Chapter IV

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Methodology reveals the various steps that are generally adopted by a researcher in studying the research problem along with the logic behind them. Researchers should also understand the assumptions underlying various techniques and the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems while others will not. Thus it is necessary for the researcher to design the methodology for the problem as the same may differ from problem to problem.

Research methodology not only talks about the research methods but also considers the logic behind the methods used in the context of the research study. It explains why only a particular method or technique is used and not others, so that research results are capable of being evaluated either by the researcher or by others. Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why particular technique of analyzing data has been used and a host of similar other questions are usually answered while explaining research methodology concerning a research problem or study (Kothari, 2005).

This chapter explains the methodology adopted in this study. It includes the design of the study, description of the sample, description of the
tools and materials used, the procedures adopted for data collection and statistical techniques employed.

4.1 METHODS ADOPTED FOR THE STUDY

Survey and experimental methods were used for collecting relevant data for the present study.

The present study focussed on children with Learning Disability. So the first step to carry out this research was to identify children with Learning Disability. Hence the survey method was adopted for identifying children with learning disability at upper primary level.

Experimental method was employed to test the effectiveness of the developed Multi Sensory Strategy (MSS) on achievement of children with Learning Disability at primary level.

4.1.1 Design of the Study

Research design stands for advanced planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view the objective of the research and the availability of the staff, time and money. The design of the research was prepared with great care as any error in it may upset the entire project. Research design, in fact, has a great bearing on the reliability of the results arrived at and as such constitutes the firm foundation of the entire edifice of the research work (Kothari, 2005).
Children with Learning Disability are a heterogeneous group exhibiting varied error patterns. Due to the inter–individual differences among these children and difficulty in equalising the group, the investigator found ‘pre-test post-test non equivalent group design’ to be most appropriate in the present experiment and thus adopted the same design.

The layout of the design is given below

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure4_1.png}
\caption{Design of the study}
\end{figure}

\subsection{Variables of the Study}

Variables are the conditions or characteristics that the experimenter manipulates, controls or observes in an experiment. In the present study,
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independent and dependent variables play a significant role. The dependent variable is a measure of behaviour of the subject and the independent variable is one that is believed to cause some change in the value of the dependent variable (Mc Burney & White, 2010). The variables in the present study are depicted in the figure 4.2.

![Diagram of variables](image)

*Figure 4.2 Major variables involved in the study*

4.1.3 Population and Sample

The population of the study consisted of upper primary school students of the age group 10-12 years, studying in standard VI. Stratified random sampling technique was used in the present study.

4.1.3.1 Sample for survey

A survey was conducted to identify the children with learning disability at the upper primary level for the present study. The sample for the survey consisted of 1500 students studying in standard VI in 24 schools of
Kottayam District selected using stratified random sampling technique. The sample was taken from all four educational districts in Kottayam, viz.; Kaduthuruthy, Kottayam, Kanjirappally and Pala. List of schools selected for the study and details of type of management, locale and the number of students based on gender are given in table 4.1

Table 4.1
Details of the School-wise Distribution of the Sample

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of School</th>
<th>Type of Management</th>
<th>Locale</th>
<th>No. of Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>1</td>
<td>Govt. H.S.S, Karapuzha</td>
<td>Govt.</td>
<td>Urban</td>
<td>28</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Govt. Girls H.S, Vaikom</td>
<td>Govt.</td>
<td>Urban</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>Govt. Model H.S.S, Changanassery</td>
<td>Govt.</td>
<td>Urban</td>
<td>32</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Govt. H.S.S, Kudamaloor</td>
<td>Govt.</td>
<td>Rural</td>
<td>43</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>Govt. H.S, Alampally</td>
<td>Govt.</td>
<td>Rural</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Mt. Carmel Girls H.S.S, Kanjikuzhy</td>
<td>Aided</td>
<td>Urban</td>
<td>0</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>M.D.Seminary H.S.S, Kottayam</td>
<td>Aided</td>
<td>Urban</td>
<td>54</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>St. Mary’s Girls H.S.S, Pala</td>
<td>Aided</td>
<td>Urban</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>9</td>
<td>St. Thomas H.S.S, Pala</td>
<td>Aided</td>
<td>Urban</td>
<td>61</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>St. Joseph’s Girls H.S, Kottayam</td>
<td>Aided</td>
<td>Urban</td>
<td>0</td>
<td>63</td>
</tr>
<tr>
<td>11</td>
<td>K.T.J.M H.S, Edamattom</td>
<td>Aided</td>
<td>Rural</td>
<td>31</td>
<td>19</td>
</tr>
</tbody>
</table>


A try out was carried out in students of three of the above listed schools and these students taken for try out were excluded in the main study. These schools had more divisions of standard VI and the exclusion of try out sample was ensured by selecting samples from different divisions.
4.1.3.2 Criteria for Identifying Learning Disability

The identification of children with Learning disability cannot be done with the help of a single tool, DTLD. Hence, to ensure the presence of Learning disability, a criterion was developed by reviewing related literature and expert opinions. One of the most popular criteria used for identifying Learning Disability was developed by Sharma (1991) and Mahajan (1994). After consultation with the experts and going through the related literature, the investigator adopted their inclusion – exclusion criteria to identify LD students studying in regular schools. The criteria used in the present study are given below:

**Inclusion Criteria**

a) Children scoring below 50% on the Diagnostic Test of Learning Disability (DTLD).

b) Children scoring above 25\textsuperscript{th} percentile on Raven’s Standard Progressive Matrices A,B,C,D and E.

c) Children scoring 50% and above on Achievement Motivation scale.

d) Children scoring 50% and above 50% on Learning Problem Checklist.

e) Children not having sensory handicaps.

f) Children without any emotional disturbances.

g) Children who are not been absent from school frequently.

h) Children of age group of 10-12 years.
3. Children scoring 50% and above on Achievement Motivation scale

Achievement Motivation Scale (Shah, 1986)


Learning Problem Checklist (Mathew, 2000)

5. Children not having sensory handicaps

Interview Schedule

6. Children without any emotional disturbances

Interview Schedule

7. Children who are not been absent from school frequently

School records

8. Children of age group 10-12.

School records

### 4.1.3.3 Sample for the experimental study

A total of 228 students were identified with Learning Disability and their parents were invited for an awareness seminar on Learning Disability and only parents of 79 students attended the same. Among them 70 parents were willing to send their children for the classes. Based on the academic achievement scores of these students collected from their respective schools, a rank list was prepared. These students were divided into two groups as per the even and odd number in the rank list and one group was considered as the experimental group and the other as the control group. Thus 35 students each were assigned to experimental group and control group. Few students with irregular attendance were excluded from these groups and the final sample of the experimental study consisted of 66 students, 33 each in the experimental group and the control group.
4.1.4 Tools used in the Study

The investigator used the following tools for the collection of data for the present study.

1) Diagnostic tests for identifying Learning Disability (DTLD) prepared and standardized by the investigator.

2) Raven’s Standard Progressive Matrices (RPM) to assess the general intelligence of the students (Raven, 1938).

3) Achievement Motivation Scale (Shah, 1986).

4) Learning Problem Checklist (Mathew, 2000).

5) Interview schedule prepared by the investigator.

6) Lesson transcripts based on Multi Sensory Strategy (MSS).

7) Lesson transcripts based on Conventional Activity Oriented Method (CAOM).

8) Academic Achievement Tests (AAT) in English, Malayalam and Mathematics, prepared and standardized by the investigator.
4.2 DESCRIPTION OF THE TOOLS

4.2.1 Construction of Diagnostic tests for identifying Learning Disability

Learning disability (LD) is a disorder that affects the skill of reading, writing and arithmetic (Rief & Heimburge, 1996). It is confused with learning difficulties most of the time. The main indication of learning disability is a discrepancy between a child’s measure of potential ability or IQ, and the child’s measured manifest ability or academic achievement (Howard, Dresser & Dunklee, 2009). To diagnose learning disability a diagnostic test is required. To construct a diagnostic test in basic skills such as reading, writing and arithmetic performance, the subject as a whole must be analyzed into sub skills and then groups of items devised to measure performance in these subskills. Unlike survey tests, which focus on total scores, diagnostic tests yield scores on each of several subskills (Aiken, 2000). Since there is no such test available for identifying students with learning disability at upper primary level, the investigator decided to construct and standardize a test to diagnose LD students at upper primary level.

The following steps were adopted in the construction of the test.

4.2.1.1 Planning the Test

The present study is focused on learning disability mainly in the areas of reading, writing and arithmetic. After going through different theses, studies and theoretical overview, the investigator found that for a student with learning disability, learning difficulty may not be of the same degree in all the
three areas, viz, reading, writing and arithmetic. So the investigator considered the three areas separately while planning the test. The Diagnostic Test for Learning Disability (DTLD) was developed to assess and identify children with learning disability.

Test Content

The identification of children with learning disability can be done only if the diagnostic test could assess the achievement in the content area which discriminate them from children without learning disability. According to Individuals with Disability Education Act (IDEA), regulations (2006) a child with specific learning disability does not achieve adequately for the child’s age in one or more of the areas viz, (i) oral expression, (ii) listening comprehension, (iii) written expression, (iv) basic reading skills, (v) reading fluency skills, (vi) reading comprehension, (vii) mathematics calculation, and (viii) mathematics problem solving, when provided with learning experiences and instruction appropriate for the child’s age (U.S. Department of Education, 2006, Identification of Specific Learning Disability). Most of the definitions of learning disability agree that the children with learning disability have difficulty in these areas. Hence the investigator decided to construct the diagnostic test by taking into consideration these eight areas. The content of the test was chosen from five of the eight components namely listening comprehension, written expression, reading comprehension, Mathematics calculation and Mathematics problem solving. Reading fluency skill was
determined by the interview with the teachers who taught the students. An
interview schedule was used for this purpose. The other two areas, oral
expression and basic reading skills, were assessed using Learning Problem
Checklist (Mathew, 2000).

