CHAPTER - IV : METHODOLOGY

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4.1 Introduction

The next important task after selecting a problem and formulating the objectives is to construct suitable tools and collect data. The present chapter commences with a detailed description of the methodology followed by the investigator to study the convergent and divergent thinking ability of the visually impaired children. The various steps followed in the methodology of this study are discussed under different headings namely; selection of research tools, construction of tools, validity and reliability of the tools, sampling procedure, method of data collection and statistical techniques used in the study.
4.2 Selection of the Tools

Selection of the tool is an important ingredient of a successful research study. There are various tools available to collect the necessary data for a research study. A researcher can select an existing research tool if it is suitable for his study. In case such tools are not available, it may be advisable to prepare necessary tools which are appropriate for the study. The prime objective of the present study is to develop Psychological tools to assess the convergent thinking, divergent thinking and mental ability of visually impaired students. Since standardized tools relevant to assess the convergent thinking, divergent thinking and mental abilities of visually impaired children are not available for the present were in Indian context, rarely available, the investigator developed the following tools and established their reliability and validity. The tools are:

a) Personal Data Sheet
b) Divergent Thinking Test in Braille Form (DTT-BF)
c) Convergent Thinking Test in Braille Form (CTT-BF)
d) Mental Ability Test in Raised Figures (MAT-RF)

4.3 Personal Data Sheet

In order to get information like the name of the school, age, sex, class, degree of blindness, on set of blindness, family size, mother tongue, family income, occupational and educational status of parents, a short questionnaire in the form of personal data sheet was prepared. The students were asked to answer the questions in the form before taking the tests. The specimen copy of personal data sheet is presented in the Appendix - A

4.4 Development of Divergent Thinking Test in Braille Form (DTT-BF)

Different researchers like Passi, Mehdhi and Paul Torrence developed their own tools (Passi Test of Creativity, Mehdhi Test of Creativity, and Paul
Torrence Test of Creativity) to assess the creativity of sighted individuals. None of these tools are suitable to assess the divergent thinking ability of visually impaired children. Hence, the investigator developed his own tool to assess the divergent thinking ability of visually impaired children. In the development of the DTT-BF, the investigator referred to the materials of Passi Test of Creativity, Mehdhi Test of Creativity and Paul Torrence Test of Creativity. As questions that stimulate divergent thinking ability are rarely found in ordinary text books used in the classes, the investigator referred to the books other than the text books to include items in divergent thinking test. While developing the DTT-BF, only questions which are applicable to visually impaired children in secondary schools were given due consideration. As a result of this, eight questions were prepared in braille form. The following criteria were kept in mind while preparing the questions.

a) They must allow multiple correct answers.

b) The questions must be at the standard of secondary level visually impaired students.

c) They must not be too difficult

d) They must be based on the day-to-day experience of visually impaired children.

These questions were then shown to five high school level Resource Teachers, Expert in the field of Education of visually impaired children, two professors in Psychology and three visually impaired children. On the basis of their suggestions, finally four questions were selected for use in the divergent thinking test. Almost all the four questions selected are related to day-to-day experiences of the visually impaired children.
4.4.1 Description of Questions in the Divergent Thinking Test in Braille Form (DTT-BF)

The Verbal Test of Divergent Thinking Test, prepared in Braille form includes two sub-tests, namely Novel Uses Test and Consequences Test.

i) Novel Uses Test:

This test presents the subject with names of four common objects viz. water, piece of cloth, piece of paper and plate - requires an individual to write as many novel, interesting and unusual uses of these objects as possible to think of. These questions are included in view to measure an individual's ability to retrieve items of information from his personal information in storage. Evidently, it measures also the subject’s ability to shift frames of reference to use the environment in an original manner. The Novel Uses Test consists of four test items namely

1) Listing the uses of water.
2) Listing the uses of piece of cloth.
3) Listing the uses of piece of paper.
4) Listing the uses of plate.

ii) Consequence Test:

The consequence test consists of four hypothetical situations.

1) What will happen if tables start walking like man?
2) What will happen if man does not require any food to eat?
3) What will happen if all sources of water in the world vanish?
4) What will happen if all plants start speaking like man?

The visually impaired students are required to think as many consequences of these situations as they can, and write them under each situation in the braille papers. The situations being hypothetical, minimize the effect
of experience and also provide them with an unlimited opportunity to make responses. The test encourages free play of imagination and originality.

