Chapter IV
Method of the Study
CHAPTER - IV

METHOD OF THE STUDY

In the proceeding chapters, the theoretical rationale of the problem and the tools along with their development were discussed. The present chapter has been developed to discuss the method of the study which covers:

4.1 The tools used
4.2 The sample
4.3 Design of the study
4.4 The procedure
4.5 The statistical techniques used for the analysis of data.
4.6 Precautions observed
4.7 Constraints and difficulties faced during the experiment.

4.1 TOOLS USED

For the present investigation following tools were used.

1. Development of Criterion Test (Developed by Investigator)
2. Development of Achievement Test (Developed by Investigator)
3. Development of Instructional Material with graphic organizers (Developed by the Investigator)
4. Group Test of Intelligence (Dr. G.C. Ahuja, 1984)

4.2 SAMPLE

In a research project, researchers usually come across unmanageable population, where in large numbers are involved, so it is difficult to study the
whole population. It is often desirable in order to reduce expenditure, time and energy, to produce greater precision and accuracy, a sample from a population should be taken. Sampling is the process by which a relatively small number of individuals or objects are selected and organised in order to find out something about the entire population from which it is selected. Sampling procedures provide generalizations on the basis of relatively small proportion of population.

In the present study, Group Test of Intelligence was administered to 300 students of class IX from the D.A.V. Senior Secondary School and Khalsa Senior Secondary School affiliated to P.S.E.B. of Ropar District in Punjab. Time limit for the test was 40 minutes, separate answer sheets were provided to the students. Scoring was done with the help of scoring key.

The intelligence scores of the students on Group Test of Intelligence were arranged in an ascending order. The 27 percent higher and 27 percent lower scoring subjects were selected and the middle group was also selected. Each one of the selected groups was randomly allocated to the three sub-groups. One group from the high scoring, second from the average and third from the low, were allocated to two experimental groups and similar matching group to control group. So, the final sample comprised of 180 students. It was purposive because Khalsa Senior Secondary School and D.A.V. Senior Secondary School of Ropar district in Punjab, which were approachable, were selected. It was random because IX class students, selected for experimentation were randomly allocated to the three groups viz, two experimental groups i.e. experimental group I, pre-graphic organizer instruction, experimental group II, post-graphic organizer instruction and third control group. Each group consisted of randomly allocated high, average and low intelligence level students. The three groups were as similar as the availability permitted. Their average age was 14 years.
There were 60 students of experimental group I, 60 students of experimental group II and 60 students of control group. The students of each group belonged to high, average and low intelligence level. The sample distribution with respect to the number of students in each sub-sample is present in Table 4.1.

**Table 4.1**

Sample Description

<table>
<thead>
<tr>
<th>INTELLIGENCE</th>
<th>T₁ (Experimental group I)</th>
<th>T₂ (Experimental group II)</th>
<th>T₃ (Control group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Intelligence</td>
<td>M = 39.41</td>
<td>M = 38.96</td>
<td>M = 38.07</td>
</tr>
<tr>
<td></td>
<td>SD = 1.04</td>
<td>SD = 1.54</td>
<td>SD = 1.31</td>
</tr>
<tr>
<td></td>
<td>n = 20</td>
<td>n = 20</td>
<td>n = 20</td>
</tr>
<tr>
<td>Average Intelligence</td>
<td>M = 33.74</td>
<td>M = 33.11</td>
<td>M = 32.62</td>
</tr>
<tr>
<td></td>
<td>SD = 2.21</td>
<td>SD = 2.67</td>
<td>SD = 2.79</td>
</tr>
<tr>
<td></td>
<td>n = 20</td>
<td>n = 20</td>
<td>n = 20</td>
</tr>
<tr>
<td>Low Intelligence</td>
<td>M = 28.96</td>
<td>M = 27.87</td>
<td>M = 28.86</td>
</tr>
<tr>
<td></td>
<td>SD = 3.08</td>
<td>SD = 3.05</td>
<td>SD = 2.98</td>
</tr>
<tr>
<td></td>
<td>n = 20</td>
<td>n = 20</td>
<td>n = 20</td>
</tr>
</tbody>
</table>

