CHAPTER - III

DESIGN OF THE STUDY

This chapter describes the sample, design, the tools, the procedure of the data collection and statistical techniques of analysis used to test the hypotheses.

Plan and procedure employed in an investigation determine its destiny. It is the character of the techniques of research on which the degree of precision, objectivity, reliability and validity of results depend. The selection of techniques and devices of an investigation is determined by the nature of the problem selected and the kind of data necessary for the solution.

The collection of data is the crucial operation in the execution of a research project. The quality of research project depends upon the quality of data. In other words, the destiny of the problem depends upon its methodology and procedure adopted by the investigator. The selection of adequate methods, tools and techniques is very difficult problem and must be handled with care in respect of their cost, ability, experience and need of the investigator.
3.1 Design:

The purpose of the present study was to examine the effectiveness of two mastery learning strategies (Bloom's mastery learning strategy and Keller's mastery learning strategy) on achievement in Economics. For this purpose an experimental method was preferred to other methods.

3.2 Experimental Method

Experimental method provides a systematic and logical method for answering the question, "If this is done under carefully controlled conditions, what will happen?" The experimenter manipulates certain stimuli, treatments, or environmental conditions and observes how the condition or behavior of the subject is affected or changed. In this method, a problem is defined and tentative answers or hypotheses are proposed. The experimenter tests the hypotheses and confirms or disconfirms them in the light of the controlled variable relationship that he has observed. It is important to note that the confirmations or rejections of the hypotheses is stated in terms of probability rather than certainty.

3.3 Factorial Design and its Dimensions

In the present study (2x2x2x2) factorial design was employed. A factorial design makes it possible to study main effects as well as interactional effects of two or more
independent variables. Independent variable is that factor, which is measured, manipulated or selected by the investigator to determine its relationship to an unobserved phenomenon. The dependent variable is that factor which is observed and measured to determine the effect of independent variables. In the present study two types of independent variables had been used - treatment variables and classification variables. Variable of strategies of mastery learning was used as treatment variables and variables of sex, cognitive style and self-concept were used as classifying variables.

The factorial design (fixed model) was used as it permits to evaluate the combined effect of two or more independent variables operating simultaneously. The dimensions of a factorial design refer to the number of factors and the number of levels of each factor. The experimental method followed was based upon a 2x2x2x2 factorial design. The layout of the factorial design used in the present study is given in Table 3.1.
#00 STUDENTS

**BLOOM'S MASTERY LEARNING STRATEGY**

- **A1**
  - GROUP-I(200)
  - **SEX**
    - MALE
    - FEMALE

**KELLER'S MASTERY LEARNING STRATEGY**

- **B2**
  - GROUP-II(200)
  - **SEX**
    - MALE
    - FEMALE

- **COGNITIVE STYLE**
  - C1
  - C2
  - FI
  - FD

- **SELF-CONCEPT**
  - D1
  - D2
  - LSC
  - HSC

**layout of the factorial design**

Table 3.1.

FD = Field Dependent
FI = Field Independent
LSC = Low Self-Concept
HSC = High Self-Concept
It is obvious from Table 3.1 that treatment variable of mastery learning strategies is designated as A and its two strategies: Bloom mastery learning strategy and Keller's mastery learning strategy as A1 and A2. The factor of sex is designated as B and its two categories as B1 and B2 corresponding to male and female. The factor of cognitive style is designated as C and its two levels as C1 and C2 corresponding to field dependent and field-independent. The fourth factor of self-concept is represented by D and its levels D1 and D2 stand for low self-concept and high self-concept. The total number of combinations came out to be $2\times2\times2\times2 = 16$ as shown in Table 3.2.
Table 3.2

Table showing number of combinations in 2x2x2x2 design

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>A1</td>
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<td>A2</td>
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<td>D2</td>
<td></td>
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</tbody>
</table>
3.4 Sampling

In the present study random sampling procedure has been adopted. Random sampling is that method of drawing a sample from a population so that every member of the population has an equal chance of being included in the sample. A sample drawn at random is unbiased in the sense that no member or section of population has any more chance of being selected than any other.