4.4.2 Pre-Tryout for Divergent Thinking Test in Braille Form (DTT-BF)

The Divergent Thinking Test (DTT-BF) was administered to a small group of eleven visually impaired children of secondary school to find out the appropriateness and specification of the test. The following observations were made in the pre-tryout.

a) Some visually impaired students faced difficulties in answering and showed less interest whereas some found it an interesting task.

b) Students hesitated to respond freely for a few questions.

c) Two low-vision students were not able to read braille and required reader’s help for knowing information given in braille form.

d) The minimum time taken for answering eight questions included in the test was 24 minutes and the maximum time taken was 66 minutes.

The pre-tryout helped the investigator to find out, to what extent the test items lend themselves to reach the objectives of the study. This also helped the investigator to decide about the instructions to be given to the subjects. Before the pilot study, the plan of administering test and ambiguous and complex words were altered.

On the basis of jury opinion and pre-tryout process, the procedure for administering the test was laid out. As visually impaired children were not familiar with these type of questions, they had to be instructed that each question had a variety of correct answers and it was left to them for discovery. They had to be told to write answers on the braille paper with the help of braille slate and stylus.
4.4.3 Pilot Study for Divergent Thinking Test (DTT-BF)

Pilot study is one of the important stages in the selection of test items. It helps the investigator to have the most relevant items for the final study. For the pilot study, 26 visually impaired students from 6 Integrated schools of Coimbatore region were taken. They were taken at random. The sample for pilot study included 15 male and 11 female visually impaired students at secondary level. They were asked to sit in a comfortable seat and provided with braille slates, braille papers and stylus. General instructions regarding the nature of the questions, time limit, mode of writing their answers in braille paper were given. Then the method of answering was explained to all of them. Their doubts were cleared with all explanations. After that, they were allowed to write the answers in braille form.

Time was counted from the instant they began answering. At the end of 8 minutes, their answers were collected. Following the first question, second question was given and it was also explained. When visually impaired children expressed that they could answer they were allowed to answer. At the end of 8 minutes, their answers were collected. In the same manner, all the 8 questions were given to them one after the other and their responses were collected.

Evolving the Scoring Key

In Divergent Thinking Test (DTT-BF), each question elicited a number of correct answers. No single person could predict the kind of responses that would be given by hundreds of students. So the scoring key had to be evolved from the responses of the group of students who took the test and who represent the population of secondary level visually impaired children to whom the test was intended.
The answer had to be scored for the three dimensions namely Fluency, Flexibility and Originality of divergent thinking. Fluency is the facility in retrieving information from memory. The number of correct responses to a question gives the scores for fluency dimension. Flexibility is the readiness to reclassify information. The number of variety of responses gives scores for flexibility dimension. Originality is the ability to produce remote or unusual responses. Remoteness is measured by low statistical frequency. The sum total of the scores in these three dimensions would give the total divergent thinking scores.

Evolving the scoring key consisted of three stages. In the first stage, the responses in the braille was transcribed. In the second stage, the analysis of the student's responses was made questionwise. The responses that were connected with the stimulus presented were accepted as correct responses and the responses that were not connected with the stimulus presented were rejected as wrong answers. The correct response to each question by the 26 visually impaired students were gathered. Similar responses to a question were grouped and it was treated as one variety. Many such varieties varied with questions. The group of answer showing varieties were arranged in clear, non-overlapping groups. For convenience these groups were given names as category "A", category "B" and "C" etc. These categories helped in determining the flexibility scores. While going through the answers of the 26 visually impaired students, it was noticed that the same answer was given by many students.

Hence the frequency of occurrence of each answer in the answer sheets (Braille sheets) of the 26 visually impaired students for a particular question was taken. This frequency helped in determining the originality score of the answer. If the frequency was less than or equal to 3 it was considered
to be very unusual and was given the originality weight symbol which fetched 5 points. If the frequency was greater than 3 and less than or equal to 8, the answer was given the originality weight symbol which was allotted three points. If the frequency of an answer was greater than 8, it was given the originality weight symbol which carried one point. The same procedure was followed for each of the 8 questions.

