CHAPTER 5
CHAPTER V

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5.5 RESUME
5.1 INTRODUCTION

A research design is the plan, structure and strategy of investigation conceived so as to tackle and encounter the research problem more efficiently and accurately. Experimental design or technique refers to the layout or set-up, procedure and conditions under which the experiment itself is carried out or conducted.

Cochran and Cox have pointed out that the principal objectives of a good experimental technique are as follow:

(1) To secure uniformity in the application of treatments.

(2) To exercise sufficient control over external influences so that every treatment produces its effects under comparable and desired conditions.

To devise suitable unbiased measures of the effects of the treatments.

To prevent gross errors, from which no type of experimentation seems to be entirely free.

A research design is a set of instructions to the investigator to gather and analyse his data in certain ways, strictly in accordance with certain controlled mechanism.

Research design is a strategy on paper like an architect's plan. Certain fundamental steps of research design must be given due importance when proposed to be used.

The first phase of the study i.e. planning and construction of problem solving approach has been described in the forgoing chapter. This chapter deals with the description of the second phase of the study i.e. implementation of problem solving approach and to study its effect on the creative personality and academic performance of secondary school pupils.

5.2  RESEARCH METHODOLOGY

Basic elements of research method are variables, hypotheses, research tools and sample selection. In this chapter these four elements are 'put in practice'.
5.2.1 Variables

Variables are the dynamic parts of the research design. The entire study design moves according to the effect of connected variables. In every study design, investigator tries to find out the effect of connected variables of the study. Mostly two variables— independent and dependent variables are acted in the research design. Variables can be found through the title of the study problem.

In present study, problem solving approach (PSA) is independent variable and academic performance (AP) and creative personality (CP) are independent variables. Three groups (i) group with discussion (ii) group without discussion and (iii) Control group (without treatment) are made for the study. Two levels of non backward and backward pupils are made for the finding out the effect of the variables within. As well as another two levels of high socio-economic status and low socio-economic status pupils of the above two levels are operated in the present study.

Thus three groups of the students were made for the study. In present study, effects of problem solving approach are found on academic performance and creative personality. Among these three groups the first group is given the treatment, i.e., problem solving approach with discussion. At the time of solving the problems this group is given chance for discussion along the students and the
investigator. This treatment is given on the base of free discussion. The time limit for discussion is controlled. In the other group the treatment has no chance for discussion. The students of this group have to solve the problems individually without discussion. The pupils of this group have given practice for the approach according to their own ability. The third group has given no treatment and is a control group.

The variables and the levels of which they operate in the present study are shown in the following table.

**TABLE 5.1**

**VARIABLES AND THEIR LEVELS**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Variable</th>
<th>Nature of the variable</th>
<th>No. of levels</th>
<th>Name of levels</th>
</tr>
</thead>
</table>
| 1.      | Treatment problem solving Approach | Independent | 3 | (i) Approach with discussion  
           |          |                        | (ii) Approach without discussion  
           |          |                        | (iii) No Approach |
| 2.      | Caste | Independent | 2 | (i) Non-Backward caste  
           |          |                        | (ii) Backward caste |
| 3.      | Socio Economic Status(SES) | Independent | 2 | (i) High SES  
           |          |                        | (ii) Low SES |
5.2.2 **Hypotheses for creative personality**

The following operational form of hypotheses for creative personality were formulated with a view to verify them with the help of statistical analysis.

**H₀₁**: There is a significant effect of problem solving approach with discussion on the creative personality of secondary school pupils.

**H₀₂**: There is a significant effect of problem solving approach without discussion on the creative personality of secondary school pupils.

**H₀₃**: There is no significant difference in Creative personality of secondary school pupils of backward caste and non-backward caste when problem solving approach is implemented or not implemented.

**H₀₄**: There is no significant difference in creative personality of secondary school pupils of Std. IX, of high socio economic status and low socio economic status.

**H₀₅**: There is no first order interactive effect of problem solving approach with discussion and caste on the creative personality of secondary school pupils.

**H₀₆**: There is no first order interactive effect of problem solving approach with discussion and socio-
economic status on creative personality of secondary school pupils.

H_{07} : There is no first order interactive effect of problem solving approach without discussion and caste on creative personality of secondary school pupils.

H_{08} : There is no first order interactive effect of problem solving approach without discussion and socio economic status on creative personality of secondary school pupils.