In the present study two separate samples were drawn from the population consisting of all 10 + 2 class students enrolled in different senior secondary school of Ambala District. A sample of 150 students was raised to determine test-retest reliability of the achievement test. The second sample of 400 students (200 males and 200 females) was raised randomly to conduct the experiment. The school wise break-up of the sample is given in Table 3.3.
Table 3.3 Break-up of the sample

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the School</th>
<th>Total No. of Students in Class 10 + 2</th>
<th>No. of Students taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Govt. Senior Secondary School, Kesri</td>
<td>95</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Govt. Senior Secondary School, Bihta</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>S.D. Senior Secondary School, Ambala Cantt</td>
<td>150</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>B.D. Senior Secondary School, Ambala Cantt</td>
<td>130</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>D.A.V. Senior Secondary School, Ambala Cantt</td>
<td>142</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Govt. Senior Secondary School, Adhoya</td>
<td>125</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Govt. Senior Secondary School, Barara</td>
<td>145</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>887</td>
<td>400</td>
</tr>
</tbody>
</table>

3.5 Tools Used:

Techniques and tests of research for the purpose of collecting data are as important to the researcher as tools to a carpenter to do his job. The researcher has to select from the available tools which will provide data for testing hypotheses. In the present study following tools were used to collect the data:

1. **Group Embedded Figure Test** developed by Witkin, Oltman and Raskin (1971) and published by Consulting Psychological Press, Inc., was used to identify cognitive style.
2. **Self - Concept List** developed by Pratibha Deo (1971) and published by National Psychological Corporation, Agra was used to study the self-concept.

3. **An Achievement Test** developed and standardized by the investigator was used to test the performance of students.

3.6 **Description of Tools**:

3.6.1 **Group Embedded Figure Test (GEFT)**:

Witkin's Group Embedded Figure test was used to assess broad dimensions of personal functioning that comes from cognitive style 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 7 very simple items and is primarily for practice, and the second and third sections, each of which contains 9 more difficult items. The time limit of 5 minutes each for the second and third sections was set. The test was administered strictly in accordance with the instructions given in the manual. The author refers to reliability as .82 found by correlating scores of the 9 items of second section and the 9 items of third section. The raw scores were used to classify the students of each group into two groups, that is, field - independent and field - dependent groups by applying the formula based upon the median of the cognitive style groups.
Self-concept is best conceived as a system of attitudes towards oneself. It consists of all the perceptions, feelings, attitudes, aspirations and values of oneself concerning of oneself. The self-concept word list is based on the self-reporting techniques and is available in both forms i.e. the check list and the rating scale. The rating scale, consisting of 90 words, is based on a 5 point scale, the five points being, very much like this, much like this, uncertain, not much like this and not at all like this. The rating scale can measure all the four aspects of the self-concept, the perceived, ideal, real and social. On all the dimensions for both positive and negative classes. Author estimated 'reliability by test-retest method. For the 15 days interval, the reliability coefficient came out to .89. Taking different time intervals from 15 days to three and half months the coefficient of correlation ranged from .62 to .86. The correlations between consistency scores ranged from .84 to .98.

The self-concept list test (SCL) (PWL) can be given individually or in groups. Instructions printed on the list should be read out by the tester so that the subjects do not hesitate to give their honest response. After reading out the instructions, the tester may ask the
subjects to "Turn the card and go ahead." There is no
limit for SCL (PWL) but usually subjects take about 15-20
minutes.

Scoring of SCL (PWL) is quick through the use of stencil
and scoring keys. The weightages for positive words the
two points are 4, 3, 2, 1 and 0 (zero) respectively and
for a negative word also the weightage is the same way.
The neutral words are to be ignored in the scoring. The
composite score is obtained by subtracting the total
negative score from the total positive score.

3.6.3 Achievement Test:

The achievement test was developed to measure the
performance of students before and after treatment. The
investigator could not get any appropriate standardized
achievement test for testing the few concepts in economics
selected for this experiment. Therefore, the investigator
constructed and standardized the achievement test himself,
for students of class 10 + 2.

3.6.3.1 Planning the Test

In this part the investigator kept in mind the following
aspects:

- To whom, the test was to be administered?
- What was to be measured?
When the measurement was to take place?
How the measurement was to take place?

On the basis of these planning strategies and on the basis of the nature of the problem following preliminary conditions were set:

1. **Test Purpose**: The purpose of the test was to measure the acquisition of economics concepts. The test was made to measure knowledge, comprehension and application of economics concepts by 10+2 class students.

2. **Target Population**: The students studying in class 10+2 in different senior secondary schools of Ambala District formed the target population.