No doubt, the sample is small for the result of the study to be generalized but availability of a large sample and feasibility of carrying and such an experimental group on large sample is beyond the control of the investigator. Even earlier investigators conducting such studies through experimental designs have used small samples. Talegraonkar (1984) had taken 34 class IX students for his study. Panda (1986) included 86 students in his sample while Chitriv (1983) had taken three intact sections of class IX for his study with 35 students in each section as his sample. Baveja (1988) took 63 students in her experimental group and 36 students in control group making a total sample of 99 students. Jamini (1991) had worked on two sections of Chemistry classes in a school. Passi and Sansanwal while reviewing research in teaching in Buch’s Fourth Survey of Research in Education (1991) had
justified the use of small samples in such experimental researches due to
deeper inquest of these studies and available methodological facilities. It is
accepted that almost all studies of this nature, as the present one have worked
on small samples only.

4.3 DESIGN OF THE STUDY

Educational research is described as experimental when the researcher
has firstly, specified a set of researchable hypotheses and secondly, has
established a systematic programme of data gathering under precisely defined
conditions in an effort to test these hypotheses. The hypotheses provide a
network of statements relating the impact of an independent variable or a set
of independent variables on some outcome variable as independent variables
(Ingersoll, 1984).

A good experimental design should provide some information with
respect to all the objectives of the experiment (Winer, 1971). Any experimental
problem has two-interrelated aspects, the design of the experiment and
statistical analysis of the data. The latter aspect is directly dependent upon
the former aspect. Statistical methods can greatly increase the efficiency of an
experiment and also strengthen the conclusions so obtained (Montgomery,
1984).

Accordingly, 3x3x3 factorial design combined with ANOVA (Campbell
and Stanley, 1963) was employed. The factorial design was used as it permits
to evaluate the combined effect of two or more experimental variables when
used simultaneously.

Information from factorial design experiment is more complete than
that obtained from a series of single factor experiments in the sense that
evaluation of interaction effects can be made. Also the population to which
inference can be made is more inclusive than the corresponding population for
a single factor experiment (Winer, 1971).
ANOVA was preferred to increase the precision of analysis of the experimental data which utilized both the pre-test and post-test scores. The present study employed two replications of 3x3x3 factorial design with three fixed variables of which the measures on one variable were repeated for mean gain on achievement scores and the retention scores.

Also, 3x3 factorial design was employed for analyzing mean gain scores on achievement test.

The model was a fixed one because all the levels of the variables in each of the designs were determined on a logical basis and were not selected by sampling (Guilford and Fruchter, 1978). Computational procedure was followed according to the technique given by Winer (1971). When a factorial design follows a fixed model in the technique of ANOVA, the error term is always the “Within treatment mean Squares” (Edwards, 1971).

There were different sets of dependent variables. The first 3x3x3 factorial design was computed by ANOVA for the mean gain on achievement scores. Here instructional treatment, intelligence and category of objectives were independent variables. Gain an achievement scores was the dependent variable which was calculated as the difference in post-test and pre-test scores for each subject.

The variable of instructional treatment was studied at three levels namely experimental group (T₁) which was taught by pre-graphic organizer instruction, experimental group (T₂) which was taught by post graphic organizer instruction and control group (T₃) which was taught by traditional instruction. The variable of intelligence was studied at three levels viz., high intelligence, (I₁), Average Intelligence (I₂) and low intelligence (I₃) levels. The third variable of categories of objectives was studied at knowledge (O₁), comprehension (O₂) and application (O₃) category.
The schematic layout of the design has been presented in the Fig. 4.1.

**Fig. 4.1. Schematic layout of 3x3x3 factorial design for mean gain on achievement scores**

![Schematic Layout](image)

- **Performance Gain**

- **T1**: Experimental group I
- **T2**: Experimental group II
- **T3**: Control group

- **I1**: High intelligence
- **I2**: Average intelligence
- **I3**: Low intelligence

- **O1**: Knowledge category of objectives
- **O2**: Comprehension category of objectives
- **O3**: Application category of objectives

The second 3x3x3 factorial design was for retention scores. The schematic layout of the design has been presented in Fig. 4.2. Here, the variable of instructional treatment was studied at three levels, namely experimental group I (**T1**), experimental group II (**T2**), and control group (**T3**). The variable of intelligence was studied at three levels viz., high intelligence (**I1**), average intelligence (**I2**) and low intelligence (**I3**). The variable of categories of objectives was studied at three levels viz., knowledge category (**O1**), comprehension category (**O2**) and application category (**O3**).
The schematic layout of the design has been presented in the Fig. 4.2.