The second stage was the application of the scoring key evolved to the answers of the 26 visually impaired students. An answer paper of a student was taken and all the 8 questions were scored one after the other applying the scoring key evolved. First, the correct responses were accepted by indicating them by tick mark. Then each correct response was given the variety symbol A or B or C etc., and afterwards the originality weight 5 or 3 or 1. Thus, each response was scored three times, the first for fluency dimension by tick mark, the second for flexibility dimension by category name A or B or C etc., and third by originality symbol.

The number of categories that occur in a particular question was taken as flexibility score. The number of ‘s, ‘s, and ‘s occurring in the answers of a question were counted and those numbers were respectively multiplied by 5, 3 and 1. The multiples were added to get scores for originality dimension. The sum total of the scores of the three dimensions gave the total divergent thinking scores for that particular question. For example, suppose a student gave the following answers to the first question namely,
Among the 12 answers 11 are correct. So fluency score number of correct responses = 11. Flexibility score is the number of categories that appear. Here categories A, B, C, D, E, G, H and I appear. Hence flexibility score is 8. Originality symbols appear in one time, 3 times and 1 time respectively. So originality score = $5 \times 1 + 3 \times 3 + 1 \times 1 = 15$. So the total divergent thinking score = 11 + 8 + 15 = 34. In the same way all questions were valued. The total score in all the 8 questions were taken as the total divergent thinking score. It was
assumed that if any new responses not given in the scoring key appeared in the final study, it should be included in a new category and should be treated as a very unusual one. The scoring keys for the DTT-BF is questions are presented in Appendix-C.

4.4.4 Selection of Questions for the Final Study

Using the scoring key evolved the answer sheets of the 26 visually impaired children were scored. The visually impaired students answered well all the questions except 4, 7, and 8. Also it was found in the pilot study that the time of the test was too long. It took nearly 96 minutes to conduct the test. 30 minutes were taken for explaining the questions and 66 minutes taken by the students to write the answers in braille. So it was felt that 8 questions in the pilot study question paper were too many. Hence the questions 4, 7 and 8 were simply omitted and no attempt was made to modify them. Besides, the second question was also omitted, as it was similar to the third question. The final test contained only four questions, that is the question with numbers 1, 3, 5, and 6. The time duration for answering four questions was fixed as 32 minutes that 8 minutes for each question. These four questions formed a good combination, as they were related to the main aspect of divergent thinking test. The final form of DTT-BF is given in Appendix-B.

4.4.5 Reliability of the Tools Used in the Study

Henry E. Garrett says (1959) "A test score is called reliable when we have reasons for believing the score to be stable and trustworthy. In fact, a comparison of scores made upon repetition of an unreliable test or upon two parallel forms of the same test will reveal many discrepancies some large and some small in the two scores made by each individual in the group. The
correlation of the test with itself computed in several ways is called the reliability coefficient of the test."

Garrett also describes four methods of establishing the reliability of a test. They are (a) Test-retest method (b) Alternate or Parallel forms (c) Split-half techniques (d) Rational equivalence method.

a) Test-Retest Method:

Repetition of a test is the simplest method of determining agreement between two sets of scores. The test is given and then it is repeated on the same group after a lapse of time. The correlation is computed between the first and second set of scores. Given sufficient time interval between the first and second administration of a test to offset memory, practice and other carry-over effects, the correlation coefficient becomes a close estimation of the stability of the test scores.

b) Alternative or Parallel Forms Method:

When alternative or parallel forms of a test can be constructed, the correlation between form "A" and form "B" may be taken as a measure of the self-correlation of the test. Under these conditions the reliability coefficient becomes an index of the equivalence of the two forms of the test. Parallel forms are usually available for standard Psychological and Educational achievement tests. In drawing up alternate test forms, care must be exercised to match test materials for content, difficulty and form, and precautions must be taken not to have the items in the two forms too similar. When alternate forms are virtually identical, reliability is too high, whereas when parallel forms are not sufficiently alike, reliability will be too low. An interval of at least two to four weeks should be allowed between administrations of test.
C) Split-Half Method:

In the split-half method the test is first divided into two equivalent "halves" and the correlation found for these half-tests. From the reliability of the half test, the self-correlation of the whole test is then estimated by the Spearman-Brown prophecy formula \( R = \frac{27}{1+r} \). Whereas " \( R \)" is the reliability of the whole test, " \( r \)" is the reliability of the half test. The procedure, in detail, is to make up two sets of scores by combining alternate items in the test. The first set of scores, for example, represents performance on the odd-numbered items, 1,3,5,7 etc., and the second set of scores, performance on the even numbered items 2,4,6,8, etc., other way of making up two half tests which will be comparable in content, difficulty and susceptibility to practice are employed, but the odd-even split is the one most commonly used.