3. **Type of Test Items**: The multiple choice items, true/false, calculation type, short answer type and fill in the blank type of items will be included in the test.

3.6.3.2 **Preparation**: Some topics were selected on economics concepts from the syllabus of class 10+2. After selecting the topics for the experimental instructions, the investigator analysed the whole topics and divided the content into 13 mutually exclusive units convenient for teaching and testing. The
instructional objectives for different units were formulated separately in behavioral terms and the same were required.

Following topics of the economics from class 10+2 were taken for the experimentation. These were as under:

1. Introduction of Economics - Meaning & definitions of Economics
2. Nature of Goods and Services
3. Demand - Meaning, Factors affecting of Demand
4. Law of Demand
5. Price Elasticity of Demand - Meaning, kinds of elasticity of demand
6. Measurement of Price Elasticity of Demand
7. Factors affecting Elasticity of Demand
8. Supply - Meaning, Factors affecting of Supply
9. Costs - Meaning and (distinguish) between different costs
10. Concepts of National Income
11. Measurement of National Income
12. Perfect Competition - Meaning, Characteristics

To fulfil the demands of the objectives the investigator developed objective type items for each of the instruction objectives. The items of test were formulated under five categories of objective type questions such as (1) True/false (2) multiple choice (3) fill in the blank type (4) short answer type and (5) calculation type.
The short description of each of them has given below:

1. **Multiple Choice**: The test consisted of multiple choice type of items and these items have four answers for each item and students were required to identify the correct answer out of the four choices. For example:

   Who Wrote "Principle of Economics?"
   (i) Adam Smith  
   (ii) Dr. Marshall  
   (iii) Robbins  
   (iv) Samuelson

2. **Short answer type**: The short answer type of items are direct questions demanding to answer in one or few sentences. For example:

   What is meant by demand?

3. **True or False**: In questions of this type, the students are asked to write True or False as the case may be:

   Marshall regarded economics as a study of material welfare.

4. **Calculation type items**: In questions of this type, the students are given numerical based problems and asked them to solve the problem. For example:
If the price of a commodity falls by 10% and its demand increases, by 30% then, what would be the elasticity of demand for that commodity.

5. Fill in the blanks: In questions of this type, the students are given two alternative answers and asked them to choose the correct answer out of the two and write in the blank. For example:

Supply refers to the ____________________.
(Stock, quantity offered for sale)

The investigator wrote down the test items keeping in mind the topics and the objectives of the test.

The following things were kept in mind while framing the test items:

1. The language used was simple;
2. Text book language was avoided;
3. The number of test items were large than the number to be retained finally;
4. Inter dependence among the items were avoided;
5. Two objectives were not put together in the same item;
6. Such items which provide a clue to the answer were avoided;
7. Adjective such as always, seldom, some times etc. were avoided.
After writing down the test items close scrutiny was done by the investigator himself. The items were arranged in a order. There were 110 items in the test at this stage. These items covered all the 13 units of instruction.

Before using the achievement test it was given to economics teachers to elicit their views on the following points:

1. To suggest any other question;
2. To critically analyze the test item from the content and language point of view;
3. To add any other area of relevance;
4. To omit the question which were not relevant;
5. To make correction for the ambiguities, poor phrasing etc;
6. To examine the relationship between the objectives of the study and test items.

After incorporating and suggestions of economics teachers, the preliminary draft was reframed with clear cut instruction scores at the top of the achievement test. Now this draft contains 100 items. Investigator had prepared a scoring key of the preliminary draft of achievement test.

3.6.3.3 Try Out of Preliminary Draft

For typing out the preliminary draft, test was given to a sample of 15 students of class 10 + 2 studying in Govt. Senior Secondary School, Kesri.
3.6.3.4 **Selection of Items on the Basis of Responses**

With the help of scoring key, the investigator evaluated the answer scripts of the students. Firstly the items, in which even a single distractor is not marked by any of the students as their response were rejected. On the basis of this criteria 3 items were deleted. On the basis of the performance of the students, discussions were held with subject teachers and the students individually. In the light of views of the subject teachers, the achievement test was properly reviewed. As a result of discussion 10 items were dropped from the achievement test and few items were modified and finally 87 items were retained in the first draft of the achievement test.