**Fig. 4.2.:** Schematic layout of 3x3x3 factorial design for retention scores.

**Retention Scores**

\[
\begin{array}{c}
\uparrow \\
T_1 \\
\downarrow \\
I_1 \quad I_2 \quad I_3 \\
\downarrow \\
O_1 \quad O_2 \quad O_3 \\
\downarrow \\
T_2 \\
\downarrow \\
I_1 \quad I_2 \quad I_3 \\
\downarrow \\
O_1 \quad O_2 \quad O_3 \\
\downarrow \\
T_3 \\
\downarrow \\
I_1 \quad I_2 \quad I_3 \\
\downarrow \\
O_1 \quad O_2 \quad O_3 \\
\downarrow \\
\end{array}
\]

- \( T_1 \) = Experimental group I
- \( T_2 \) = Experimental group II
- \( T_3 \) = Control group
- \( I_1 \) = High intelligence
- \( I_2 \) = Average intelligence
- \( I_3 \) = Low intelligence
- \( O_1 \) = Knowledge category of objectives
- \( O_2 \) = Comprehension category of objectives
- \( O_3 \) = Application category of objectives

The third 3x3 factorial design was analyzed with the help of ANOVA for gain scores on study habits. Here instructional treatment and levels of intelligence were the independent variables and gain scores on study habits was the dependent variable. The variable of instructional treatment was studied at three levels viz., experimental group I \((T_1)\), experimental group II \((T_2)\) and control group \((T_3)\). The variable of intelligence was studied at three levels viz., high intelligence \((I_1)\), average intelligence \((I_2)\), and low intelligence \((I_3)\) levels. The schematic layout of the design has been presented in Fig. 4.3.
Different kinds of variables used in the study are as under:

**Treatment Variables**

As the impact of graphic organizer instruction criterion variables has to be studied, the instructional treatment in the form of graphic organizer instruction followed by teacher and traditional instruction were used as treatment variables. For instruction, the three treatment groups used in the study two are experimental groups and one is control group.

**Dependent Variables**

The dependent variables were achievement and retention in social studies. The students were scored on these variables before and after the treatment in all the three groups.

**Organismic Variables**

In research, frequent use is made of response inferred organismic variables (Edwards, 1968), which means a classification based upon prior observation of responses. Intelligence was the organismic variable in the
present study, upon which classification of groups was made. Intelligence was controlled by equating the number of high, average and low intelligence subjects in each group.

**Situational Variables**

Situational variables like teacher, time, duration of treatment, institutional variations, conditions of instruction, use of teaching aids, subjects to be taught, sample size and the like were controlled administratively and through selection of the sample, equating the time regarding the groups through equal treatments and like-wise.

**Table 4.2**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Variables controlled</th>
<th>Controls employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional treatment</td>
<td>Gain scores on achievement</td>
<td>Class to be taught</td>
<td>Administrative (only IX Class was taught)</td>
</tr>
<tr>
<td>Intelligence</td>
<td>Retention scores</td>
<td>Subject to be taught</td>
<td>Only social studies as a subject was taught</td>
</tr>
<tr>
<td>Category of objectives</td>
<td>Gain scores on study habits</td>
<td>Teacher variations</td>
<td>Same teacher taught three groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size of the sample</td>
<td>Equal number of students were taken in a group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average age of the sample</td>
<td>All the sections included pupils of the average age group 14 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Situational variables (i) Period of treatment (ii) Duration of treatment</td>
<td>All the groups were taught for 43 periods of 35 minutes each</td>
</tr>
</tbody>
</table>
4.4 PROCEDURE

Procedure of the experiment comprised of two main stages which are selection of the sample and conducting the experiment.

Stage 1
Selection of the sample

The present study was conducted on 180 students of class IX from the D.A.V. Senior Secondary School and Khalsa Secondary School of District Ropar in Punjab. Class IX students were selected for experimentation after administration of intelligence test to 300 class IX students (as explained under the sub-heading sample in the present chapter). Each group consisted of randomly allocated high, average and low intelligence level students.

Stage 2
Conducting the experiment

The experiment was conducted in four phases as given below:

Phase I : Administration of the pre-test.
Phase II : Conducting the instructional program.
Phase III : Administration of the post test
Phase IV : Administration of the retention test.