**Preparation of the Blueprint**

The blueprint is a document that gives a complete picture of the test. It
shows the distribution of number of questions and scores assigned for
different objectives and the various aspects of the content. It helps the test
constructor to prepare appropriate questions to suit the purpose of test
construction. The objective of the DTLD is to identify the difficulties in
reading, writing and arithmetic. The content area selected was from the above
mentioned five areas namely listening comprehension, written expression,
reading comprehension, mathematical computation and mathematics problem
solving. Thus the blueprint was prepared showing the distribution of number
of questions and scores for these objectives, in all the five areas of the
content. The details of the blue print for the final draft of DTLD are given in
table 4.3.
### Methodology

#### Table 4.3

**Blueprint of the final form of Diagnostic Test of Learning Disability**

<table>
<thead>
<tr>
<th>No.</th>
<th>Content</th>
<th>Objectives</th>
<th>R</th>
<th>W</th>
<th>A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Listening Comprehension</td>
<td></td>
<td>10(1)</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Reading Comprehension</td>
<td></td>
<td>10(1)</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Written Expression</td>
<td></td>
<td>2(5)</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Mathematical Computation</td>
<td></td>
<td>10(1)</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Mathematics Problem Solving</td>
<td></td>
<td>10(1)</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

R = Reading; W = Writing; A = Arithmetic

Number outside the brackets indicates number of questions and the number within the brackets indicates scores assigned to each question.

**4.2.1.2 Construction of the Test Items**

The test items were prepared taking into account the minimum levels of learning required for a student at the upper primary level. A draft test consisting of 88 items with 100 marks were prepared. The items were intended to measure the listening comprehension, written expression, reading comprehension, mathematical computation and mathematical problem solving ability of students.

**Listening Comprehension**

Listening comprehension encompasses the multiple processes involved in understanding and making sense of spoken language. These include...
recognizing speech sounds, understanding the meaning of individual words, and/or understanding the syntax of sentences in which they are presented. Listening comprehension is more than just hearing what is said; rather, it is the ability to understand the meaning of the words s/he hears and to relate to them in some way. Good listening comprehension enables one to understand it, remember it and discuss it. In DTLD the listening comprehension exercises involves listening to a brief passage read aloud by the teacher and then responding in writing to some questions based on that passage. Students are asked to listen carefully and answer the questions. The passage will be read twice.

**Written Expression**

Writing is a form of communication that allows putting ones’ feelings and ideas on paper, organizing knowledge and beliefs into convincing arguments, and conveying meaning through well-constructed text. Writing involves transcription skills like handwriting, spelling, punctuation, capitalization, and grammar as well as composition skills like planning, content, organization, and revision. Sample item on written expression included in DTLD is given below.

"நூறு வரி அரச பிறசவைகளுக்கு 5 மகரை செய்யுங்க?"

**Reading Comprehension**

Reading comprehension requires not only good linguistic knowledge but also an ability to follow (and recall) sequences- as in stories and factual
texts (Kelly & Philips, 2014). In DTLD items to assess reading comprehension included reading a passage and writing response to the questions based on it.

**Mathematical Computation**

Mathematical computation includes calculating accurately and efficiently using numbers. Computing mentally is an important computational skill. To be proficient with computation, one should be able to do a good deal of computing in their heads without resorting to paper and pencil. But this does not necessarily mean that everyone uses the same procedure for all problems. A sample item to test the ability for computation is given below.

1. Count the number of stars on figure

![Stars]

**Mathematical Problem Solving**

Mathematical Problem Solving involves detecting steps or processes between the posing of the task and the answer. DTLD includes word problems to assess the ability of solving mathematical problems. Sample item on word problem included in DTLD is given below.

1) If 5\textsuperscript{th} of a month falls on Monday, what day will it be on 20\textsuperscript{th} of the month?
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Items with 20 marks for each area were included in the first draft of DTLD. The prepared items were scrutinised by experts and modifications were made according to their suggestions. The items were arranged according to their expected level of difficulty. The draft consisted of five sections. Necessary directions were given for each section. Space for entering the answers was provided in the question paper itself. The copy of the draft of the test is given as appendix III (A).

4.2.1.3 Procedure Adopted to standardise the Diagnostic Test.

The prepared test consisted of five sub tests measuring five different content areas, viz., listening comprehension, written expression, reading comprehension, mathematical computation and mathematical problem solving. It was decided to conduct the test and do item analysis separately for each section. The procedure adopted for standardization of the Diagnostic Test of Learning Disability is described below.

Tryout

The test was administered to a group representing the whole population. For that the investigator chose 110 students of standard VI from three schools, M D Seminary Higher Secondary School, St. Joseph’s Girls’ High School in Kottayam District and M G M Higher Secondary School, Pampady. These schools were also included in the final sample. As they had multiple divisions of standard VI, the data collected for the try out were not
taken as the sample for the final study. Table 4.4 gives the details of the schools and sample selected for try out.

Table 4.4
_Schools and Sample selected for Tryout_

<table>
<thead>
<tr>
<th>Name of Institution</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>M D Seminary Higher Secondary School, Kottayam</td>
<td>40</td>
</tr>
<tr>
<td>St. Joseph’s Girls’ High School, Kottayam</td>
<td>40</td>
</tr>
<tr>
<td>M G M Higher Secondary School, Pampady</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>110</strong></td>
</tr>
</tbody>
</table>

Two consecutive class periods were used to ensure that the students got enough time to complete the test. The average time used was noted to fix the time limit for the final test.

**Scoring**

Incomplete scoring sheets were rejected and thus the total number reduced to 100. The scoring was done with the scoring key prepared by the investigator. Single score was given for each correct answer and zero score for every incorrect answer. The essay questions for evaluating written expression were given 5 credits with one score each. The 5 credits were distributed equally for the following five aspects: correct use of grammar, spelling, vocabulary, expression of ideas and good handwriting.
4.2.1.4 Item Analysis

It is the process of establishing the suitability of an item for inclusion in the final test. The quality of dichotomous items 1-20 and 24-88 was ascertained by analyzing two important characteristics of the item, namely i) Difficulty Index and ii) Discriminating Power.

For the present study the procedures and formula suggested by Ebel and Frisbie (1991) were used to calculate the Difficulty index and Discriminating Power.

Index of Item Difficulty

\[ \text{Index of Item Difficulty} = \frac{U + L}{2N} \]

Index of Discriminating Power

\[ \text{Index of Discriminating Power} = \frac{U - L}{N} \]

Where \( U \) = Number of right responses in the upper group

\( L \) = Number of right responses in the lower group

\( N \) = Number of subjects in any of the group.

The item analysis of the descriptive items 21-23 were done using t-value calculation. In evaluating the responses of high and low groups (27 percent of subjects with the highest and lowest total scores) to the items, a ratio is found out using Edwards Allen Formula

\[ t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum(X_H - \bar{X}_H)^2 + \sum(X_L - \bar{X}_L)^2}{n(n-1)}}} \]
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Where \( \bar{X}_H \) = Mean score on a given statement for the high group

\( \bar{X}_L \) = Mean score on a given statement for the low group

\( X_H \) = Score of an individual on given statement in the high group

\( X_L \) = Score of an individual on given statement in the low group.

\( n \) = Number of subjects in the correction group

The value of ‘t’ is a measure of the extent to which a given item differentiates between the high and low groups (Edwards, 1957).

4.2.1.5 Selection of Items for the Final Test

The answer sheet of each section of the test was analyzed separately. Items to be in the final test were selected on the basis of difficulty index and discriminating power of the items. Items having difficulty index between 0.25 and 0.75 and discriminating power above 0.25 were selected for the final test. After the item analysis using t-value calculation, those item having t-value more than 1.75 were selected. On the basis of item analysis, the investigator selected 42 items in the final test. The details regarding the difficulty index and the discriminating power of each of the dichotomous items and t value of descriptive items are given as appendix III (B).

Preparation of the Final Test

Out of the 88 items included in the tryout, 42 items were selected for the final test based on the t value, difficulty index and the discriminating power of items. The selected items were arranged under each component. The time limit for answering the test was fixed to be 60 minutes, 1 minute
each for every item except in written expression and 5 minutes were allotted for answering the descriptive items in the component- written expression. The final test was printed in the booklet form with all necessary instructions. The sample of the final diagnostic test, its English version and scoring key are given as appendices III (C), III (D) & III (E).

4.2.1.6 Validity of the Test

The validity of a test depends upon the fidelity with which it measures, what it purports to measure (Garrett, 2004). More specifically, it is a judgement based on evidence about the appropriateness of inferences drawn from test scores. The principal method of establishing validity involves the appraisal of theoretically expected patterns of relationship among item scores or between test scores and other measures. As far as Diagnostic test for Learning Disability is concerned, face validity and content validity are important (Mathew, 2000).