d) The Method of "Rational Equivalence:

The method of rational equivalence represents an attempt to get an estimate of the reliability of a test free from the objections raised against the other methods. Two forms of a test are defined as equivalent when corresponding items \( a, A - b, B \) etc. are interchangeable, and when the inter-item correlations are the same for both forms. The method of rational equivalence stress the inter-correlation of the items in the test and the correlations of the items with the test as a whole. The formula to determine the reliability is

\[
r = \frac{n / (n-1) \times \sigma^2 - pq}{\sigma^2}
\]
in which
\( r = \) reliability coefficient of the whole test.
\( n = \) number of items in the test
\( \sigma = \) the standard deviation of the test scores
\( p = \) the proportion of the group answering a test item correctly
\( q = 1 - p = \) proportion of the group answering test item incorrectly

4.4.6 Reliability of Divergent Thinking Test in Braille Form (DTT-BF)

Test-retest method was used by the investigator to determine the reliability of the test items in divergent thinking test. 26 visually impaired children from six integrated schools at Coimbatore region were selected for pilot study. They constituted reliability sample. The coefficient of correlation between the two administrations of the test were calculated by using product-moment correlation method.

\[
 r = \frac{N \sum XY - \sum X \cdot \sum Y}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}
\]

The test-retest reliabilities of the divergent thinking factor scores and also the total score were calculated and tabulated as follows.

<p>| Test - Retest Reliabilities of Factors Scores and the Total Divergent Thinking Score N=26 |
|---------------------------------|----------------|----------------|----------------|</p>
<table>
<thead>
<tr>
<th>Fluency score</th>
<th>Flexibility score</th>
<th>Originality score</th>
<th>Total Divergent thinking score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.929</td>
<td>0.675</td>
<td>0.915</td>
<td>0.901</td>
</tr>
</tbody>
</table>
The correlations are considerably high ranging from 0.675 to 0.929. These values are highly satisfactory. The reliability of the total divergent thinking score which came out to be 0.901 is again quite high.

**4.4.7 Validity of the Tools Used in the Study**

Henry E. Garrett defines validity as "the fidelity with which it measures what it purports to measure". He mentions three methods of establishing validity. They are:

a) Determining validity by means of judgments
b) Determining validity experimentally
c) Factorial validity

**a) Determining Validity by Means of Judgment**

According to this method, if competent persons in the field say that a test is a good one, then the test is considered to be a valid one. Standard educational achievement examination represents the consensus of many educators as to what a child of a given age or grade should know about arithmetic, English, History or Geography and it is judged to be valid if its content consists of questions covering these areas. By this method both "content validity" and "face validity" are established.

**b) Determining Validity Experimentally**

The validity of a test is determined experimentally by finding the correlation between the test and some independent criterion, or a qualitative measure such as a judgment of the character or excellence of work done. For instance, intelligence tests were first validated against school grades, rating for aptitude by teachers, and other indices of ability. A high correlation between a test and a criterion is evidence of validity provided i) the criteria were set up independently and ii) both the test and criterion are reliable.
c) Factorial Validity:

In the statistical method called factor analysis, the intercorrelations of a large number of tests are examined and if possible smaller number of more general "factors" or that categories. The factors presumably run through the often complex abilities measured by the individual test. It is sometime found for example, that 3 or 4 factors will account for the intercorrelations obtained among 15 or more tests. The validity of a given test is defined by its factor loadings and these are given by the correlation of the test with each factor. A vocabulary test, for example, may correlate 0.85 with the verbal factor extracted from the entire test battery. This coefficient becomes the test’s factorial validity.

4.4.8 Validity of Divergent Thinking Test in Braille Form (DTT-BF)

For this test, validity was established by means of judgment method. The question paper prepared for assessing divergent thinking of visually impaired was shown to eminent special educator, special teachers, Psychology professors and Reader in Psychology. On the basis of their suggestions, questions were selected for preparing divergent thinking test to visually impaired children. This procedure speaks for content and face validity of the test.

