CHAPTER – III
DESIGN OF THE STUDY

The previous chapter deals with the review of related literature predating to the present study. The present chapter embodies the relevant objectives, hypotheses, research methods, population, sample, research tools and the statistical techniques employed for analysis of data.

Kerlinger asserts that research design has two basic purposes-
1. To provide answer to research question,
2. To control the variance.

A research design, components and proposals would give an adequate attention to each appropriate and applicable design components. It should be made clear that the design components are in part mandatory and in part choices made by researcher.

According to Mouley, “A study cannot be evaluated unless its procedures are reported in sufficient detail to make such an evaluation possible. The selection of the design should be particularly clear and precise to allow the grasp to grasp exactly what was done in the event of a need for verification on refutation to present its exact replication.”

These are presented in brief in the following paragraphs:-

The third step of the scientific research is to prepare a research design. A research design is a mapping strategy, which is based on sampling technique. It includes objectives, hypotheses, sampling, research strategy, method used, tools & techniques for collecting evidences and analyzing the data. A research design is the work before getting the project underway. A research design includes the following components:

1. Objectives of the study
2. Hypotheses of the study
3. Research method & research strategy
4. Sampling design
5. Choice of the research tools
6. Data collection
Choice of statistical techniques

Research design is a blueprint of procedure that enables the researcher to test hypotheses by reaching valid conclusion about relationships between independent and dependent variable. In the views of Kerlinger, Research design has two basic purposes:

- To provide answers to research questions.
- To control variances.

Research design is devised to enable the researcher to justify the research findings in terms of reliability, validity, objectivity and accuracy. Any research plan is deliberately and specifically conceived and executed to have empirical evidence to work out research problems.

3.1 OBJECTIVES OF THE STUDY

The present study is designed to realize the following objectives:

O1. To study the relationship between metacognition and problem solving ability among senior secondary students.
O2. To study the relationship between metacognition and self-esteem among senior secondary students.
O3. To study the difference between the mean scores of metacognition among rural and urban senior secondary students.
O4. To study the difference between the mean scores of metacognition among male and female senior secondary students.
O5. To study the difference between the mean scores of metacognition among senior secondary students having high and low problem solving ability.
O6. To study the difference between the mean scores of metacognition among senior secondary students having high and low self-esteem.
O7. To study the difference between mean scores of metacognition among male senior secondary students having high and low problem solving ability.
O8. To study the difference between mean scores of metacognition among female senior secondary students having high and low problem solving ability.
O9. To study the difference between mean scores of metacognition among male senior secondary students having high and low self-esteem.
O10. To study the difference between mean scores of metacognition among female senior secondary students having high and low self-esteem.

O11. To study the difference between the mean scores of metacognition among rural senior secondary students having high and low problem solving ability.

O12. To study the difference between the mean scores of metacognition among urban senior secondary students having high and low problem solving ability.

O13. To study the difference between the mean scores of metacognition among rural senior secondary students having high and low self-esteem.

O14. To study the difference between the mean scores of metacognition among urban senior secondary students having high and low self-esteem.

3.2 HYPOTHESES OF THE STUDY

H1 There is no significant relationship between metacognition and problem solving ability among senior secondary students.

H2 There is no significant relationship between metacognition and self-esteem among senior secondary students.

H3 There is no significant difference between the mean scores of metacognition among rural and urban senior secondary students.

H4 There is no significant difference between the mean scores of metacognition among male and female senior secondary students.

H5 There is no significant difference between the mean scores of metacognition among senior secondary students having high and low problem solving ability.

H6 There is no significant difference between the mean scores of metacognition among senior secondary students having high and low self-esteem.

H7 There is no significant difference between mean scores of metacognition among male senior secondary students having high and low problem solving ability.

H8 There is no significant difference between mean scores of metacognition among female senior secondary students having high and low problem solving ability.
H₉ There is no significant difference between mean scores of metacognition among male senior secondary students having high and low self-esteem.

H₁₀ There is no significant difference between mean scores of metacognition among female senior secondary students having high and low self-esteem.

H₁₁ There is no significant difference between the mean scores of metacognition among rural senior secondary students having high and low problem solving ability.

H₁₂ There is no significant difference between the mean scores of metacognition among urban senior secondary students having high and low problem solving ability.