3.6.3.5 **Final Draft**

The first draft was administered to a sample of 100 students of class 10 + 2 and then their answer scripts were evaluated. Selected items of the first draft were taken for the final draft. Kelley’s method (1939) was adopted to find out the difficulty value (D.V.) and discriminating power (D.P.). Item difficulty is the mean item score which stands for empirical probability that the target population will pass the item.
For calculating the difficulty value (D.V.) and discriminating power (D.P.) the following formulae were used:

\[
\text{D.V.} = \frac{RU + RL}{N}
\]

\[
\text{D.P.} = \frac{RU - RL}{0.5 N}
\]

where:
- \(RU\) = No. of correct responses in the upper group
- \(RL\) = No. of correct responses in the lower group
- \(N\) = Size of sample in upper and lower group.

The upper and lower groups were formed as follows:
1. All the students' responses were arranged in the descending order on the basis of the total marks obtained.
2. The first 27 percent cases formed the upper group and last 27 percent cases formed the lower group.

The criteria of taking 27% cases in the upper group and lower group is in accordance with Kelley's remark that best discriminations are obtained if one takes this percentage in the two groups. In this way the D.V. and D.P. for each item is computed for this achievement test and are given (Appendix - VI).
The items which have item difficulty value ranging .25 to .80 were retained. The items which ranged from .20 to .80 on the discriminating power index were retained. On the basis of this criteria, the items at serial no. 15, 25, 37, 38, 47, 58, 684 were rejected from the achievement test and remaining 78 items were retained.

3.6.3.6 Reliability of the Achievement Test:

Reliability is one of the most important characteristics of measuring tool. Reliability refers to the degree to which a measuring tool gives consistent results. If it gives the same result in successive measurement it may be called reliable.

The reliability of the achievement test was found by the Test - Retest Method. The achievement test was administered to a sample of 150 students studying in class 10 + 2. This sample of population was not included in the experimental sample of population.

After a gap of 15 days the test was again administered to the same population and the correlation between the two sets of scores obtained in both the tests were computed.

The reliability coefficient was calculated by using Product Moment method of coefficient of correlation. The coefficient of correlation was found to be 0.92 (Appendix - VII) which quite significant at 0.01 level.
3.6.3.7 Validity of the Achievement Test:

Validity means truthfulness. The test was validated against the criterion of 'content validity'. Content validity is concerned with the adequacy of sampling of a specified universe of contents. The achievement test was found to possess content validity as there was correspondence between the table of specification and the test items. The concurrent validity was also determined by computing a correlation between scores obtained on achievement test and school marks in the subject of Economics obtained in the annual examination. The coefficient of correlation was 0.95 showing high validity.

3.6.3.8 Normality of the Achievement Test:

The test is said to be normal if the difficulty level of the items is balanced one, that is test contains neither very difficult items nor very simple ones. The item difficulty index of the test-items was ranging from .25 to .80. Many of the items were rejected and modified in the light of item difficulty index.

The item difficulty index of the achievement test can be said to be normal achievement tests. The achievement test developed was used as pretest and post test and copy of the test is given in Appendix - III.
3.7 Development of Mastery Learning Strategies Lesson Plans

The main aim of this study is to compare the effectiveness of two mastery learning strategies one is Bloom's mastery learning strategy and the other is Keller's mastery learning strategy. The investigator prepared 13 teaching lesson plans for each mastery learning strategy.

3.7.1 Development of Bloom's Unit Plan (Lesson Plan)

The investigator prepared Bloom's mastery learning strategy lesson plans keeping in view the unit and objectives of instruction. For the Bloom's mastery learning strategy of instruction 13 teaching units (lesson plans) were developed. The procedure of developing lesson plans were same for all. The material was prepared for each instructional objectives. The outlines of each lesson plan were comprised of the following components.

1. Topic
2. Instructional Objectives
3. Pre - Requisite Knowledge
4. Remedial Instruction
5. Instructional Aids
6. Content Sequence
7. Instructional Programme

One of the model lesson plans based on Bloom's mastery learning strategy is attached in the appendix (Appendix - I)
After a series of discussion with the supervisor about the essential conditions, the investigator prepared Keller's mastery learning strategy keeping in view the unit and objective of instruction. The material was prepared for each instructional objectives. The procedure followed as given below:

Steps:

1. Description of objective of instruction
2. Note or brief discussion
3. Examples/Questions and Answers

1. **Description of Objectives**: As the first step, the objectives of instruction was described in a very easy language and in small sentences which the students would be able to understand without having any difficulty. The way of elaboration was very systematic and sequential. Firstly the meaning of the subject of instruction was defined clearly. The content was discussed with suitable examples.