Face Validity

Face validity is a judgement concerning how relevant the test items appear to be. Stated another way, if the test definitely appears to measure what it purports to measure “on the face of it”, then it could be said to be high in face validity. A test’s lack of face validity could contribute to a lack of confidence in the perceived effectiveness of the test. Sometimes even parents may object to having their children tested with instruments that lack ostensible validity (Cohen, Swerdlik & Kumthekar, 2014). In order to
establish the face validity of the final test, it was given to experts for scrutinizing each item of the test.

**Content Validity**

Content Validity refers to the degree to which the test actually measures, or is specifically related to, the traits for which it was designed. It shows how adequately the test samples the universe of knowledge and skills that a student is expected to master. Content validity is based up on careful examination of course text books, syllabi, objectives and judgment of subject matter specialists (Best & Kahn, 2004).

To ensure content validity of the test, from the eight areas suggested by IDEA regulations (2006), the following five were selected: Listening comprehension, Written expression, Reading comprehension, Mathematics calculation and Mathematics Reasoning. These areas strongly influence the academic achievement. Test items for 20 marks for each of the areas were given. It was further supplemented by interviewing selected scholars and experts in languages (English and Malayalam) and Mathematics. The items selected from all the areas were finalized on the basis of the suggestions of subject experts. The content validity of the test was thus ensured.

**4.2.1.7 Reliability**

A test is reliable to the extent that it measures whatever it is measuring consistently. A reliability coefficient is an index of reliability, a proportion that indicates the ratio between the true score variance on a test and the total
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In tests that have a high coefficient of reliability, errors of measurement have been reduced to a minimum, reliable tests are stable in whatever they measure and yield comparable scores upon repeated administration (Best & Kahn, 2004). In the present study, split half method was used for determining the reliability of the DTLD. In this method the score obtained for each individual was divided into two groups by pooling the odd number items and even number items. The reliability was determined by using the Spearman-Brown Prophecy formula the reliability of each test was calculated.

\[ r = \frac{2r_{HH}}{1 + r_{HH}} \]

where \( r \) = the reliability of the whole test

\( r_{HH} \) = the reliability of the half test.

The obtained score in each section of the test is given in table 4.5

Table 4.5

<table>
<thead>
<tr>
<th>Tests</th>
<th>Reliability Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening Comprehension</td>
<td>0.73</td>
</tr>
<tr>
<td>Written Expression</td>
<td>0.67</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>0.74</td>
</tr>
<tr>
<td>Mathematical Computation</td>
<td>0.78</td>
</tr>
<tr>
<td>Mathematical Reasoning</td>
<td>0.76</td>
</tr>
</tbody>
</table>
4.2.1.8 Objectivity

The objectivity of a test affects both the validity and reliability of it. In the diagnostic test prepared, inclusion of only objective type items ensured objectivity. To measure written expression two essay type questions were included. The objectivity of these items was ensured using marking scheme for evaluation.

4.2.1.9 Practicability

The practicability of the DTLD is maintained by means of the ease of administration, readiness of interpretation, economy in initial cost, probability of securing materials, time required for scoring and analyzing results. The prepared test was easy to administer as it was in the paper form, the students were asked to write the correct answer in the question paper itself. The duration of the test, type of items included and scoring key add to the practicability of the test.

4.2.2 Raven’s Standard Progressive Matrices Sets A, B, C, D and E

Since learning disability does not occur due to low intelligence, the students having average or above average intelligence should be selected. So the investigator decided to use a non-verbal test of intelligence. Experts agreed up on that a good intelligence group test should have at least the following qualities: 1) it should be valid and reliable, 2) it should be adjusted in difficulty to the age of subjects, 3) the test should be objective, 4) the test item should be graded properly, 5) the test should be adequately standardized
on a representative sample of population, 6) the test should be interesting to
the subjects, 7) the length of the test should be adequate and 8) the test
should possess simplicity of responses and scoring.

Considering the above mentioned factors, the investigator decided to
use Raven’s Standard Progressive Matrices Sets A, B, C, D and E (Raven,
1938) for measuring the intelligence of pupils in the present study. This is a
non-verbal group test administered to measure a person’s capacity to
apprehend meaningless figures presented for observation, see the relations
between them, conceive the nature of the figures, completing each system of
relations presented and so develop a systematic method of reasoning (Raven
1960). The test is intended for pupils above 10 years of age. The test consists
of 60 problems divided into 5 sets of 12 each. In each set the first problem is
the easiest one and the consecutive problems become gradually difficult in
each set. The order of the test provides the standard training in the method of
working. The 5 sets provide 5 opportunities for grasping the method and 5
progressive assessment of a person’s capacity for intellectual activity. The
tests are meant to evaluate the person’s ability to discern and utilize a logical
relationship presented by non-verbal materials. The problem requires in
varying degrees, analytical and integrating operations of the kind called
‘insight through visual activity’. The test is intended to cover the whole range
of intellectual development of a child.
Everyone irrespective of his/her age was given exactly the same series of problems in the same order and was asked to work at his/her own speed, without interruption from the beginning to the end of the test. A person’s total score provides an idea of his/her intellectual capacity, whatever be his/her nationality or education. The test has retest reliability varying with age from 0.83 to 0.93. This test is a popular measure used in Indian schools. A copy of the score card of Raven’s Standard Progressive Matrices is given as appendix X.

4.2.3 Learning Problem Checklist

The learning problem checklist constructed and standardized by Mathew (2000), was used in the present study. The two areas, oral expression, reading skills, essential to diagnose Learning disability was included in the checklist. The checklist consisted of twenty five items. These items were categorised under different areas of learning difficulties as given below.

1. Classroom behaviour

2. Academic Symptoms:- a) Reading b) Arithmetic c) Spelling d) Writing e) Speaking

3. Motor Response

The construct validity of the checklist was established by correlating it with a standardised tool and the value obtained was 0.84. The checklist also had a test retest reliability of 0.68 which reveals that it is highly reliable. A copy of the Learning Problem Checklist is given as appendix VII.
4.2.4 Achievement Motivation Scale

Since learning disability does not occur due to low motivation, the students having average or above average motivation should be selected. So the investigator decided to use a three point scale verbal test of motivation. Experts agreed up on that a good motivation group test should be valid, reliable, adjusted in difficulty to the age of subjects, objective, graded properly, adequately standardized on a representative sample of population, interesting to the subjects, adequate in length of the test and possess simplicity of responses and scoring.

So the investigator used Achievement Motivation Scale (Shah, 1996) to find out the general motivation of students.

The Achievement Motivation Scale (Shah, 1996) was constructed based on the forced-choice technique. The main components included in Achievement Motivation Scale were need for academic success, need for vocational achievement, need for social achievement and need for skill achievement.

The Achievement Motivation Scale is a three point scale. Each statement is followed by three alternative responses. The alternatives are arranged in order of one’s inclination towards achievement in the areas, namely academic, vocational, social context and skills. Weightage 1, 2 and 3 are respectively awarded for alternatives (a), (b) and (c) of any statement. The test – retest reliability coefficient varied between 0.77 and 0.87, which reveals
that it is highly reliable. The validity of the scale was ascertained in a three-fold fashion—content validity, item validity and congruent validity. The copy of the scale and its Malayalam version are given in the appendices VIII(A) and VIII(B).

4.2.5 Interview schedule prepared by the investigator.

An interview schedule was prepared by the investigator to obtain the information about the students from their teachers. The interview schedule is a guide an interviewer uses when conducting a structured interview. It contains a set of questions designed to be asked in order to obtain desired information. In the present study, interview schedule was used to obtain information about sensory handicaps, emotional disturbances and reading fluency skill of the students. The questions were therefore worded in this area. After preparing the items, it was discussed with primary school teachers and their suggestions were obtained. There were 12 items in the final form of the interview schedule. A sample of the interview schedule is given in the appendix IX.

4.2.6 Academic Achievement Tests (AAT)

Separate Achievement tests are constructed to measure the academic achievements of the students in English, Malayalam and Mathematics. Academic achievement refers to a student’s attainment of academic content areas. It gives objective feedback on students learning and understanding. These tests provide the most uniform, valid and reliable measures of students’ progress. The children
with Learning Disability especially those with Dyslexia, Dysgraphia, and Dyscalculia encounter maximum difficulty in the achievement of languages and Mathematics. Hence academic achievement in languages and Mathematics were to be measured to assess the effectiveness of the developed Multi Sensory Strategy. Since the sample selected has to master two main languages in the upper primary level namely, English and Malayalam, achievement tests in both the languages have to be constructed. The investigator thus prepared three achievement tests - in English, Malayalam and Mathematics, each having three sub tests. The major areas of both the languages and Mathematics were given due consideration while constructing the test. The major areas for languages chosen were reading comprehension, vocabulary and grammar. For Mathematics, areas chosen were multiples and factors, place value and word problems. These areas were decided after consultation with experts, teachers and parents. The Achievement test in English, Achievement test in Malayalam and Achievement test in Mathematics were prepared based on a blueprint.

4.2.6.1 Achievement Test in English

Achievement test in English was constructed to measure the performance of students in English, before and after the experiment. The test consisted of objective type questions. The test was designed to assess the students’ achievement in Reading Comprehension, Vocabulary and Grammar in English language. The test carried a maximum weightage of forty five marks with eighty minutes duration. The procedure of test development is discussed below.
4.2.6.1.1 Preparation of the Achievement Test in English

The investigator prepared the preliminary test with forty five objective type questions with fifteen each in the following three areas.