H₁₃ There is no significant difference between the mean scores of metacognition among rural senior secondary students having high and low self-esteem.

H₁₄ There is no significant difference between the mean scores of metacognition among urban senior secondary students having high and low self-esteem.

3.3 VARIABLES OF THE STUDY

(a) Independent Variables:
- Problem Solving Ability
- Self-Esteem.

(b) Dependent Variable:
- Metacognition

3.4 METHODS OF THE STUDY

Selection of the research methods depends upon the nature of the study and objectives to be achieved. Methods of the study or methodology are the sheet anchor of any research proposal. It is the procedure that has to be adopted is decided upon before starting work on it. Here are many methods of collecting, analyzing reporting research data. There are basically three different types of methods in educational research –

3.5 TYPES OF METHODS

- Descriptive method
- Historical method
Experimental method

Descriptive Method:

No category of educational research is more widely used than the type knowledge as survey method or normative survey or descriptive research. It is concerned with present and attempts to determine the status of the phenomenon under investigation.

Type of descriptive research-
- Survey testing,
- The questionnaire and
- Interview

Historical Method:

Historians, philosophers’ social psychiatrists, literary men as well as social scientists, use the historical approach as a dynamic and organism and its structures and functions as steadily growing and undergoing change and transformation. Social scientists in particular are interested of concerned with social change. In simple words it is used to establish connection and relationship among past events and facts and arriving at conclusions concerning them. The purpose of historical research is to develop full and complete understanding of the past events so as to interpret the present day happenings.

According to Good and Scate, “Historical composition is a synthesis and constructive process that involves the mechanical problem of documentation of the logical problem of selection and arrangement of topic and sub-topic and philosophical problems of interpretation.”

Experimental method: Experimental method is a scientific method. It is also known as scientific enquiry method. This is most precise, accurate and reliable method. It is oriented to future in the sense that the researcher is seeking to evaluate something new experimentation simply enables us to improve the conditions under which we observe and thus, to arrive at more precise results. This is essence of scientific method.

According to William I.B. Berveridge, “An experimental usually consist in making an event occur under known conditions where’s many extraneous influences
as far as possible are climates and close observation is possible so that relationship between phenomena can be revealed.”

For the present study, the investigator adopted the descriptive or survey method because this method was considered to be more suitable for the present problem.

3.5.1 Method Used

In the present investigation Descriptive Survey Method was employed to find out the effect of problem solving ability and self-esteem on metacognition. The present piece of research was a descriptive survey. The main purpose of this work is to study the metacognition among senior secondary students in relation to their problem solving ability and self-esteem in the schools of Jhajjar district. It involves interpretation comparison measurement, classification, understanding a solution of significant educational problem.

3.5.2 Descriptive Method

It describes what are describing, a recording and interpreting condition of what exist. It involves some type of comparison or contrast and attempts to discover relationship between manipulated variables. The choice of methods depends on the purpose of the study because more significant differences also exist with respect to the purpose which the method is to serve, the nature of the problem for which they are appropriate and procedure employed in contact of each.

The present methodology of this study is based on descriptive research. Best and Khan (1989) states that descriptive formulation and testing, the analyses of the relationship between non-manipulated variables that exist or have already occurred are selected and observed. As is evident from the definition to descriptive research, it not only concerns itself with formulations and testing of hypothesis but also analyzing the relationship existing between various variables. The stress is also laid on the generalization development from the piece of research. Then the descriptive method was considered most appropriate for conducting the study of school teachers. In this study, organization climate of different schools were taken as dependent variables and psychological were taken as independent. Methods and techniques to pick up the appropriate population and sample is given in the best line.
3.6 POPULATION AND SAMPLE

The students of both rural and urban areas schools of district Jhajjar constituted the population of the subjects in the present study. Owing to certain problems was not feasible to study the whole population so the parameters have been estimated by the sample statistics. Various sampling methods are available to pick up a representative sample. The stratified sample method was used to draw the sample for the present study. The Jhajjar district constituted the area of the study. The stratified sample method was used to draw the school sample for the present study. The Jhajjar district constituted the area of the study. The stratified sample method was used to draw the school sample for the present study. The selection of schools was made on stratified basis after processing list to all the schools in Jhajjar district. While the investigator visited each school, he obtained the list of all students. Also out of this list, he randomly picked up sixteen students from each school. If a student earmarked for this study or was not found present in the school, it was later on conducted at his residence in the same way, if someone refused to co-operate with the study, another student was replaced on the random basis. But such cases were very few and rarely noticed. Thus 320 students from different schools of rural and urban area with 16 students from each school constituted the sample for this study.