Phase I
Administration of the pre-test

This phase involved the administration of the following tests to the students of the experimental groups and control group i.e.

- Criterion test
- Study habits inventory

Separate response sheets were provided. The answer sheets were scored with the help of scoring key. The scores indicated the previous knowledge possessed by the students and their study habits.
Phase II

Conducting the instructional program.

To find the efficiency of the independent variables, the instructional treatment was manipulated in the form of teaching based on pre graphic organizer instruction and post graphic organizer instructions and traditional teaching method. The instructional treatment was given for 46 days to the three groups. The experimental group I was taught through pre graphic organizer instruction, experimental group II was taught through post graphic organizer instruction and group III was taught through traditional instruction. Same topics were taught to the three groups. The instructions were conducted through well structured lesson plans in the content selected for treatment. The treatment was conducted by the investigator herself in all the three groups so as to minimize teacher variable and maximize precision.

Phase IV

Administration of the Post-Test

Immediately after the instructional treatment was over, the subjects were assessed on criterion measures to know the effect of the treatment. For this, the students were administered the post test for all the treatment variables using the same criterion test as the pre-test. Also students were administered study habits.

Phase V: Administration of the Retention test

Twenty days later, the criterion test was again administered to the students to get a measure of retention. Again the obtained answer sheets were scored with the help of scoring key. The data schedule of the experiment has been given in Table 4.3.
Table 4.3
Date Scheduled of the Experiment

<table>
<thead>
<tr>
<th></th>
<th>Experimental group I, (pre graphic organizer instruction)</th>
<th>Experimental group II, (post graphic organizer instruction)</th>
<th>Control group (conventional/traditional instruction)</th>
</tr>
</thead>
</table>

4.5 STATISTICAL TECHNIQUES

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

- Graphical representation.
- Qualitative analysis of criterion scores.
- Factorial design 3x3x3, Analysis of variance from mean gain on achievement scores.
- Factorial design 3x3x3, Analysis of variance for retention scores.
- Factorial design 3x3, Analysis of variance for gain scores on study habits.
- Descriptive statistics like mean, standard deviation of achievement scores.

For further investigation, t-test was used for testing the significance of difference between the means gain on achievement, retention and study habits of different groups.
4.6 PRECAUTIONS OBSERVED

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

- All the subjects were oriented to the tests and respective graphic organizer instructions as per their treatments in the beginning of the experiment.
- 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 a relaxed natural setting.
- All the subjects were taught by the investigator herself to avoid any variation in the teacher variable.
- The effectiveness of the experimental treatment was ensured by establishing rapport and liaison in the school, maintaining natural setting, harmonious atmosphere, providing sufficient time for various activities in the experimentation and the like.
- It was ensured that the topics on contents of treatment had not been previously taught to the students and not even taught by any other teacher during the experiment to any of the groups viz., experimental groups and control group.
- During each of three treatments, attempt was made to stick to the limits of the specific graphic organizer instruction for treatment to the respective group and not to deviate from the teaching learning activities in the lesson plans of the treatment during execution.
- 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 orientation was adequate to meet this demand.
- Teaching periods of 35 minutes duration were utilized fully for treatment and time was not wasted during experimentation.
4.7 CONSTRAINTS AND DIFFICULTIES FACED DURING EXPERIMENT.

It will not be improper to mention some of the difficulties faced or the constraints of the experiment for the knowledge of those who intend to conduct such researches in future. Such constraints of the experiment also need to be taken not of. These are:

a) It is quite an effort to make teachers and principal agree to cooperate in this experiment.

b) It is an essential requisite for every experiment that the treatment be fully during the days of treatment. Thus, it was ensured that the sample groups were regularly attending the school excepting some unavoidable circumstances.

c) Some difficulties were also faced during the orientation of students towards their respective treatments. In the beginning, the students appeared to be hesitate to come forward with response and views. But after the motivation and encouragement, the students began to take interest in teaching learning activities.

d) The experimenter had to teach the lesson as per the syllabus and time schedule also, as they were pursuing a regular course of studies. Thus the experimental schedule had to be adjusted accordingly.

e) Specific events like anxiety, fatigue or interest and the like factors were beyond the control of the researcher. These could have a stimulating or distributing effect upon the performances of the subject. These factors were not taken in the account, their effect can not be more than marginal.