1. **Reading Comprehension** – Reading is challenging particularly when the student is suffering from Dyslexia. Comprehension is even more challenging. Reading comprehension is an area which emphasis understanding along with reading words. The failure of this act is one of the main features describing learning disability. For students with learning disability, reading comprehension is very complex area as they are unable to recognize the space between words/lines, reverse or omit words/letters while reading. The draft of Achievement test in English consisted of fifteen items to test the capacity of the student to comprehend what he/she reads. For this, 5 items each based on three paragraphs were included in the test.

2. **Vocabulary** – To understand and use any language, knowledge about its vocabulary is essential. One of the area which affect the reading and writing skill of students is vocabulary. The first draft of Achievement test in English consisted of fifteen items to test the vocabulary. A sample item is given below.

1. Worship
   
   a) sleep  b) prey  c) pray  d) beat
3. **Grammar** – Another main area for language acquisition is grammar. Grammar is a set of rules that deals with the syntax and word structure of a language. The test consisted of fifteen items on grammar. A sample item is given below.

Write plurals:

City - ----------

The investigator prepared the tests after consulting experts in the field of languages and teachers who are teaching English at school level.

4.2.6.1.2 **Preparation of the Blueprint.**

The blueprint is the three dimensional chart showing the coverage of content, objectives and form of questions. It is a document that gives a complete functional picture of the test. It shows the distribution of questions and scores for different curricular objectives, various aspects of the content and the forms of questions corresponding to each content item and the specific objective. Since the test was intended to assess the achievement in English, the content selected was Reading Comprehension, Vocabulary and Grammar. The form of question consisted of only objective type items. The content and the curricular objectives of the test is stated as follows

I. Reading Comprehension

a. Reads and comprehends a passage.

b. Reads and locates specific information.
Methodology

c. Guesses the meanings of unfamiliar words.

II. Vocabulary

a. Identifies the meaning of the words.

b. Uses appropriate letters to fill up the missing letters in a word.

c. Uses appropriate vocabulary for effective writing.

III. Grammar

a. Improves accuracy in the use of language by using suitable tenses.

b. Uses appropriate question tags in a sentence.

c. Uses correct form of plural and adverb

Preparation of the blueprint helped the investigator to have an objective based achievement test. More than the required numbers of items were included in the test under each objective and content sub-unit. This was done to get enough items for the final test.

4.2.6.1.3 Tryout

After reviewing each of the test items for the suitability of the test purpose, the items were arranged according to their expected level of difficulty. The easiest items were included in the beginning for motivating pupils. The draft was printed with necessary directions. A copy of the draft test is given as appendix IV (A).
Tryout of the test was administered to a group representing the whole population to find out the difficulties that may arise while administering the test, drawbacks of the test items and to determine the time limit. The students' answers were examined with a view to locate the changes needed in the test. The tryout was administered to a stratified sample of 108 students of VIth standard from Mount Carmel Higher Secondary School, Kottayam. Since the schools had multiple divisions in VIth standard, these students were not included in the final sample.

The responses were marked by the students in the space provided in the question paper itself. Eighty minutes was allotted to answer forty five items in the try out.

4.2.6.1.4 Scoring

After eliminating incomplete score sheets, the number were reduced to 100. For easiness of scoring, the investigator prepared a scoring key for the test. As per the scoring scheme of the test, one score was allotted for each correct answer and zero score for every incorrect answer.

4.2.6.1.5 Item Analysis

It is the process of establishing the suitability of an item for inclusion in the final test. The quality of each item was ascertained by analyzing two important characteristics of the item, namely i) Difficulty Index and ii) Discriminating Power.
For the present study the procedures and formula suggested by Ebel and Frisbie (2004) were used to calculate the Difficulty index and Discriminating Power.

4.2.6.1.6 Selection of Items for the Final Test

The answers of each section of the test were analyzed separately. Items to be in the final test were selected on the basis of difficulty index and discriminating power of the items. Twenty five items with difficulty index between 0.25 and 0.75 and discriminating power more than 0.25 were selected for the final test. Necessary information and other details were added before printing the final draft of the test. The details regarding the difficulty index and discriminating power of each item, final form of test and scoring key are given in the appendices IV (B), IV (C) and IV (D) respectively.

The blue print for the final test is given below.

Table 4.6

*Blue print of the final form of Achievement test in English*

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Content</th>
<th>Curricular Objectives</th>
<th>Form of Question (Objective)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reading comprehension</td>
<td>Ia, Ib, Ic</td>
<td>7(1)</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Vocabulary</td>
<td>IIa, IIb, IIc</td>
<td>10(1)</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Grammar</td>
<td>IIIa, IIIb, IIIc</td>
<td>8(1)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

Number outside the brackets indicates number of questions and the number within the brackets indicates scores assigned to each question.
Thus the final test consisted of 25 items and the time limit for the final test was fixed to forty minutes taking into consideration the average time limit in the try out. The same test was used as both pre test and post test in the study.

4.2.6.1.7 Reliability

In the present study, Kuder - Richardson formula 20 was used for determining the reliability of the test. The Kuder - Richardson Formula 20 checks the internal consistency of measurements with dichotomous choices. It is applicable when each question has either right or wrong answer. A correct answer scores 1 and an incorrect answer scores 0. The formula is

\[ \rho_{KR20} = \frac{k}{k-1} \left( 1 - \frac{\sum_{j=1}^{k} p_j q_j}{\sigma^2} \right) \]

(Hopkins, Stanley & Hopkins, 1990)

Where \( k \) = number of questions, \( p_j \) = number of people in the sample who answered question \( j \) correctly, \( q_j \) = number of people in the sample who didn’t answer question \( j \) correctly, \( \sigma^2 \) = variance of the total scores. Values range from 0 to 1. A high value indicates reliability; while too high a value (in excess of .90) indicates a homogeneous test. Using this formula the reliability of each component was calculated.
Methodology

Table 4.7

Reliability Coefficients of the Achievement Test in English

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Tests</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reading Comprehension</td>
<td>0.74</td>
</tr>
<tr>
<td>2</td>
<td>Vocabulary</td>
<td>0.78</td>
</tr>
<tr>
<td>3</td>
<td>Grammar</td>
<td>0.76</td>
</tr>
</tbody>
</table>

4.2.6.1.8 Validity of the Test

The process of gathering evidence is called validation. A test is said to be valid to the degree that it measures what it claims to measure (Best & Kahn, 2004).

- **Face Validity**

  A test is said to have face validity when it appears to measure whatever the author had in mind. Face validity is necessary when we must decide what items are suitable for children and which are acceptable to adults (Garrett, 2004). In order to establish the face validity of the final test, it was submitted to a panel of experts who certified it after scrutinizing the items of test.

- **Content Validity**

  The critical type of validity for achievement test is content validity, sometimes called content relevance (Hopkins, Stanley & Hopkins, 1990). Content validity is the extent to which the elements within a measurement procedure are relevant and representative of the construct that they will be used to measure (Haynes, Richard & Kubany, 1995). The content validity
addresses the match between test questions and the content or subject area that are intended to be assessed. Content validity is most often measured by relying on the knowledge of people who are familiar with the construct being measured. Experts in the content or subject area generally judge content validity.

To ensure the content validity of the test, the items were selected from different sources, viz., course text books and standard reference books. It was further supplemented by the interviewing selected English language experts. The items selected from all the areas were finalized on the basis of the suggestions of subject experts. The content validity of the test was thus ensured.

4.2.6.1.9 Objectivity

In the Achievement Test prepared for English, the objectivity was ensured by including objective type test items and the application of scoring key and marking scheme.

4.2.6.1.10 Practicability

The practicability of the Achievement Test for English is maintained by means of the ease of administration, readiness of interpretation, economy in initial cost, probability of securing materials, time required for scoring and analyzing results. The prepared test was easy to administer as it was in the paper form, the students were asked to write the correct answer in the
question paper itself. The duration of the test, type of items included and scoring key add to the practicability of the test.

4.2.6.2 Achievement Test in Malayalam

To measure the performance of students in Malayalam before and after the experiment, an Achievement test in Malayalam was constructed. The test consisted of objective type questions. The test was designed to assess the students’ achievement in Grahanam, Padaprayogam and Vyakaranaparam in Malayalam language. The draft test carried a maximum weightage of forty five marks with eighty minutes duration. The procedure of test development is discussed below.

4.2.6.2.1 Preparation of the Achievement Test in Malayalam

The investigator prepared the preliminary test with forty five objective type questions with fifteen each from the following three areas.

1. **Grahanam** – This term refers to comprehension. In this component the emphasis is given to reading comprehension. The test consisted of fifteen items on ‘grahanam’. For this, 5 items each based on three passages were included in the test.

2. **Padaprayogam** – This is the corresponding term for ‘vocabulary’ in Malayalam. The test consisted of fifteen items on ‘padaprayogam’. A sample item is given below.

   ശാബ്ദാഭാഷാ പ്രയുക്തി

   1. [Object]: ..............................................
2. **Vyakaranam** – This the Malayalam term for grammar. To test ‘vyakaranam’ fifteen items are included in the test. A sample item is given below.

Vyanjana 

1. काओतिर का उपयोग

The investigator prepared the tests after consulting experts in the field of language education and teachers who are teaching Malayalam at school level.

**4.2.6.2.2 Preparation of the Blueprint.**

The blue print for the Achievement test in Malayalam was designed giving due weightage to content, curricular objectives and form of question. The content and the curricular objectives of the test is stated as follows:

I. Grahanam

   a. Reads and comprehends a passage.
   
   b. Reads and locates specific information.
   
   c. Guesses the meanings of unfamiliar words.