4.5 Development of Convergent Thinking Test in Braille Form (CTT-BF)

According to Cornish (1989) all the intelligence tests are Convergent Thinking Tests. Worth mentioning intelligence tests(Convergent Thinking Test) are: Stanford - Binet intelligence scale, Wechsler intelligence scale and Ahuja group test of intelligence etc. But none of these tests is suitable to measure Convergent Thinking of visually impaired children. Among these tests, Ahuja group test of intelligence is in verbal form and standardised for south Indian children to measure their intelligence. Hence, the investigator referred to this test
in developing convergent thinking test in Braille form for visually impaired children. In developing the CTT-BF, the following criteria were followed.

i) The problems must be within the capacity of the secondary school visually impaired children.

ii) They must be within their life experiences

iii) They must be interesting

iv) They must stimulate their thinking ability

v) Each problem must have only one correct answer.

About 35 questions were collected from booklet. They were shown to a panel of resource teachers for visually impaired children in secondary schools; Experts in the field of education of visually impaired and professors in psychology. With their help, 26 questions were selected for the pilot study. They were prepared in braille for better understanding of visually impaired children.

Convergent thinking test contained 26 multiple choice questions. All these 26 questions were prepared in braille paper and each question was presented with five answers. The visually impaired children had to find out the correct answer among five and record their answer in braille papers.

4.5.1 Pilot Study for Convergent Thinking Test in Braille Form (CTT - BF)

After deciding the questions for pilot study, the question paper was prepared in the braille form and was given to the visually impaired children. The investigator explained the general instructions regarding the time, mark, and answering procedure. Their identification data were written on the question paper. Students were asked to use separate braille sheet for recording their answers.
For pilot study 20 male and 16 female visually impaired children from integrated schools and schools for the blind were randomly selected. Question papers were distributed and general instructions were explained to them. They were asked to answer all the questions and they had to write answers on the braille paper with the help of braille slate and stylus. The example questions were solved and explained to the students. The time for the test was 20 minutes. The answer papers were collected after the stipulated time duration for the test.

4.5.2 Selection of Questions for the Final Study

The answer papers of the 36 visually impaired students were scored and their marks were consolidated for ready reference. The difficulty index and discriminative power of each item was calculated. The item having difficulty level 28 to 80 and with discriminating power above 15 were included in the test. As 6 questions were deleted based on item analysis, the final test consists of 20 only. The duration of the test was 15 minutes. The Specimen copy of Convergent Thinking Test in Braille Form (CTT-BF) is presented in Appendix - D. The scoring key for CTT-BF is presented in Appendix - E.

4.5.3 Reliability of Convergent Thinking Test in Braille Form (CTT-BF)

Among the four methods stated above, the split-half method was used by the investigator to determine the reliability of the test items. A sample of 36 visually impaired children were selected from the six integrated schools and one special school. The CTT-BF was administered on them. Then the test items were divided into two equivalent halves by pooling the scores on odd numbered and then even numbered items and the correlation was found for these half-test by using Karl Pearson correlation coefficient formula.
\[ r = \frac{N \sum XY - \sum X \sum Y}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}} \]

\[ = \frac{36 \times 2384 - (283 \times 288)}{\sqrt{[(36 \times 2411) - (283)][(36 \times 2512) - (288)]}} \]

\[ = 0.609 \]

From the half-test reliability, the whole test reliability was calculated by using Spearman Brown's formula

\[ r = \frac{2 r^{1/2}}{1 + r^{1/2}} \]

\[ = \frac{2 \times 0.609}{1 + 0.609} = 0.756 \]

The obtained correlation value of whole test (0.756) was found to be highly significant.

4.5.4 Validity of Convergent Thinking Test in Braille Form (CTT-BF)

Ahuja Test of intelligence was referred to for preparing Convergent Thinking Test in Braille. Questions were also prepared having certain criteria in mind. The test paper was shown to competent Resource Teachers, Special Educators, and Psychologists and based on their suggestion the items were selected. Thus the validity of convergent thinking test was established by means of judgments.

The second method, namely determining validity experimentally was also attempted. Items in the intelligence test have single correct answers. They also measure reasoning abilities. So intelligence tests can be considered to have some element of convergent thinking. Also, intelligence tests were validated.
against, school achievement test by Psychologists. It is reported in the Handbook of Culture Fair Intelligence Test (1960)

In this study, the Convergent Thinking Test Score was correlated with Mental Ability Test adapted by the investigator (MAT-BF). The obtained correlation was found to be 0.793 in the whole sample of 159 visually impaired children. This correlation value was found to be highly significant.