H_{09} : There is no first order interactive effect of caste and socio economic status on creative personality of secondary school pupils.

H_{10} : There is no second order interactive effect of problem solving approach with discussion, caste and socio economic status on creative personality of secondary school pupils.

H_{11} : There is no second order interactive effect of problem solving approach without discussion, caste and socio economic status on creative personality of secondary school pupils.

5.2.3 Hypotheses for Academic Performance

The following operational form of hypotheses for academic performance were formulated with a view to verify
them with the help of statistical analysis.

\( H_{O_1} \): There is a significant effect of problem solving approach with discussion on academic performance of secondary school pupils.

\( H_{O_2} \): There is a significant effect of problem solving approach without discussion on academic performance of secondary school pupils.

\( H_{O_3} \): There is no significant difference in academic performance of secondary school pupils of backward caste and non backward caste when problem solving approach is implemented and not implemented.

\( H_{O_4} \): There is no significant difference in academic performance of secondary school pupils of high and low socio economic status.

\( H_{O_5} \): There is no first order interactive effect of problem solving approach with discussion and caste on academic performance of secondary school pupils.

\( H_{O_6} \): There is no first order interactive effect of problem solving approach with discussion and socio economic status on academic performance of secondary school pupils.

\( H_{O_7} \): There is no first order interactive effect of problem solving approach without discussion and caste on academic performance of secondary school pupils.
There is no first order interactive effect of problem solving approach without discussion and socio economic status on academic performance of secondary school pupils.

There is no first order interactive effect of caste and socio economic status on academic performance of secondary school pupils.

There is no second order interactive effect of problem solving approach with discussion, caste and socio economic status on academic performance of secondary school pupils.

There is no second order interactive effect of problem solving approach without discussion, caste and socio economic status on academic performance of secondary school pupils.

5.2.4 Research Tools

The following were the main tools which were used to observe the data for this study.

1. Programme for Problem Solving Approach (PPSA) developed by investigator.

2. A Standardized Socio-Economic Status (SES) scale prepared by K.G. Desai.

3. Gujarati version of Creative Personality Test
prepared by Donald W. Mackinnon.

(4) The result sheet of std. IX as the academic performance of the pupils.

The study plan was designed with the help of above selected tools. The outlook of above tools may describe as under:

(1) Programme for Problem Solving Approach (PPSA)

This programme as a tool was developed and tried out by investigator himself. In the present study the effect of this programme was to be found out on academic performance and creative personality of the students.

There are five small booklets of problem.

In chapter IV the preparation and try out procedure of these booklets are given. Each booklet contains eight problems; contents of Mathematics, Science, Gujarati Language and Social Science are included in the above five booklets as the subjects. The booklets are given in Appx. 1.

5.2.5 Sample Procedure

It is very difficult to work on the total students for any research, as the factor like time, finance etc. are limited. Sometimes experimental design also puts restriction on the sample selection. Owing to this limitations
it was decided to work on a sample for present study.
Sampling is a process of selection of subjects. The purpose of sampling is to study a small group i.e. assumed to be representative of the large group population which it is drawn.

According to Borg

"The factor that must often differentiate between good and poor research is not the fund available the size of the sample or the sophistication of the statistics it is cure and thought that goes into research Plan."

Now it is worth to fix the size of sample before selecting the sample for the study.

Bono has opined:

"There is no ideal size. Twelve people are a convenient number but a brainstorming session can work very well with as many as fifteen or as six."

This study concludes experimental method. It is the most exacting and difficult to all methods and also important from the scientific point of view. But the experimental

2. Walter B. Borg : "Educational Research"
London Longmans Green And Co. Ltd. 1963
P. 116.

3. Edward De Bono : Lateral Thinking Creativity
method restricts the sample size, as the programmes are to be put on Anvil to study its effects.

Scoring procedures may be various types among which the following classification is specific and useful too.

(1) Random sampling
(2) Stratified sampling
(3) Quota sampling
(4) Multi-stage sampling
(5) Systematic sampling
(6) Cluster sampling
(7) Purposive sampling

From these types, the investigator had to select such a sample, which would satisfy the following characteristics.

(a) In general, creative personality and academic performance should normally be distributed.

(b) Socio-economically the students should be from affluent group.

(c) The school should be known to the experimenter for easy approach and full co-operation of the students as well as the staff.

(d) The school should have co-educational system.
The school should have at least three classes of Std. IX having fifty students, to compare three treatments to be implemented.