II. Padaprayogam

   a. Uses appropriate vocabulary for effective writing.
   
   b. Identifies the meaning of the words.
c. Forms words using given letter. Uses appropriate synonyms and antonyms

III. Vyakaranaparam

a. Improves accuracy in the language by using noun and adverb.

b. Applies appropriate Sandhi/euphonic rules.

The form of question selected was objective type.

4.2.6.2.3 Tryout

The test items were constructed by ensuring the suitability of the test, purpose and consulting with the experts. The easiest items were included in the beginning for motivating pupils. The draft was printed with necessary directions. A copy of the draft test is given in the appendix V (A).

Tryout of the test was administered to a group representing the whole population to find out the difficulties that may arise while administering the test, drawbacks of the test items and to determine the time limit. The students' answers were examined with a view to locate the changes needed in the test. The tryout was administered to a stratified sample of 110 students of VI\textsuperscript{th} standard (same students were not included in the final sample) from Mount Carmel Higher Secondary School, Kottayam.

The responses were marked by the students in the space provided in the question paper itself. Eighty minutes was allotted to complete the draft test in the try out.
4.2.6.2.4 Scoring

After eliminating the incomplete scoring sheets, the total number was reduced to 100. For easiness of scoring, the investigator prepared a scoring key for the test. As per the scoring scheme of the test, one score was allotted for each correct answer and zero score for every incorrect answer.

4.2.6.2.5 Item Analysis

The quality of items was ascertained by analyzing the difficulty index and discriminating power of each item. The formula suggested by Ebel and Frisbie (2004) were used to calculate the Difficulty index and the Discriminating Power.

4.2.6.2.6 Selection of Items for the Final Test

The answers of each section of the test were analyzed separately. Items to be in the final test were selected on the basis of difficulty index and discriminating power of the items. Twenty five items with difficulty index between 0.25 and 0.75 and discriminating power more than 0.25 were selected for the final test. Thus 25 items were selected for the final test. Necessary information and other details were added before printing the final test. The details regarding the difficulty index and the discriminating power of each item, final form of test and scoring key are given as in appendices V(B), V (C) and V (D) respectively. The blueprint for the final Achievement test in Malayalam is given below.
Table 4.8

*Blue print of the final form of Achievement test in Malayalam*

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Content</th>
<th>Curricular Objectives</th>
<th>Form of Question (Objective)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grahanam</td>
<td>Ia, Ib, Ic</td>
<td>8(1)</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Padaprayogam</td>
<td>IIa, IIb, IIc, IIId</td>
<td>7(1)</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Vyakaranaparam</td>
<td>IIIa, IIIb,</td>
<td>10(1)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

Number outside the brackets indicates number of questions and the number within the brackets indicates scores assigned to each question.

Thus the final Achievement test in Malayalam consisted of 25 items and the time limit for the final test was fixed to forty minutes. The same test was used as both pre test and post test.

4.2.6.2.7 **Reliability of the test**

Kuder - Richardson formula 20 was used for determining the reliability of the test. Values range from 0 to 1. A high value indicates reliability; while too high a value (in excess of .90) indicates a homogeneous test. Using this formula the reliability of each component was calculated.
Table 4.9

Reliability Coefficients of the Achievement Test in Malayalam

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Tests</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grahanam</td>
<td>0.83</td>
</tr>
<tr>
<td>2</td>
<td>Pada prayogam</td>
<td>0.79</td>
</tr>
<tr>
<td>3</td>
<td>Vyakaranaparam</td>
<td>0.73</td>
</tr>
</tbody>
</table>

4.2.6.2.8 Validity of the Test

The process of gathering evidence is called validation. A test is said to be valid to the degree that it measures what it claims to measure (Best & Kahn, 2004). There are several types of validity, and different types of tests and uses of tests need different types of validity.

**Face Validity**

A test is said to have face validity when it appears to measure whatever the author had in mind. Face validity is necessary when we must decide what items are suitable for children and which are acceptable to adults (Garrett, 2004). In order to establish the face validity of the final test, it was submitted to a panel of experts who certified it after scrutinizing the each item of test.

**Content Validity**

The critical type of validity for achievement test is content validity, sometimes called content relevance (Hopkins, Stanley & Hopkins, 1990). Content validity is the extent to which the elements within a measurement procedure are relevant and representative of the construct that they will be
used to measure (Haynes, Richard & Kubany, 1995). That is content validity addresses the match between test questions and the content or subject area they are intended to assess. Content validity is most often measured by relying on the knowledge of people who are familiar with the construct being measured. Experts in the content or subject area generally judge content validity.

To ensure the content validity of the test the items were selected from different sources, viz., course text books and standard reference books. It was further supplemented by the interviewing selected Malayalam language experts. The items selected from all the areas were finalized on the basis of the suggestions of subject experts. The content validity of the test was thus ensured.

4.2.6.2.9 Objectivity

In the Achievement Test prepared for Malayalam, the objectivity was ensured by including objective type test items and the application of scoring key and marking scheme.

4.2.6.2.10 Practicability

The practicability of the Achievement Test for Malayalam is maintained by means of the ease of administration, readiness of interpretation, economy in initial cost, probability of securing materials, time required for scoring and analyzing results. The prepared test was easy to administer as it was in the paper form, the students were asked to write the correct answer in
the question paper itself. The duration of the test, type of items included and scoring key add to the practicability of the test.

4.2.6.3 Achievement Test in Mathematics

Achievement test in Mathematics was constructed to measure the performance of students in Mathematics before and after the experiment. The test consisted of objective type questions. The draft test was designed to assess the students’ achievement in Place value, Word problem and Multiples and Factors in Mathematics. The test carried a maximum weightage of forty five marks with eighty minutes duration. The procedure of test development is discussed below.

4.2.6.3.1 Preparation of the Achievement Test in Mathematics

The investigator prepared the preliminary test with forty five objective type questions with fifteen each in the following three areas.

1. Place value – It is the numerical value that a digit has by virtue of its position in a number. This is an area where the children with learning disability face great challenge. The test consisted of fifteen items to check the knowledge of place value. A sample item is given below.

Write the place value of number underlined.

267.................................

2. Word Problem – this area was selected by the investigator to check the student’s capacity to do word problems. Here, the ability to comprehend
the problem and to solve it is assessed. The test consisted of fifteen items on problem solving. A sample item is given below.

Reenu was born on January 19, 1988. How old will she be on April 19, 2009?

3. **Multiples and factors** - Factors are numbers used to multiply to get a total. A multiple is a number which can be divided by another number without a remainder. The test consisted of fifteen items to find multiples and factors. A sample item is given below.

Find the LCM of:

15,20,5…………………

The investigator prepared the tests after consulting experts in the field of Mathematics education and teachers who are teaching Mathematics at school level.

**4.2.6.3.2 Preparation of the Blueprint.**

The blue print for the Achievement test in Mathematics was designed giving due weightage to content, curricular objectives and form of question. The content and the curricular objectives of the test is stated as follows

I. **Place Value**

a. Comprehends number concept.

b. Recognises the place value of a number.
Methodology

c. Recognises the meaning of numbers with more digits.

II. Multiples and Factors

a. Comprehends computation.

b. Applies computational skill in finding multiples and factors.

III. Word Problem

a. Recognises the operations needed to solve word problems.

b. Applies operational skill in problem solving.

The form of question selected was objective type.

4.2.6.3.3 Tryout

After reviewing each of the test items for the suitability of the test purpose, the items were arranged according to their expected level of difficulty. The easiest items were included in the beginning for motivating pupils. The draft was printed with necessary directions. Tryout of the test was administered to a group representing the whole population to find out the difficulties that may arise while administering the test, drawbacks of the test items and to determine the time limit. The students' answers were examined with a view to locating the changes needed in the test. The tryout was administered to a stratified sample of 110 students (not included in final sample) of VI\textsuperscript{th} standard from Mount Carmel Higher Secondary School, Kottayam. The responses were marked by the students in the space provided in
the question paper itself. Eighty minutes was allotted to the students to complete the draft test. A copy of the draft test is given in the appendix VI (A).

4.2.6.3.4 Scoring

For easiness of scoring, the investigator prepared a scoring key for the test. As per the scoring scheme of the test, one score was allotted for each correct answer and zero score for every incorrect answer. Incomplete and manipulated scoring sheets were rejected and the sample became 100.

4.2.6.3.5 Item Analysis

It is the process of establishing the suitability of an item for inclusion in the final test. The quality of each item was ascertained by analyzing two important characteristics of the item, namely i) Difficulty Index and ii) Discriminating Power.

For the present study the procedures and formula suggested by Ebel and Frisbie (2004) were used to calculate the Difficulty index and Discriminating Power.

4.2.6.3.6 Selection of Items for the Final Test

The answers of each section of the test were analyzed separately. Items to be in the final test were selected on the basis of difficulty index and discriminating power of the items. Twenty items with difficulty index between 0.25 and 0.75 and discriminating power more than 0.25 were selected for the final test. Thus twenty five items were selected for the final test. Necessary information and other details were added before printing the
The final draft of the test. The details regarding the difficulty index and discriminating power of each item, final form of test, its English version and scoring key are given as in appendices VI (B), VI(C), VI (D) and VI (E) respectively.

The blueprint for the final the Achievement test in Mathematics is given below.

Table 4.10

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Content</th>
<th>Curricular Objectives</th>
<th>Form of Question (Objective)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Place Value</td>
<td>Ia, Ib, Ic</td>
<td>8(1)</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Multiples &amp; Factors</td>
<td>IIa, IIb</td>
<td>9(1)</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Word Problem</td>
<td>IIIa, IIIb</td>
<td>8(1)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>

Number outside the brackets indicates number of questions and the number within the brackets indicates scores assigned to each question.