2. **Note**: The vast description of subject matter was briefly given in one or two lines which was called note.
3. Examples/Questions with Answers: After the description, note, the examples and questions with answers were given. One of the model lesson plan based on Keller's, mastery learning strategy is attached in the appendix (Appendix - II).

3.8 Procedure

The present study was conducted in three phases. First phase consisted of the achievement test as pre-test to measure the performance, Group Embedded Figure Test to measure cognitive style, Self-concept list to measure the self-concept. Second phase consisted of actual conduct of experiment. Two groups each containing 200 students (100 males and 100 females) were taught through different mastery learning strategy. Group I was taught through Bloom's mastery learning strategy and Group II through Keller's mastery learning strategy. At the end of experiment, the achievement test was administered as post test. Schematic lay out procedure is given in Table 3.4.

<table>
<thead>
<tr>
<th>Table 3.4</th>
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<tbody>
<tr>
<td><strong>Schematic Layout Procedure</strong></td>
</tr>
<tr>
<td><strong>Group A1</strong></td>
</tr>
<tr>
<td><strong>Phase-I</strong></td>
</tr>
<tr>
<td>Achievement Test (Pre-test), Group Embedded Figure test, Self-Concept Test.</td>
</tr>
</tbody>
</table>
Phase-II
Teaching through Bloom's mastery learning strategy.
Teaching through Keller's mastery learning strategy.

Phase-III
Achievement Test as Post-Test.
Achievement Test as Post-Test.

3.9 **Collection of Data**:

The tests were administered in the uniform sequence and in the following order:

1. Group Embedded Figure Test by Witkin
2. Self-Concept List Test by Pratibha Deo
3. Pre-Test Scores (Achievement Test)
4. Post-Test Scores (Achievement Test)

3.10 **Statistical Analysis of Data**:

Appropriate descriptive statistics like mean, median, mode, SEM, were worked out to classify the sample into various groups. Kurtosis and skewness was also computed to know the normal distribution. For standardizing achievement test, coefficient of correlation, discriminating power and discriminating value were computed.

The analysis of variance (four way) was computed to find out the main effects and interactional effects of independent variables on achievement. In case of significant F-ratio, t-ratios were computed to find the significance of differences between means of different combinations.
3.10.1 **Experimental Control**

Lindquist (1953, pp 8-11) discusses basic types of errors in conducting the experiments. These errors are commonly known Type S, Type G and Type R errors. These were controlled by taking the following steps:

1. **Type S errors** were controlled through statistical means. These errors are those which characterise simple random sampling. (An initial check by testing IQ's and comparing means of ages was also made to test whether the groups were properly formed - description follows).

2. **Type G errors** were minimised by 'fixing' same classroom, similar timings and same teacher etc. for each of the two treatment groups at each of the two levels. Type G errors arise due to the operation of extraneous factors which tend to have the same effect on all members of any given treatment group, but different effects on different treatment groups in any single replication.

3. **Type R errors** were controlled through sampling techniques using randomisation wherever possible. These errors arise from variations in treatment effects from replication to replication, due neither to type S nor Type G errors, but genuinely characteristic of the individual replications or subpopulations. Since the school selected was representative of average school population and city of average city in this part of India, type R errors are hopefully minimised. (This, however, was one practical limitation of the study that
experiment could not be replicated in several different schools which should have been a strict random sample of schools from the population of schools involved as there were practical difficulties in the form of complexity of the problem, time and labour involved, disorganisation of classes, schedule etc. of the schools involved).

3.10.2 Control of Variables

Organismic variables such as IQ, Sex, S.E.S. etc. have been controlled through randomization, wherever possible, in this experiment.

Stimulus variables were controlled by assigning same teacher, classroom etc. to each of the two treatment groups at each of the two levels. Since the same teacher taught each of the two treatment groups, same time could not be fixed hence to keep the variable of time 'fixed' the two groups were alternately taught at the two fixed periods each day.

Response variables were taken care of by post testing each individual student in the same classroom by the same experimenter, by the same tasks presented in a particular order.

Any bias in the treatment effect resulting from uncontrolled error variations was successfully eliminated by randomizing the error variations with reference to the treatment.