According to the above requirements, the investigator selected the purposive sampling technique for this study. Claims have been made that this method gives "More representative sample than objective method."

Garrett\(^4\) says:

"A purposive sample may be expressly chosen, because in the light of available evidence, it mirrors some larger groups with reference to given clarification."

A school satisfying all the requisite conditions named "N.R.A. Vidyalaya, Bhiloda" was selected for the purpose. There were five classes of Std. IX. Among these classes, three classes were selected for the sample. As per the pre-determined purpose of the selection of sample the classes were formed according to the variability of creative personality of the students. The composition of the sample was found as shown in table 5.2 below.

| TABLE 5.2 |
| COMPOSITION OF SAMPLE UNDER STUDY |
|-----------------|---|---|---|---|
| CLASSES         | IX A | IX B | IX C | TOTAL |
| BOYS            | 41   | 43   | 43   | 127   |
| GIRLS           | 10   | 08   | 10   | 38    |
|                 | 51   | 51   | 53   | 155   |

Out of these three groups A, B, C, two groups i.e. A & B were selected as an experimental group and group C as a control group. These designs are further classified in the Fig. 5.1 i.e. Flow Chart of Sampling.

FLOW CHART OF CREATIVE PERSONALITY TEST

CREATIVE PERSONALITY TEST

PRE-TEST

EXPERIMENTAL GROUPS

TOTAL 102

PSA WITH DISCUSSION IX A

TOTAL 51

PSA WITHOUT DISCUSSION IX B

TOTAL 51

CPT POST TEST DATA

CONTROL GROUP

TOTAL 53

IX C
5.3 STATISTICAL TECHNIQUES \hspace{0.1cm} EXPERIMENTAL DESIGN

Experimental design and statistical techniques had to be adopted for the testing of the hypotheses. Main design and tools techniques are enlisted herein, out of which the investigator has made use of the techniques keeping in view the needs of the method adopted. Design and statistical techniques have been described in this chapter.

5.3.1 Various Experimental Design

Types of experimental designs can be divided into two groups as follows:

(i) Single Group Design
(ii) Separate Control Group Design.

(i) Single Group Design

Single Group experiments do not involve a separate control or comparison group. These designs are further classified in the following manner.

(a) One shot case study.
(b) One group Pre-test, Post-test Design.
(c) The time series Experiment.
(d) The Equivalent Time-Sampling Design.
(e) The Equivalent Material Design.
(ii) Separate Control Group Design

This type of experiments required at least one comparison. Comparison may be between two or more experimental treatments or between groups exposed to X and groups not exposed. Some well known techniques are like these.

(a) Static Group Comparison.
(b) The pre-test, post-test control group design with randomisation.
(c) The Solomon Four Group Design.
(d) The Post-test only Control Group Design.
(e) The Non-equivalents Control Group Design.
(f) Separate Sample Pre-test Post-test Design.

To get the comparative idea about all the described techniques table is given on next page. It gives advantages and disadvantages of the experimental design.

Looking to the above, one can infer that separate control group design is the applicable type for the study undertaken. Moreover (b) technique i.e. the pre-test, post-test control group design with randomised static is the most suitable to be adopted for the research. Justification is the most suitable techniques which can be given as:

(i) Selection is eliminated here because SS have been assigned at random to experimental and control groups.
(ii) Instrumentation can also be controlled by having
the same observer participating with both groups.

(iii) There is a control group comprised of the same type of SS as are in the experimental group regression can be ruled out.

(iv) The experimental and control groups are tested together and at the same time.

(v) The effects of experimental morality can also be checked by examining, the pre-test scores of those who failed to show up for the post-test comparison.

5.3.2 ANOVA: A Factorial Design

In some experiments, there are two or more independent variables, each of which is varied in two or more ways, called levels. If experimenter takes all possible combination of variables with levels and incorporate each combination as a separate experimental condition arrangement made, is known as Factorial Design. In a factorial experiment, the effect of number of different factors is investigated simultaneously particularly with an aim to study not only the main effect of the factors involved but also interactive effects which are best studied with factorial design.

Edward\(^5\) defines the three models according to the

levels of factors as below.

"When the levels of factors are not randomly selected, the ANOVA model is referred to as a fixed model, when the levels of each factor have been randomly selected from the large population, the ANOVA model is referred to as a random effect model. If the levels of some factors have been randomly selected and those of others have not, the ANOVA model is referred to as a mixed model."