The final Achievement test in Mathematics consisted of 25 items and the time limit was fixed to forty minutes.

4.2.6.3.7 Reliability

The Kuder - Richardson formula 20 was used for determining the reliability of the test. The Kuder - Richardson Formula 20 checks the internal consistency of measurements with dichotomous choices. It is equivalent to
performing the split half methodology on all combinations of questions and is applicable when each question is either right or wrong. Values range from 0 to 1. A high value indicates reliability; while too high a value (in excess of .90) indicates a homogeneous test. Using this formula the reliability of each component was calculated.

Table 4.11

Reliability Coefficients of the Achievement Test in Mathematics

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Tests</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiples &amp; Factors</td>
<td>0.69</td>
</tr>
<tr>
<td>2</td>
<td>Place Value</td>
<td>0.72</td>
</tr>
<tr>
<td>3</td>
<td>Problem Solving</td>
<td>0.74</td>
</tr>
</tbody>
</table>

4.2.6.3.8 Validity of the Test

The process of gathering evidence is called validation. A test is said to be valid to the degree that it measures what it claims to measure (Best & Kahn, 2004). There are several types of validity, and different types of tests and uses of tests need different types of validity.

Face Validity

A test is said to have face validity when it appears to measure whatever the author had in mind. Face validity is necessary when we must decide what items are suitable for children and which are acceptable to adults (Garrett, 2004). In order to establish the face validity of the final test, it was submitted to a panel of experts who certified it after scrutinizing each item of the test.
Content Validity

The critical type of validity for achievement test is content validity, sometimes called content relevance (Hopkins, Stanley & Hopkins, 1990). Content validity is the extent to which the elements within a measurement procedure are relevant and representative of the construct that they will be used to measure (Haynes, Richard & Kubany, 1995). The content validity addresses the match between test questions and the content or subject area that are intended to assess. Content validity is most often measured by relying on the knowledge of people who are familiar with the construct being measured. Experts in the content or subject area generally judge content validity.

To ensure the content validity of the test the items were selected from different sources, viz., course text books and standard reference books. It was further supplemented by the interviewing selected Mathematics scholars and experts. The items selected from all the areas were finalized on the basis of the suggestions of subject experts. The content validity of the test was thus ensured.

4.2.6.3.8 Objectivity

In the Achievement Test prepared in Mathematics, the objectivity was ensured by including objective type test items and the application of scoring key and marking scheme.
4.2.6.3.9 Practicability

The practicability of the Achievement Test in Mathematics is maintained by means of the ease of administration, readiness of interpretation, economy in initial cost, probability of securing materials, time required for scoring and analyzing results. The prepared test was easy to administer as it was in the paper form, the students were asked to write the correct answer in the question paper itself. The duration of the test, type of items included and scoring key add to the practicability of the test.

Thus the final Achievement test in Mathematics consisted of 25 items and the time limit for the final test was fixed to forty minutes. The same test was used as both pre test and post test.

4.2.7 Lesson transcripts based on Multi Sensory Strategy

A Multi Sensory Strategy (MSS) is an important instructional tool as no two children learn in exactly the same way. Multi Sensory Strategy (MSS) focus on presenting students with new information from their external environment- based on what they can see, hear, touch and interact with- to help them better understand and remember what they are learning, particularly in reading, writing and arithmetic.

Some children learn best by seeing, and some by touching. However, combinations of our senses are used in everyday learning. The four modalities children primarily use in school are the visual, auditory, tactile and kinesthetic. The visual modality allows children to learn through what they
This is the fastest way most children process information. The auditory modality provides information through hearing. Auditory processing is generally slower than visual processing. The tactile modality allows for learning through touching and writing. Children use their tactile sense when they use manipulative skills, and when they take notes. The kinesthetic modality encourages learning through using whole body (McIntosh & Peck, 2005). When more avenues are accessed in a lesson, the better is the chance that information will lock itself in to a child’s memory.

In the present study, Multi Sensory Strategy (MSS) was designed to improve the academic achievement of children with Learning Disability. The use of Multi Sensory Strategy (MSS) makes learning more permanent. Students with Learning Disability usually learn best when instruction incorporates some combination of visual, auditory, kinesthetic and tactile (VAKT) input as well as many opportunities to practice. The programme was developed based on the well established principles of sequence of development of reading, writing and arithmetic skills. The programme focused on the acquisition of prerequisite skills, reading comprehension, vocabulary, grammar, place value, multiples and factors and word problems. The main features of Multi Sensory Strategy (MSS) are given below.

**Main Features of the Multi Sensory Strategy (MSS)**

The lessons developed based on Multi Sensory Strategy (MSS) have the following main features:-
1. Multi-sensory strategy was adopted to teach Children with Learning Disability. In this approach children learn through the VAKT- Visual, Auditory, Kinesthetic and Tactile modalities simultaneously.

2. Each unit has a general objective and each lesson has a specific objective.

3. Activities in the lessons were arranged in a sequential order from simple to complex. Only after achieving the objective of the previous lesson, students would learn the next lesson.

4. Lessons were prepared requiring 60 minutes to cover a single concept.

5. The concept taught in the previous class was reviewed before going to the new lesson.

6. Multi-sensory approach as well as multi-tier approach was followed.

7. Each activity emphasized verbalization and visualization for both concept clarity and skill acquisition.

8. Worksheets and activity cards were given to the children to provide enough practice.

9. Learning activities were linked to the previous activities, whenever possible.

10. Two or more types of activities were used to introduce a concept
11. In order to develop their eye-hand co-ordination, the children were made to make handicrafts.

12. The learned concepts were revitalized through music and movement frequently.

13. Brain-Gym exercises were given to enhance their whole-brain learning which needed to be practiced every day.

14. Activities used for individual subject depended upon the ability of the particular child and they matched the learning style of the individual.

15. Sports and Games were also included in the programme as outdoor activities to cater to the needs for improving physical development of the children.

16. Guidance and counselling was given to the child and his/her parents as needed.

After learning each concept, the students’ learning and understanding was assessed through formative evaluation.

4.2.7.1 Design of the Multi Sensory Strategy (MSS)

The design and delivery of effective instruction requires more than formulating a lesson plan; it also requires a comprehensive understanding of goals, word learning characteristics, stages of word acquisition, and instructional approaches. The investigator designed the Multi Sensory Strategy (MSS) on the basis of theories and models of multi sensory teaching
discussed in chapter 2. Besides, research studies revealed the effectiveness of multisensory approach in teaching.

The term multisensory is often used to describe strategies that involve learners in activities that include the use of two or more sensory modalities simultaneously to take in or express information. Multisensory instruction is one important dimension of the practices and approaches useful with students who have problems with language learning, including reading and writing (Farrel & Sherman, 2011).

The investigator designed the Multi Sensory Strategy (MSS) based on mainly four models viz., Orton-Gillingham approach (1930), Repeated Reading Model (LaBerge & Samuels,1979), Collaborative Strategic Reading (Klingner & Vaughn, 1998), Multi sensory Approach (Kelly & Philips, 2014). The diagram depicting the Multi Sensory Strategy (MSS) designed for the present study is given below.
The Multi Sensory Strategy (MSS) was designed incorporating mainly six elements based on the above mentioned models. They are objectives, motivational act, pre requisite/revision, direct instruction, memory training, and review.

i) Objectives

Objectives are observable and measurable behavioural changes brought about in learners. They are the short term goals which lead to the long term goal. In the present study the teaching units were designed with a general...
objective followed by specific objectives. The lesson transcript was prepared on specific objective. These objectives ensure proper designing of learning activities and evaluation strategies for assessment.

**ii) Motivational Act**

As explained by Throndike in his law of readiness, learner should be ready for successful learning. Motivational act is included in the design to ensure that the curiosity and eagerness to learn is evoked in the learners. It helps the student to approach learning with a happy mind. Games can also be incorporated into lessons in order to reinforce learning in an enjoyable way so that ‘learning is fun.’ In the present study attention ‘e’ test, brain gym, craft making etc were also included in the motivational act.

Brain Gym activities are claimed to improve eye teaming (binocular vision), spatial and listening skills, hand–eye coordination, and whole-body flexibility. Doing this manipulates the brain, improves learning and recall of information. According to the P.E. Dennison (1989) and G.E. Dennison (1989), the right and left hemispheres must be coordinated. The front and back parts of the brain must also be coordinated. And the top and bottom parts of the brain must be coordinated, too. Exercises involving right and left hemispheres of the brain were practiced as brain gym.

Another activity used to increase the capacity of attention among students was ‘Attention e test’. In this activity students were given a cutting of
news paper and were asked to mark every ‘e’ letter in it. Students who spotted very few at the beginning showed drastic change by the end of the treatment.