4.6 Mental Ability Test in Raised Figures (MAT - RF)

To assess the mental ability of visually impaired children, Raven's Coloured Progressive Matrice Test was adapted into raised figures. The Raven's colored Progressive Matrices (CPM) in ink print can be used satisfactorily with people who for any reason, cannot understand or speak the language, with people suffering from physical disabilities, aphasias, cerebral palsy or deafness, as well as with people who are intellectually sub-normal and deteriorated. This test was standardized by J.C. Raven. It was proved to be immune to cultural influences and so could be used in any part of the world. This test consists of three sets "A", "AB", and "B". The three sets of twelve problems constituting the CPM are arranged to assess the Chief Cognitive process of individuals. The three sets together provide three opportunities for a person to develop a consistent theme of thought. But, the problems given in the CPM are in ink prints which can not be tactually perceived by visually impaired children. Hence, the CPM was adapted for visually impaired children in raised figures.

According to N.K. Jangira, M.N.G. Mani and Raychoudhary, M (1987) "Sighted children have a better edge over visually disabled children in acquisition of knowledge through experience. The sighted have natural learning and visually impaired child have mediated learning." Therefore, there is a
need for adaptation to the presentation of CPM for visually impaired children. The criteria followed while adapting the CPM were

a) The task given in ink print must be adapted into raised figures in such a way that the visually impaired individual is able to explore, discriminate and recognize with their tactual sense.

b) The adapted material must be durable and prepared with solid materials like threads, buttons, coins and braillon sheets etc.

c) Material must be tactually attractive as well as possible.

By keeping the above mentioned criteria in mind all the 36 problems in CPM were adapted in raised figures. The master copy prepared by the investigator was copied in braillon sheets plastic sheets) with the help of thermoform copier.

4.6.1 Pre-Tryout for Mental Ability Test in Raised Figures (MAT-RF)

These raised figures were then shown to five resource teachers, expert in the field of education of visually impaired children, two professors in psychology and five visually impaired students. On the basis of their suggestion, certain aspects of figures were modified, substituted and omitted. Finally 36 raised figures which were found to be most suitable were selected for use in the mental ability test. Almost all the 36 problems selected reflect the concept of Raven's Progressive Matrices.

4.6.2 Description of Mental Ability Test in Raised Figures (MAT-RF)

This test consists of 36 problems in raised figures divided into three sets each of 12. The three sets provided three opportunities for
grasping the method and three progressive assessments of a visually impaired children's capacity for intellectual activity. The total score of the visually impaired children in 36 problems will be considered as an index of their intellectual capacity. The sample problems in raised figures are given in Appendix - F

4.6.3 Reliability of Mental Ability Test in Raised Figures (MAT-RF)

Raven's progressive matrices is now used internationally, and no general revision of it has yet appeared necessary to assess mental ability of sighted individuals. The test author has already established test-retest reliability and it was found to be highly significant in positive direction. In this study, the investigator adapted this RPM to visually impaired children in raised form and it demanded further establishment of the validity and reliability. Hence, test-retest method was used to find out reliability of MAT-RF. The test was given to 26 visually impaired children of 6 integrated schools and the MAT-RF was administered to them. After 20 days the same test was administered to the same sample and the test scores were calculated. The coefficient of correlation between test and retest scores was calculated by using product moment correlation method. The obtained coefficient of correlation 0.760 was found to be highly significant at 0.01 level.

4.6.4 Validity of Mental Ability Test in Raised Figures (MAT-RF)

Judgement method was employed to establish the validity for this test. The Mental Ability Test prepared in raised form was shown to eminent resource teachers, experts in the field of special education for visually impaired children and Professor, Readers in Psychology. On the basis of their suggestions, the adopted form of RPM test was prepared for visually impaired children.
4.6.5 Procedure for Using Mental Ability Test (MAT-R)

The visually impaired children to be assessed were seated comfortably
in a desk and mental ability test books (MAT-RF) were distributed. They were
asked not to open the books until the scribe writers were ready.

The investigator said "open your books to the first page". The scribe
writers demonstrated for the visually impaired students to tactual exploration.
After this, the following instructions were given to them.