In this study there are three groups: Two experimental groups and one control group, where two groups would get training through problem solving approach programme developed by the investigator and other would not. Out of these two experimental groups one group would get a chance of discussion in problem solving procedure, while second group would not get a chance of discussion. Other two independent variables as discussed ahead are caste and socio-economic status. The investigator has decided to take two levels of each by considering above median and below median scores. Therefore ANOVA model of this study is a fixed model and hence it involves both fixed effects and random effects.

To study the effect of treatment (problem solving approach) on academic performance and creative personality of different two caste and two socio economic status of the
students. 3x2x2 factorial design with a randomised group design has been employed as a statistical tool.

5.3.3 **Statistical Technique in ANOVA**

In this ANOVA technique, the treatment, caste and socio economic status are the independent variables, while academic performance and creative personality are the dependent variable. The 3x2x2 factorial design has been developed as shown in the tabular form in Table 5.3.

Before proceeding for F-test it would be proper to look into the assumptions underlying ANOVA technique. They are parametric assumptions: viz.

1. An equal unit scale is assumed for the measurement of the dependent variable.

2. Homogeneity of variance is the basic assumption that is, the samples of the group coming from the same population have equal variance.

For the test of homogeneity the F max test can be used. The formula for F-max (Allen L. Edward) is given below.

\[
F_{max} = \frac{\text{Maximum variance}}{\text{Minimum variance}}
\]
**TABLE 5.3**

3x2x2 FACTORIAL DESIGN FOR DATA ANALYSIS

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable</th>
<th>Treatment</th>
<th>A&lt;sub&gt;2&lt;/sub&gt;</th>
<th>A&lt;sub&gt;2&lt;/sub&gt;</th>
<th>A&lt;sub&gt;2&lt;/sub&gt;</th>
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<tr>
<td></td>
<td></td>
<td>PSA&lt;sup&gt;2&lt;/sup&gt;</td>
<td>with</td>
<td>without</td>
<td>PSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>discussion</td>
<td>discussion</td>
<td>discussion</td>
<td></td>
</tr>
<tr>
<td>Caste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;</td>
<td>N X</td>
<td>M X&lt;sup&gt;2&lt;/sup&gt;</td>
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</tr>
<tr>
<td>C&lt;sub&gt;1&lt;/sub&gt;</td>
<td>N X</td>
<td>M X&lt;sup&gt;2&lt;/sup&gt;</td>
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<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;</td>
<td>N X</td>
<td>M X&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>C&lt;sub&gt;2&lt;/sub&gt;</td>
<td>N X</td>
<td>M X&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caste</td>
<td>CP (Creative Personality)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;</td>
<td>N X</td>
<td>x&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;1&lt;/sub&gt;</td>
<td>M X</td>
<td>x&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;</td>
<td>N X</td>
<td>x&lt;sup&gt;2&lt;/sup&gt;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;2&lt;/sub&gt;</td>
<td>M X</td>
<td>x&lt;sup&gt;2&lt;/sup&gt;</td>
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....cont'd
<table>
<thead>
<tr>
<th>SES</th>
<th>AP</th>
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<tbody>
<tr>
<td>C_1</td>
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</tr>
<tr>
<td></td>
<td>M X^2</td>
</tr>
<tr>
<td>B_1</td>
<td>N X</td>
</tr>
<tr>
<td>C_2</td>
<td>M X^2</td>
</tr>
<tr>
<td></td>
<td>N X</td>
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<tr>
<td></td>
<td>M X^2</td>
</tr>
<tr>
<td>B_2</td>
<td>N X</td>
</tr>
<tr>
<td>C_2</td>
<td>M X^2</td>
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</table>

<table>
<thead>
<tr>
<th>SES</th>
<th>CP</th>
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<tbody>
<tr>
<td>C_1</td>
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</tr>
<tr>
<td></td>
<td>M X^2</td>
</tr>
<tr>
<td>B_1</td>
<td>N X</td>
</tr>
<tr>
<td>C_1</td>
<td>M X^2</td>
</tr>
<tr>
<td></td>
<td>N X</td>
</tr>
<tr>
<td></td>
<td>M X^2</td>
</tr>
<tr>
<td>B_2</td>
<td>N X</td>
</tr>
<tr>
<td>C_2</td>
<td>M X^2</td>
</tr>
</tbody>
</table>
If the Fmax value is not significant, the basic assumption (2) is found to be satisfied.