Craft making was included to improve the eye hand coordination of the students. Activities like clay modelling, jewellery making etc were done as part of it.

iii) Pre-requisite/ Revision

A revision exercise is used to check on a learner’s understanding and consolidate their previous learning. Revision of previous learning helps the learner to thoroughly follow new teaching points. In case of the first lesson this session can be used to check the pre requisite. In the Multi Sensory Strategy (MSS) treatment, this was done by either asking questions or through small tests at the beginning of the class.

iv) Direct Instruction

Direct Instruction is a combination of small-group and face-to-face instruction using carefully articulated lessons in which cognitive skills are broken down into small units (Carnine, 2000). It includes explaining lesson content to students through multisensory strategy. In the present study direct instruction was based on a three-tiered RTI (Response to Intervention) model. In Tier I, the whole group is exposed to new teaching points through instruction involving different modalities viz., visual, auditory, kinesthetic and tactile (VAKT). The progress of students is assessed using worksheets. In Tier II those who do not show progress in tier I are included and these
students are divided into small groups. Then they are taught with more activities on the new teaching point and their progress is assessed using the same worksheets. In tier III, individual instruction is given. Those students who lack progress in tier II are recommended for tier III. Tier-III was specifically designed to address the needs of individual students. During the course of study if the students in lower tiers could achieve as those in higher tier, they were moved to higher tier.

![Pyramid of Response to Intervention](image)

*Figure 4.4 Pyramid of Response to Intervention*

v) **Capacity Building (memory training)**

The aim of this element is to increase the capacity for storing information in long-term memory. Memory problems are the most consistently reported area of difficulty in learners with dyslexia/learning disability. Learners with learning disability may have a normal memory span for visual information but remember fewer verbal items than expected for
their age (Kelly & Philips, 2014). Working memory skills can be developed in children with learning disability through multisensory strategies to facilitate the holding of information in memory. Here worksheets/exercise/puzzles are given to practice independently.

vi) Review

The purpose of review is to find out whether the learner has understood the new teaching points introduced in the lesson. At the end of every lesson a review is conducted for assuring the accomplishment of the objectives of the current lesson. Here the students were encouraged to demonstrate what they learned and what they remember. This is carried out with the help of worksheets, picture card, puzzles, games etc. Reviewing the objectives will also help the educator to set up the goals for the next lesson.

Teaching Points

The teaching points for the present study were decided based on school textbook and expert opinion. The teaching points were arranged in three subjects - English, Malayalam and Mathematics. They were sequenced under nine units, three each for each subject. A preliminary class was given at the beginning to assess their present level of understanding.

Preliminary Class

a) General Objective: To assess the level of understanding

b) Specific Objectives:
1. To recognize primary colours (red, blue, yellow) and secondary colours (green, orange, violet/purple)

2. To recognize basic figures (circle, rectangle, triangle, square)

3. To understand basic concepts (big-small, long-short, more-less, left-right, many-few, high-low, large-small)

4. To classify things according to their characteristics (Sorting, ascending and descending order)

5. To colour a picture precisely.

The outlines of the teaching units with respect to the subjects, English, Malayalam and Mathematics are given below.

**English**

Unit 1: Letters and Words

a) General Objective: To enable the children to recognise and understand alphabets and words in English

b) Specific Objectives:

1. To understand alphabets

2. To understand vowels

3. To read and write words

4. To recognise rhyming words

5. To read and write words with blends
6. To read and write words with diphthongs and blends

7. To identify use of suffixes and prefixes

8. To understand opposites

Unit 2: Grammar

a) General Objective: To enable the children to understand grammar

b) Specific Objectives:

9. To understand past tense

10. To understand present tense

11. To understand future tense

12. To understand nouns

13. To understand question words

14. To understand adverbs

15. To understand adjectives

16. To read and write sentences with three words

17. To read and write sentences with more than three words

Unit 3: Reading Comprehension

a) General Objective: To enable the children to acquire the skills of reading

b) Specific Objectives:

18. To recite an experience clearly in a sequence.
19. To read and retell a story that is read.

20. To write a story that is read and retold.

**Malayalam**

Unit 4: Letters and Words

a) General Objective: To enable the children to recognise and understand alphabets and words in Malayalam

b) Specific Objectives:

1. To read and write vowels

2. To read and write consonants

3. To understand vowel signs

4. To read and write words.

5. To read and write words with chillaksharam

6. To read and write words with conjunct consonants

7. To understand synonyms

8. To understand antonyms

Unit 5: Vyakaranam

a) General Objective: To enable the children to acquire the understanding of grammar in Malayalam
b) Specific Objectives:

9. To recognize and use noun

10. To recognize and use adjective

11. To recognize and use verb

12. To recognize and use adverb

13. To read sentences with three words

14. To write sentences with three words

15. To read sentences with more than three words

16. To write sentences with more than three words

Unit 6: Grahanam

a) General Objective: To enable the children to acquire the reading comprehension skill.

b) Specific Objectives:

17. To recite an experience clearly in a sequence.

18. To read a story

19. To retell a story that is read.

20. To write a story that is read and retold.
Mathematics

Unit 7: Number concept

a) General Objective: To enable the children to acquire the number concept.

b) Specific Objectives:

1. To identify digits and numbers
2. To understand the concept of zero
3. To understand odd and even numbers
4. To identify number sequence
5. To know the concept of greater than, less than and equal to.
6. To understand the place and the value of numbers in its position.
7. To understand the concept of whole numbers.
8. To understand the concept of fractional numbers.
9. To understand the concept of decimal numbers.
10. To count by 100s and 1000s.

Unit 8: Computation

a) General Objective: To enable the children to perform the four fundamental arithmetical operations using numbers – whole numbers, fractional numbers and decimal numbers
b) Specific Objective:

11. To understand the concept of addition.

12. To understand the concept of subtraction.

13. To understand the concept of multiplication.

14. To understand the concept of division.

15. To solve problems involving division.

16. To know the concept of LCM and HCF.

17. To understand the concept fractions (proper, improper, mixed).

18. To add two fractions.

Unit 9: Word Problems

a) General Objective: To enable the children to develop the necessary skills for doing word problems

b) Specific Objectives

19. To identify the required arithmetic operation for doing word problems.

20. To apply the concept of four fundamental operations in word problems

4.2.7.2 Preparation of Lesson Transcript Based on Multi Sensory Strategy

The experiment based on Multi Sensory Strategy (MSS) consisted of three broad units (areas) each in English, Malayalam and Mathematics. Each unit had several activity based lessons arranged in sequential order to fulfil
Methodology

the general objective of the unit. Lesson transcripts on Multi Sensory Strategy (MSS) were planned based on the specific objectives (teaching points) of each unit. Lesson transcripts were prepared and implemented with the guidance of a special education teacher who teaches children with special needs. Each lesson was designed to achieve a single specific objective. Such 60 lesson transcripts were prepared; 20 lessons each for English, Malayalam and Mathematics.

4.2.7.2.1 Sample Lesson format on English language based on the design of the Multi Sensory Strategy (MSS)

<table>
<thead>
<tr>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pupil acquire writing skill</td>
</tr>
<tr>
<td>Specific objective - To write three letter words</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motivational Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain gym exercise, Attention ‘e’ test</td>
</tr>
<tr>
<td>Practice total recall act which helps to build co-ordination.</td>
</tr>
<tr>
<td>Total Recall Act- Students are asked to do a physical act- ‘touch your head’. Then add another task.’ Touch the head and run to the window’. As they progress in the game add more commands, like clap your hands while running back, count, pick up a pen and draw a picture of a flower before running back etc, to make it complex.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-requisite/ Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say aloud three letter words through brainstorming</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I- Direct instruction given to whole group using Visual Auditory</td>
</tr>
</tbody>
</table>
**Kinesthetic Tactile (VAKT)**

Teacher shows the name card with a three letter word (eg: dig). Teacher says the name and students repeat the word. Asks to identify each letter. Students watch the teacher writing the word on board saying each letter. Use a mirror to say the word and see the shape of mouth while reading the word. Identify the letters in word. Practice forming the word using cuttings of alphabets. Practice writing the word. Repeats the activity with more cards with three letter words (eg; put, log, eat, far, man, one, out, him, old).

Progress check : Fill in the blanks

He .......... a spoon in her hand.
Rita sat on a fallen .......... by side of the river.
I hope she will not ........ too many of the delicious fruit for they will make her very ill.
Is the farm.......... from here?
Sunny was a wealthy ........
There was......beautiful flower in her garden.
Ramu said he is going......to play.
Nobody told.....about the party.
The .....lady stayed in the home.

**Tier II- Instruction to small groups based on the learning need**

Shows a picture card of a person digging a pit and identifies the act. Use a mirror to say the word and see the shape of mouth while saying the name of the object. Identify the letters in word. Practice forming the word using cuttings of alphabets. Practice writing the word. Repeats the activity with more cards with three letter words (eg; put, log, eat, far, man, one, out, him, old).

Progress check.
### Tier III – Instruction using VAKT to individual student

Shows a picture card of an object with three letter name and identifies the object. Shows the name card with the same three letter name and ask to identify each letter. Watch the video showing formation of the word. Looking into name card forms the word using cuttings of alphabets.

Progress check.

### Capacity Building

Practice writing each word on worksheet (corresponding to each picture given)

<table>
<thead>
<tr>
<th>Form the word using alphabet blocks and feel the letters.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Form the word using alphabet blocks and feel the letters.</th>
</tr>
</thead>
</table>

### Review

Fill in the blanks choosing the correct word from the bracket

- A …… is sitting on a chair. (man/map)
- Cow …… grass. (eat/out)
- The ….. lady was sick. (had/old)
- My school is…from my home. (put/far)

The sample of lesson transcripts based on MSS for English is given as I (A).
4.2.7.2.2 Sample lesson format on Malayalam language based on the design of the Multi Sensory Strategy (MSS)

<table>
<thead>
<tr>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>क्षेत्रः (रक्ष्य तत्त्वः एकमात्रलेखकताः)</td>
</tr>
<tr>
<td>Specific objective - क्षेत्रः २० असाधारणताः</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motivational Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain gym exercise, Attention ‘e’ test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-requisite/ Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>मार्गः 20 असाधारण रक्ष्य एकमात्रलेखकताः</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I- Direct instruction given to whole group using VAKT</td>
</tr>
</tbody>
</table>

| Progress Check- क्षेत्रः २० असाधारणताः |

244
Tier II- Instruction to small groups based on the learning need

Tier III - Instruction using VAKT to individual student.
The sample of lesson transcripts based on MSS for Malayalam is given as I(B).