Considering the resources limitations, it was decided to include the two types of schools: rural schools and urban schools were taken. The sample of 320 students includes both males as well as females. As it was impractical to test and evaluate every school so, the sample taken is 320 students from 20 schools.

i) 10 from rural
ii) 10 from urban area

3.6.1 Sample

The present study has been conducted on a sample of 320 senior secondary students in Jhajjar district. The sample was selected by using stratified random sampling technique.

SAMPLE Design [320 Students: 160 male (80 urban + 80 rural) + 160 female (80 urban + 80 rural)]

After implementing the problem solving ability and self-esteem inventory on 320 students, 25 per cent high scorers and 25 per cent low scorers have been taken
into consideration as high and low and problem-solving ability as well as high and low self-esteem students. So, 80 students having high problem solving ability and 80 students having low problem solving ability and 80 students of having high self-esteem and 80 students having low self-esteem have been taken into consideration.

Layout of the Sample:

- **N=320**
  - **Male (160)**
    - Urban (80)
    - Rural (80)
  - **Female (160)**
    - Urban (80)
    - Rural (80)

- **High Problem Solving Ability (80)**
- **Average Problem Solving Ability (160)**
- **Low Problem Solving Ability (80)**

- **Male (160)**
  - High Self-Esteem (80)
  - Average Self-Esteem (160)
  - Low Self-Esteem (80)

- **Female (160)**
  - High Self-Esteem (80)
  - Average Self-Esteem (160)
  - Low Self-Esteem (80)
The sample is selected by stratified random sampling technique from the population of senior secondary students. The list of senior secondary schools or rural and urban areas from where data were collected is given in Table 3.1 and Table 3.2.

Table 3.1
Name and Numbers of Rural Senior Secondary Schools from where data were collected

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of the School</th>
<th>Class selected</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>1.</td>
<td>Govt. Sr. Sec. School, Jahazgarh, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>2.</td>
<td>Govt. Sr. Sec. School, Matan Hail, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>3.</td>
<td>Govt. Sr. Sec. School, Dighal, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>4.</td>
<td>Govt. Sr. Sec. School, Dubaldhan, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>5.</td>
<td>Govt. Sr. Sec. School, Majra (D), Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>6.</td>
<td>R.C.M. Sr. Sec. School, Majra (JZ), Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>7.</td>
<td>Paramount Sr. Sec. School, Chhuchhakwas, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>8.</td>
<td>Mother India Sr. Sec. School, Marout, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>9.</td>
<td>Sarvodya Sr. Sec. School, Khanpur, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>10.</td>
<td>Gyan Jyoti Sr. Sec. School, Kasni, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td></td>
<td>Total No. of Students</td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>
### Table 3.2

**Name and Numbers of Urban Senior Secondary Schools from where data were collected**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of the School</th>
<th>Class selected</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>1.</td>
<td>Govt. Sr. Sec. School, Beri, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>2.</td>
<td>Govt. Sr. Sec. School, Jhajjar-I.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>3.</td>
<td>Govt. Sr. Sec. School, Jhajjar-II.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>4.</td>
<td>S.D. Sr. Sec. School, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>5.</td>
<td>Govt. Sr. Sec. School, Bahadurgarh, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>6.</td>
<td>Golden Valley Sr. Sec. School, Bahadurgarh, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>7.</td>
<td>D.H. Lowerence Sr. Sec. School, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>8.</td>
<td>Green Field Sr. Sec. School, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>9.</td>
<td>Little Angel Sr. Sec. School, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td>10.</td>
<td>Rama Krishna Sr. Sec. School, Beri, Jhajjar.</td>
<td>XII</td>
<td>08</td>
</tr>
<tr>
<td></td>
<td>Total No. of Students</td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

#### 3.7 TOOLS USED

- Meta Cognition Inventory (MCI) by Punita Govil (2003). This test available in both mediums i.e. in English and Hindi. This scale consists of 30 items.
• Problem Solving Ability Test (PSAT-d) by L. N. Dubey (2006). This test available in both mediums i.e. English and Hindi. This test consists 20 items.
• Self-Esteem Inventory (SEI) by G.P. Thakur (1989). The inventory has two parts. Part one has 29 items and measures personally perceived self. The second part of the inventory. i.e., socially perceived self was used, which has 30 items.