Hence ANOVA summary has been given to test whether the group means differ or not, in the following form.

**TABLE 5.4**

ANOVA SUMMARY SHOWING BETWEEN GROUPS AND WITHIN GROUPS

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean SS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The level of significance at 0.05 level and 0.01 level of confidence has been accepted in educational research.

The summary of the complete ANOVA to test whether there exists the effect of independent variables or not and whether there exists any order of interactive effect of variables on the dependent variables say creative personality and academic performance, would be of the form shown below:
<table>
<thead>
<tr>
<th>Source of variance</th>
<th>SS</th>
<th>df</th>
<th>MSS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment A&lt;sub&gt;1&lt;/sub&gt;</td>
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<td></td>
<td></td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Caste B</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SES C</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>A&lt;sub&gt;1&lt;/sub&gt; x B</td>
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<td></td>
<td></td>
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<tr>
<td>A&lt;sub&gt;1&lt;/sub&gt; x C</td>
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<tr>
<td>A&lt;sub&gt;2&lt;/sub&gt; x C</td>
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<td></td>
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<tr>
<td>B x C</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A&lt;sub&gt;1&lt;/sub&gt; x B x C</td>
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<tr>
<td>A&lt;sub&gt;2&lt;/sub&gt; x B x C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td></td>
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</tr>
</tbody>
</table>

The value of F are obtained by dividing each of the mean sum of squares (MSS) by error variance, i.e. within groups mean square. The level of significance at 0.05 and 0.01 levels of confidence has been accepted to study the main effect and interactive effect on the creative personality and academic performance. Thus the hypothesis could be tested for acceptance or rejection.
EXECUTION OF PROBLEM SOLVING APPROACH PROGRAMME

The resultant work derived from the use of foregoing tools, techniques etc. is elaborately discussed in this chapter under heads:
(i) Familiarization with PSA programme.
(ii) Experimental work done.
(iii) Response Analysis.
(iv) Observation.

5.4.1 Familiarization with Problem Solving Approach Programme

Before implementation of problem solving approach programme, it is important to be familiar with the programme and its execution. This chapter includes in specific aspects of pre-experimental namely, introduction procedure, time schedule and formation of the programme.

5.4.1.1 Introduction Procedure

Stressing the significance of the directions given in the programme booklet, Thorndike\(^6\) states:

"It is very important that the instructions be clear and adequately detailed. When the test is of familiar and the procedures are simple, a brief paragraphs of instructions will suffice."

Before starting to solve the problems the instructions were given to the pupils, mentioned in each booklet of problems of selected every subject. The method of solving problems was given in instructions. Separate notebook was given to every pupil to give the solution of each problem. Time limit was given in instructions. The instruction procedure is given in detail as appendix.

5.4.1.3 Time Schedule

The problem solving approach programme includes five set of programmes having eight problems in each set which is to be spread over ten weeks duration as determined in chapter IV. Flow chart will give the idea of a study at a glance. While administering the each set of problem items required four periods of 40 minutes. In the beginning the implementation started with creative personality test CPT as a pre-testing.

It was given to all the three groups of students under study. All the three groups were so formed that they found homogeneous on the achievement test.

By the next week of the pre-testing, the two groups were selected randomly for experimentation and third group was treated as a control group. i.e. no such programme was to be given to the students of control group. One of the experimental groups, had applied the approach with
discussion while the other experimental group had not. The training period of ten weeks was given to both the experimental groups. One booklet of each subject was given two weeks time for training programme. In one week two period had been arranged for training. One period of 40 minutes was given in school time table. After completion of the training of the programme the creative personality test was given to all the three groups to study the effect of programme. Thus the experimental work required ten week duration to train the students.

5.4.1.3 Formation of the Problems for PSA

The format of the programme was discussed in detail in chapter IV. In starting 100 problems were selected. After testing these problems, 40 problems were selected for final form for the programme. Five booklets were prepared for four subjects i.e. Mathematics, Science, Social Science and Gujarati language. Eight problems were arranged in each booklet. Sixteen problems of mathematics, eight of each subject science, language and social science were formed for programme.

The whole programme (i.e. forty problems) consists five booklets. So the time required was 20 periods. Two periods per week were given so that training lasted for ten weeks i.e. 2 and half months.
Implementation started with CPT as pre-test. It was given to all three classes of IX grade at a time in separate classes. Three teachers of school complex assisted the investigator during the testing.