"This is "A", you know what it is. The upper part is the problem figure
with a bit missing. Each of these bits below (they points to each in turn) is the
right shape to fit the space, but they do not complete the pattern. The answer
figure "A" (the scribe writer points to the bit and then to the pattern) is quite the
wrong pattern. Answer B and C are wrong - they fit the space, but they are not the
right pattern. What about answer bit F? It is the right pattern (The scribe writer
illustrated that the pattern is the same as the pattern above) but it does not go all
over. Put your finger on the one that is quite right." The scribe writer noticed if
this was done correctly. If necessary, the visually impaired student was given
further explanation by the investigator and then said "yes, the answer figure D is
the right one. So the answer to A.1 problem is D. Go on like that by yourselves
until you get to the end of the test book."

4.6.6 Supervision:

The investigator observed the visually impaired student's activity in
such a way that each person had answered correctly to the first five problems.
Once the visually impaired students had grasped the nature of the initial problems,
scribe writer gave no further assistance in the method of reasoning to them.
Responses of the visually impaired children were noted in the separate answer
sheets. Fifteen minutes after the commencement of the test, investigator met
all the scribe writers one by one personally and perceived performance of the visually impaired children. The answer sheets were then evaluated by the investigator. The scoring key of Mental Ability Test in Raised Figures is given in Appendix - G

The number of correct answers to the given problem were counted, and given raw score of mental ability of the visually impaired children. It was considered for further reference regarding mental ability of visually impaired children.

4.7 Sample of the Study

There are several types of sampling procedures, each one particularly appropriate in a given set of circumstances. The type of sampling procedure selected should help to prevent bias and ensure more representativeness. According to the Survey Report (NIVH 1987, 1995) there are 109 integrated schools and 26 special schools for visually impaired in Tamilnadu. For the purpose of the study, the investigator selected 19 integrated schools and 2 special schools randomly from 109 integrated schools and 26 special schools respectively. All the visually impaired students selected for this study were braille readers and studied in the secondary grade (6th, 7th, 8th & 9th) of the respective schools and they forms the sample of this study. Thus a total of 159 visually impaired children in secondary grade (104 from integrated schools and 55 from special schools) were selected for this study by using cluster sampling technique. The name of the schools and number of students selected for this study are given in the following table.
### SCHOOL - WISE DISTRIBUTION OF SAMPLE FOR FINAL STUDY

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Name of the school</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>T B</td>
<td>L V</td>
</tr>
<tr>
<td>1</td>
<td>St Mary Hr Sec Madurai</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Union Christian Hr Sec, Madurai</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>American college Hr Sec, Madurai</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Al-Amin Hr Sec Madurai</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>CSI Girl's Hr Sec Madurai</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Lucy Pery Hr Sec Madurai</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>OCPM Girl's Hr Sec Madurai</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>TSU, Hr sec, Madurai</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>St Josep High school Caddalore</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Hans Rover Hr Sec Perambalur</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>St Andrew High School Manapparai</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>SCSMS Girl's School Sivakasi</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>St Paul's Hr Sec Myladudurai</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Mary Sargent Hr Sec Tirunelveli</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>School for the blind Nazareth</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>YMCA High school Madras</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>CSI High school Ikkad Madras</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>WTMM High school Walajabad</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>Govt Girl's school Walajabad</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>Little Flower School for the blind, Madras</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>CSI school for the blind Irenipuram</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>43</strong></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

**Note**  
T B - Totally Blind  
L V - Low - Vision
4.8 Data Collection

After deciding the tools and the sample, steps were taken for data collection. First, the schools selected for the data collection were contacted through letter and suitable timing for administrating test was fixed. Each school was visited twice for administration of the tests. On the first day, the personal data form and the Mental Ability Test (MAT-RF) were administered. On the second day the Convergent Thinking Test (CTT-BF) and Divergent Thinking Test (DTT-BF) were administrated. The same procedure was followed for all the schools selected for this study. The consolidated data is presented in Appendix - H.

4.9 Statistical Techniques used in the Study

The obtained data were analyzed by using appropriate statistical techniques. The investigator employed parametric statistics and correlational methods to process the data collected from the sample. Students "t" test and analysis of variance procedures were used to find out the difference between the groups as per the classification of the variables. The correlation coefficient was used to explore the relationship between the dependent variables with regard to the different categories of the sample. Similarly, Multiple Regression Analysis was used to predict which independent variable influences the dependent variables.

The analysis and interpretation of study results are presented in chapter - V.