole inventory was worked out to by using split half method. The reliability coefficient is 0.86 which is fairly high and indicates that the inventory is reliable.
3.6 PROCEDURE

The present study was conducted in following phases:

**Phase I:** During this phase, lesson plans in traditional method, concept mapping and concept attainment model were developed. An achievement test in selected science concepts from 10th class syllabus was constructed for local use.

**Phase II:** During this phase, the entire three tests namely-achievement test as pretest, Torrance test of style of learning & thinking (1988) and study habit inventory (1983) by Mukhopadhyay & Sansanwal were administered to the whole sample.

**Phase III:** During third phase, each group was assigned a teaching strategy through lots and was taught science concepts.

**Phase IV:** During fourth phase, achievement test in science as post test to all the students.

3.7 DATA COLLECTION

The responses of the students on all the tests were scored as per scoring procedure given under the respective tests. The raw data comprised of the following set of scores.

1. Pre test achievement scores and Post test achievement scores. Achievement gain scores were calculated as the difference between post test scores and pre test scores.

2. Style of learning and thinking scores in respect of left-brain, right-brain and whole-brain scores, which were converted into standard scores as per the instructions in the manual.

3. Study habit inventory scores in respect of good study habits and poor study habits.
3.8 STATISTICAL ANALYSIS OF DATA

The following statistical techniques were employed to analyses the data obtained from the experiment to test the hypotheses.

Descriptive statistics like mean, median, mode, kurtosis, skew-ness, standard deviation and frequency polygons were computed to study the nature of the distribution of scores. ANOVA and t-tests were computed to test the hypotheses. A three way analysis of variance [(3x3x2) instructional strategies x SOLAT (L, R, and W) x study habits] was computed to find out the main interrelational effects of instructional strategies, SOLAT and study habits on achievement.

3.9 OPERATIONAL DEFINITIONS OF THE TERMS USED IN THE STUDY

For the purpose of the present study, the various concepts may be operationally defined as below:

Achievement

Achievement as measured by the achievement test developed and standardized by the investigator in the form of scores.

Acquisition

It refers to the attainment of certain abilities and development of certain skills during the learning process. Acquisition means “a new response added to the organism’s repertory of response through learning”. (Atkinson, J; Bema, E & Woodworth, R.S.1988)

Concept:

Concept is a symbolic construction that represents some common and general features of objects and events. There are two types of features: relevant features connected by some specific rules and irrelevant features connected by
any rule. It is the basic unit of all types of learning that has been acquired in different ways during the time.

**Concept formation** refers to the process of establishing a new category, and consists essentially of a process of abstracting the essential common features of a class of objects or events.

**Concept Mapping**

It refers of the organized knowledge to make connection between new concepts and prior concepts. The maps are drawn in the form of concepts (representation circles) and linking the various concepts, which show relationship between various concepts.

**Attainment**

Refers to the process of finding predictive defining attributes that distinguish exemplars from non-exemplars of the class one seeks to discriminate.

**Concept attainment**

It is an indirect instructional strategy that uses a structured inquiry process. In concept attainment model, students figure out the attributes of a group or category that has already been formed by the teacher. To do so, students compare and contrast examples that contain the attributes of the concept with examples that do not contain those attributes. They then separate them into two groups. Concept attainment, then, is the search for and identification of attributes that can be used to distinguish examples of a given group or category from non-examples.

**Cerebral dominance/Hemispheric**

It refers to the individuals how they process a particular thing in different ways. Some of the individuals prefer to use right side of the brain, while some of them prefer to use left side of the brain and some prefer both the
sides of hemisphere, as measured by Torrance’s style of learning and thinking (SLOAT, 1988).

Study habits

It refers to acquisition of knowledge and skill through more or less permanent mode of study. Study habits is defined as Good and Bad study habits as measured by Mukhopadyay and Sansanwal (1983, 87, 92) study habits inventory.

LAYOUT OF THESIS

Chapter-1 Introduction
Chapter-2 Review of Literature
Chapter-3 Methods and Procedure
Chapter-4 Development and Description of tools
Chapter-5 Analysis and Interpretation of data
Chapter-6 Summary and conclusion
Bibliography