5.4.2 Experimental Work Done

Before training programme the CTP and SES tests were given to all three groups. They had given their responses separately in these tests. They had to give their answers in the test-papers. These tests are given in appendix-3 and 4. On the front page of these tests-answer book, they were asked to give their required personal data.

After collecting the data of CPT and SES, the training was started for two experimental groups. On the first day of training a small answer book was given to every pupil in which they have to give the solutions of the problems. A small form of answer is given in appendix-5. To solve geometrical problems they had given tressing paper for testing and find out the possibilities of solution of the problems. Pupils of experimental group one - IX A class were solving the problems on their own and followed the discussion with the teacher. Investigator himself was discussing the possibilities of solutions of the problems. In another experimental group there was no chance for discussion. The pupils of this group had to solve the problems by their own ways-abilities. Thus these two
Experimental groups had given training for solving the various problems. Investigator had taken support of another science teacher in this work. Some instructions were given to the pupils on every booklet of various problems of subjects. The investigator established the rapport with some introductory remarks, just as-

Eight problems have been given in each booklet. First and Second booklets involve mathematical problems. Third booklet involves problems related to science. Fourth and fifth booklets involve the problems related to Linguistic and social aspects. You have been provided an opportunity to think and to find the solution. This is an humble attempt to develop the skill of solving the problem.

Try to find the solution of problems with an open mind. Don't prevent your thoughts taking place into your mind. You will get the solution definitely. Give the solution as rapidly as possible. If you can't think about the solution, take the next. Think about the solution of the remaining or left problems on getting time.

You are expected to answer each problem in separate booklet. Your name, village, standard and sex are to be mentioned on the booklet.

Expecting your full co-operation. Now start your attempt.

The time schedule for the execution of whole programme is shown in Table 5.6 to follow.
TABLE 5.6
PROGRAMME WISE PERIOD DISTRIBUTION (WEEKLY)

<table>
<thead>
<tr>
<th>Week</th>
<th>Period</th>
<th>Day</th>
<th>Lesson</th>
<th>Problem No.</th>
<th>Content of the problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Oral</td>
<td></td>
<td></td>
<td>Instructions</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td><strong>Booklet-1 (Work-book-1)</strong></td>
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<td></td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>Monday 1</td>
<td>1</td>
<td>1</td>
<td>Arithmetic</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Wednesday 2</td>
<td>2</td>
<td>2</td>
<td>Arithmetic</td>
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<tr>
<td>II</td>
<td>3</td>
<td>Monday 3</td>
<td>3</td>
<td>3</td>
<td>Arithmetic</td>
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<tr>
<td></td>
<td>4</td>
<td>Wednesday 4</td>
<td>4</td>
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<td>Arithmetic</td>
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<tr>
<td><strong>Booklet-2 (Work-book-2)</strong></td>
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<tr>
<td>III</td>
<td>5</td>
<td>Monday 5</td>
<td>5</td>
<td>9</td>
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<td>IV</td>
<td>7</td>
<td>Monday 7</td>
<td>7</td>
<td>11</td>
<td>Geometry</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Wednesday 8</td>
<td>8</td>
<td>12</td>
<td>Geometry</td>
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<tr>
<td><strong>Booklet-3 (Workbook-3)</strong></td>
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<tr>
<td>V</td>
<td>9</td>
<td>Monday 9</td>
<td>9</td>
<td>13</td>
<td>Geometry</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Wednesday 10</td>
<td>10</td>
<td>14</td>
<td>Geometry</td>
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<tr>
<td>VI</td>
<td>11</td>
<td>Monday 11</td>
<td>11</td>
<td>15</td>
<td>Geometry</td>
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<td></td>
<td>12</td>
<td>Wednesday 12</td>
<td>12</td>
<td>16</td>
<td>Geometry</td>
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<td><strong>Booklet-4 (work-book-4)</strong></td>
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<tr>
<td>VII</td>
<td>13</td>
<td>Monday 13</td>
<td>13</td>
<td>25</td>
<td>Gujarati</td>
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<tr>
<td></td>
<td>14</td>
<td>Wednesday 14</td>
<td>14</td>
<td>26</td>
<td>Gujarati</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Gujarati (in Gujarati)</td>
</tr>
<tr>
<td>VIII</td>
<td>15</td>
<td>Monday 15</td>
<td>15</td>
<td>27</td>
<td>Gujarati</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Wednesday 16</td>
<td>16</td>
<td>28</td>
<td>Gujarati</td>
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<td></td>
<td></td>
<td>Gujarati</td>
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</tbody>
</table>