For data collection variety of devices may be used keeping in view the stability of the study. Therefore selection of appropriate tools is of vital importance for collection of data which depends on various considerations such as objectives of study, availability of suitable test scale, personal competence of the investigator to administer, score and interpret the results.

3.7.1 Description of Meta Cognition Inventory (MCI) by Punita Govil.

Meta Cognition Inventory (MCI) developed by Punita Govil was used in the present study. This test available in both mediums, i.e. in English and Hindi. This scale consists of 30 items.

Reliability

The reliability of the test was determined by two methods : Cronbach’s alpha coefficient and test-retest method. For this purpose, the final draft of the test was administered to a sample of 700 college students studying in different Universities. With the help of resulting scores alpha coefficient was calculated which was found to be 0.85. For computing reliability coefficient by test-retest method, the test was again administered to 300 college students out of the same 700 students and the test-retest reliability was calculated by finding out the correlation coefficient between scores obtained on test and retest. The value of reliability coefficient was found to be 0.82.

Validity:

To ascertain the validity of the test, the draft test was given to a panel of experts consisting of 20 eminent experts of different universities. Each expert was asked to indicate the degree to which each item assessed the metacognition of the respondents. The degree of agreement of experts on each item indicated the validity of
the test. Corrections were made in the test items in accordance with their suggestions. According to their views, the test possesses satisfactory content validity.

**Administration of the Tool**

This inventory can be administered individually or in group. It should be completed under certain standardized instructions. First the respondents should be asked to fill in the personal data blank printed on the front page. The investigator should read the instructions loudly and clearly. The respondents should follow him carefully. The administrator should explain the mode of responding to the items of the inventory. When he becomes sure that the students have understood the mode of recording their responses, he should permit them to turn over the front page and record their responses.

**Scoring**

Meta-Cognition inventory- the inventory contains 30 items, each item being a statement followed by a four point scale: ‘not at all’, ‘somewhat’, ‘to a considerable extent’ and ‘very much so’. If a respondent marks ‘not at all’ he is given a weightage of 1 point. Similarly 2, 3 and 4 points are given for markings on ‘somewhat’, ‘to a considerable extent’ and ‘very much so’ respectively.

**3.7.2 Description of Problem Solving Ability Test**

Problem Solving Ability Test (PSAT-d) developed by L. N. Dubey was used to assess problem solving ability of students. This test is available in both mediums, i.e. in English and Hindi. This test consists 20 items.

**Reliability**

The reliability coefficient of the test was calculated by the following methods:

<table>
<thead>
<tr>
<th>Method</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman-Brown Formula (Split-half method)</td>
<td>0.78</td>
</tr>
<tr>
<td>Kudar – Richardson formula (Rational equivalence method)</td>
<td>0.76</td>
</tr>
</tbody>
</table>
Validity

The coefficient of validity was calculated by correlation the scores with the following tests:

<table>
<thead>
<tr>
<th>Test</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Intelligence Test (R. K. Tandon)</td>
<td>0.68</td>
</tr>
<tr>
<td>Test of Reasoning Ability</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Administration of Problem Solving Ability Test-

1. The test administered should ensure that seating arrangement is good. Pupils should get sufficient light and fresh air. These should be sufficient distance between two seats.
2. All the pupils should have pencils or pens. For emergency the tester should also have some pencils ready with him.
3. While administering the test in a group, not more than 30 pupils should be given the test at a time.
4. The tester should be at least assisted by a supervisor in the administration of the test.
5. The time limit for the test is only 40 minutes. Therefore the tester should be very particular about time.
6. The instructions for the test to the pupil written on the test booklet should be read clearly and slowly. He should ensure before starting the test all the pupils have fully understood the instructions.