...
The execution of the programme was carried on as discussed below:

Before the implementation of the programme the investigator had kept zero period, for instructions and experimental work. The subjects under experimental condition were made aware of different types of thinking viz., Inductive thinking, Deductive thinking, Creative thinking, Convergent and Divergent thinking and Lateral thinking. These different types of thinking have been remained the primary base of the PSA. Investigator gave some separate instructions to the experimental group $A_1$ and $A_2$. The pupils had given some instructions about how to write the solution-answers of the problems in the given answer-book.

According to the time schedule of programme implementation, the investigator had treated both the experimen-
According to the devised five work book the programme was implemented in five parts as below:

**Part-1 (Programme-1)**

In this programme the time fixed was of two week. Eight problems were given to two groups. Eight problems of mathematics were given for treatment. Investigator himself had taken charge of group $A_1$ (group with discussion). Another teacher of investigator's school had taken charge of second group $A_2$ (group without discussion). Work book-1 was given to every student. They were asked to give the solution of the problems in the given answer book. Table clocks were given to both the groups so that the pupils can record the time for solving the various problems given in work-book-1. Four periods were arranged for the schedule. Investigator and another teacher had noted the responses of the students. Students gave the solutions of the problems time to time. Sufficient practice was given to the both groups.

**Part-2 (Programme-2)**

In this programme the time fixed was also of two week. Eight problems of geometry were given in this programme. Tressing papers were given to the pupils for finding the solutions of the problems. In this programme trial and error method was adopted by the students. Four periods were arranged for the schedule. Responses of the
students were noted at the time of given programme-2.

Part-3 (Programme-3)

In this programme eight problems of science were given. Four periods were fixed for this training programme. Problems of general science, physics and chemistry were covered in this programme. Problem 19 and 22 were also of Biology. Work-book-3 was given to two groups. The responses of the students were noted.

Part-4 (Programme-4)

In this training programme eight problems of Gujarati language were given to the students. Four periods were fixed for this programme. Most of these problems are funny problems. Pupils could solve these problems with "Words play game." Problems 30, 31, 32 are of creativity. Work-book-4 was given to every student of both the groups. The responses of the student were noted.

Part-5 (Programme-5)

Eight problems of social science were given to the students in this programme. The feelings of the students were kept in mind during this training programme. Surrounding atmosphere and the effect of its on the students were considered in this programme. Work-book-5 was given to every student of both the groups. Four periods were fixed for this programme.
This was the last training programme and so the investigator and teacher administrator thanked all the students and teachers for their co-operation.

After the completion of PSA programme, the CPT and academic performance were administered to all the students for post-test study.

5.4.3 Response Analysis

The programme was not to be standardized at this level, so the response analysis should not be based on statistical conclusion like reliability, validity or norms establishment. This programme is meant for the development of creative personality and academic performance. Due to this reason it was necessary to analyse the responses according to the number of correct responses of the problems included in the PPSA.

5.4.4 Observations

The following important observations were made from the implementation of the programme.

(1) At the time of implementation of the programme, in the beginning the students of group with discussion were not interested in discussing the problems but after a week they took interest in the discussion. Some students gave unexpectedly very good
responses during the training programme.

(2) The students of group without discussion were quite creative to solve the problems. Moreover some students who were found idle in the beginning of the time limit, proved quite creative and outstanding in their responses at the end.

(3) The programme was found to be a little tough and confusing to some students in beginning but after one or two weeks they were interested in the training programme.

(4) Some girls were more interested in this programme than boys. Girls were found more sincere and particular in their training.

(5) In the beginning of the training some students tried to copy the solutions of the problems, but after instructions and two weeks training they were free from that habit.

(6) The training programme proved to be very interesting and encouraging too in respect of all the students of study.
In this chapter, the plan was designed with the help of selected tools, sample and hypotheses which are narrated to present their importance and due weightage. Separate control group design is accepted and the selection of the statistical technique ANOVA was found fit on the basis of its multiple advantages. The organization and implementation procedures were carried out with due care.

In the next chapter, the data obtained on CPT and AP have been put to statistical analysis to study the hypotheses put forth.