Scoring

There are 20 problems in the test. Each problem has four alternative answers. Out of these four answers only one is correct. If the pupil writes the correct answer he should be given one mark, and if he writes a wrong answer zero should be given. In the end all the marks should be added.

3.7.3 Description of Self-Esteem Inventory (SEI) by G.P. Thakur.

Self-Esteem Inventory (SEI) developed by G.P. Thakur was used to assess the self-esteem of the senior secondary school students. The inventory has two parts. Part one has 29 items and measures personally perceived self. The inventory has two
parts. Part one measures personally perceived self and part two measures socially perceived self. In the present study the second part of the inventory i.e., socially perceived self was used, which has thirty items.

Reliability of the Inventory

The two sets of the inventory were administered to a sample of 400 students. Split-half reliability co-efficients were calculated for both the sets of the inventory which came out to be 0.82 and 0.78 for personally perceived self and socially perceived self respectively of the 400 students, 150 students were administered the two sets of the inventory again after a gap of six weeks for evaluating re-test reliability coefficients. Re-test reliability co-efficients were found for both the tests were 0.69 and 0.66 respectively for personally perceived self and socially perceived self.

Administration of the Tools

This inventory can be administered individually or in group. It should be completed under certain standardized instructions. First the respondents should be asked to fill in the personal data blank printed on the front page. The investigator should read the instructions loudly and clearly. The respondents should follow him carefully. The administrator should explain the mode of responding to the items of the inventory. When he becomes sure that the students have understood the mode of recording their responses, he should permit them to turn over the front page and record their responses.

Scoring

Self-Esteem Inventory consists thirty items, seventeen are socially desirable and thirteen are socially undesirable. Of the thirty items, 17 are socially desirable and 13 are socially undesirable. There are 7 possible response to each item/statement i.e. totally correct, correct to a large extent, partially correct, uncertain, partially wrong, wrong to a large extent and totally wrong. The maximum score of this inventory is 210 and minimum score is 30. The items which are socially desirable would get 7 scores if answered completely true and 1 if answered completely false. Other intermediate answers would get scores accordingly. The socially undesirable items would be scored in the opposite manner, i.e., the completely false point would get 7 scores and
completely true would get 1 score. Here low score indicates poor self-esteem while high score indicates high self-esteem. For the purpose of the present study this inventory was locally adapted.

3.8 COLLECTION OF THE DATA

After looking into the nature of study it was necessary to obtain the information of every item included in the questionnaires. The data was collected individually. The researcher went to the schools to contact the teachers for the selection of the students. He established proper rapport with them and then administered the questionnaires. The selection of students was done on random basis. Thus the investigator visited the schools and collected the data himself from each school 16 students were selected.

3.9 STATISTICAL TECHNIQUES USED

The Mean and Standard Deviation is calculated of the entire test conducted on the students. Karl Pearson’s Product Moment Correlation was used to see the relationship of Metacognition with problem solving ability and self-esteem and ‘t’ test was used to see the significant difference among senior secondary students in relation to their gender and locality by using Statistical Package for Social Sciences (SPSS) version 17.

3.10 ANALYSES AND INTERPRETATION

A list of schools having senior secondary classes of Jhajjar district is procured. Schools are selected from the list by stratified sampling method. Then from those schools 320 students of twelfth classes have been taken. The principals of these schools and class teachers of twelfth classes are contacted and a time schedule of collecting data will be finalized. The tools for meta-cognition, self-esteem and problem solving ability are administered. Scoring is done as per the guidelines given in the respective manuals. The data thus collected is subjected to statistical treatment. After administration of the standardized test, the answer sheet is collected and the scoring is done with the help of manual provided with the test series. The mean and standard deviation is calculated by separating the each test.
To find out the difference among male & female, rural & urban students, ‘t’ test was used and to see the relationship among variables, i.e. Metacognition, Problem Solving Ability and self-esteem, Karl Pearson’s Product Moment Correlation technique was employed. The Null Hypothesis is tested at 0.01 level. The interpretation is done purely on the basis of objectives and hypotheses keeping in mind.

The entire Hypotheses constricted for the study is tested on 0.01 level and their significance or not significance feature is calculated, while checking their significance the objectives is considered in mind.