4.2.7.2.3 Sample lesson format on Mathematics based on the design of the Multi Sensory Strategy (MSS)

Objective

The pupil acquire number concept

Specific objective - To understand the concept of zero.

Motivational Act

Brain gym exercise, Attention ‘e’ test

Write the numbers one to ten each on a paper cutting. Fold it so that the number written on it is not visible. Place it in a box and ask the students to pick one. Then the students have to gather a number of items equal to the
number in their paper cutting. The peers are then asked to identify the number by counting the items.

**Pre-requisite/ Revision**

Students are given building blocks with numbers pasted on it. They are asked to arrange it in ascending order.

**Direct Instruction**

**Tier I- Direct instruction given to whole group using VAKT**

Three boxes are placed on the table. One box is filled with four balls and another with six balls. The third one is kept empty. The students are asked to count the balls in the boxes. And write it on the box. When students struggle to write a number on the third box, the concept of zero is explained. The property of zero is reinforced with the help of music

**ZERO**

I am zero. I am zero.

Some say I’m nothing. I have no value.

I’m essential invaluable.

I’m the origin on the number line.

The positive numbers are to my right.

The negatives to my left.

I’m neither negative nor positive.

I’m zero. I’m zero.

Progress check - Point to
Methodology

a) The tray with zero eggs.

b) The ball with no dots.

c) The stalk with zero leaves.

d) Fill up the missing numbers in the number line.

-5  _  -3  -2  -1  0  1  _  3  4  5

**Tier II- Instruction to small groups based on the learning need**

A basket with eight sweets is placed on the table. A student is invited to sing the ‘zero’ song. As he/she sing, take the sweets out of the basket one by one. At the end of the song say “There are no sweets in the basket. There are zero sweets in the basket”. A set of pictures with objects is displayed. Count then aloud. Point out the pictures with zero objects and write ‘0’ on it. A chart showing number line is explained. Students are given a worksheet in which they have to fill the numbers in the number line.

Progress check.

**Tier III – Instruction using VAKT to individual student.**

Students are taken to a staircase. A game is organised in which the students
are asked to start at the top of the stairs. When called out ‘two’ the students must jump two steps down. If the teacher calls out ‘zero’ the students must stay where he/she is. Then take them back to the classroom. Ask them to jump five times, three times etc. When asked to jump zero times, they should do nothing.

**Progress check**

**Capacity Building**

With the help of the following pictures, retell the story.

<table>
<thead>
<tr>
<th>Circle the trees that have 0 apples.</th>
<th>Circle the Number - 0</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Tree Images" /></td>
<td><img src="image2.png" alt="Number Line" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>0</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

**Review**

Draw a plant with zero flowers

Fill up the number line

![Number Line](image3.png)

The sample lesson transcripts based on MSS for Mathematics and its English version are given as I (C) and I (D).
Lesson based on each specific objective under each unit was prepared and implemented. The unit ‘Letters and Words’ was included to attain the major components ‘Vocabulary (Padaprayogam)’ in both the languages, English and Malayalam. The component ‘Place value’ and ‘Multiples and factors’ were to be acquired through units ‘Number concept and Computation’.

4.2.8 Lesson Transcripts Based on Conventional Activity Oriented Method

Lesson transcripts based on the Conventional Activity Oriented Method (CAOM) were prepared for the same contents. In this method, the students were taught the objectives through teacher directed lectures, notes on board, and worksheets for drill and practice. Sixty lesson transcripts, twenty each for English, Malayalam and Mathematics were prepared. The lesson transcripts were prepared on the basis of general and specific objectives. During the class sufficient explanations were given regarding the topic of the lesson. The sample lesson transcripts on Conventional Activity Oriented Method (CAOM) for English, Malayalam and Mathematics and its English version are given in appendices II (A), II(B), II(C), and II(D).

4.3 PROCEDURE ADOPTED FOR DATA COLLECTION

The collection of data was done at three phases.

Phase I: Identification of children with learning disability.

Phase II: Awareness programme for parents.
Phase III: Testing effectiveness of the developed Multi Sensory Strategy.

PHASE I

4.3.1 Identification of children with learning disability Collection of Data for Survey

The investigator visited the schools selected and obtained prior consent from the concerned heads. The tests were conducted in each school as per a pre-fixed schedule. The investigator administered Diagnostic Test for Learning Disability (DTLD), Raven's Standard Progressive Matrices (RSPM), and Achievement Motivation Scale (AMS) the students in standard VI. Data regarding the students were collected through informal interaction with them and from their teachers using Learning Problem checklist and interview Schedule.

Duration of each school period was 40 minutes. Three such periods were needed to conduct all the three tests. Most the schools allowed various durations, the investigator had to visit the same school on many days. Since there was practical difficulty to score all the responses of all three tests and identify children with learning disability in a large group, all the three tests were administered to the whole group. The responses of children who satisfied the criteria assessed by DTLD only were scored for RSPM. Those who satisfied the criteria assessed by RSPM only were scored for the third test, AMS.
Criteria for Identification of Children with Learning Disability

Identification of children with Learning Disability was based on the criteria discussed in the beginning of the chapter. The various steps followed to identify the children with Learning Disability are as follows:

CRITERION 1

Children scoring below 50% on the Diagnostic Test of Learning Disability (DTLD): This criterion was met by administering the Diagnostic Test of Learning Disability (DTLD) individually to each child. Children whose score lay above the 50 percentage were eliminated from the study. And only 38.4 percentage of students scored below 50 percentages in DTLD. Thus out of 1500 sample from the 24 schools in Kottayam District, 924 got eliminated.

CRITERION 2

Children scoring above 25th percentile on Raven's Standard Progressive Matrices A, B, C, D and E: This criterion was met by administering the Raven’s Standard Progressive Matrices individually to each child. Children whose score lay above 25th percentile were retained for the study as they were having required level of intellectual functioning, i.e., average or above average. Children whose score lay at or below the 25th percentile were eliminated from the study as they had below average intellectual functioning, a possible factor for their poor performance in learning.
However a discrepancy score of +1 was used to include children who had scored one less than the required cut-off score to rule out any error due to cultural/social factors. The Raven’s Standard Progressive Matrices was given to the total sample but scoring was done for 576 only, i.e., the number after elimination according to criterion one. Out of the 576 students, 98 students were eliminated as per criterion two- who exhibited below average intellectual functioning.

**CRITERION 3**

**Children scoring 50% and above on Achievement Motivation scale:** This criterion was met by administering the Achievement Motivation Scale (Shah Beena, 1996). This was administered to the total sample but scoring was done for 478 only i.e., after elimination according to criterion two. From these, 25 students who scored below the cut off point in Achievement Motivation Scale were eliminated. Only those students who had adequate motivation were retained for further study.

**CRITERION 4**

**Children scoring below 50% on Learning Problem Checklist:** To ascertain whether the students possessed Learning Disability, a Learning Problem checklist was used by the investigator and was administered to the teachers of the 453 students, after elimination according to the criterion three. From these, 133 students who scored below 50% on learning problem checklist were eliminated.
CRITERION 5

Children not having sensory handicaps: This criterion was met by informal interaction with the child. Teacher’s opinion was also sought with regard to the child’s ability to hear, see and respond to classroom questions. This was done with the help of the Interview schedule. Out of the 320 students, 22 were eliminated based on this criterion.

CRITERION 6

Children without any apparent emotional disturbances: Details about the family background of 298 students (after eliminating as per criterion five) were collected. Teachers’ opinions regarding the behaviour of these students were taken using the interview schedule. These students were also observed and interacted informally. According to teachers opinion and informal observation, those children who showed symptoms of emotional and behavioural problems like maladjustment, withdrawal, over- anxiety, erratic behaviour and aggressiveness were eliminated. Thus out of 298 students, 24 students were eliminated.

CRITERION 7

Children who are not been absent from school frequently: Since absence in the previous class makes it very difficult for the child to get continuity in the new lesson. If the child misses classes frequently, that could be a possible reason for his/her poor performance. So such children were eliminated at this stage by referring to the daily attendance register and also
after taking the opinion of the class teacher. Thus out of 274 students, 19 students were eliminated according to this criterion.

**CRITERION 8**

**Children of age group 10-12 years:** Attributing the difficulty to learn arithmetic to their immaturity, and introduction of English as a subject only in Standard V children below ten years of age were eliminated. This was done by checking school records. By referring to the school records children who were below 10 years and more than 12 years were eliminated. Out of 255 students, 27 students were eliminated according to this criterion.

**Scoring**

Scoring was done as per the scheme provided with various tests. Thus a total of 1272 students were eliminated from the total sample and 228 students were identified with Learning Disability.

**PHASE II**

4.3.2 **Awareness Programme for Parents**

A combined effort by parents, teachers, professionals and society is required for helping children with learning disability. Parents play a crucial role in the rehabilitation processes of children with learning disability. Parents are best suited for solving learning disability problems since they have the greatest emotional and intellectual investment in their own children’s development, problems and future. They do not have to wait for someone else to take the initiative. Therefore, they can and must take responsibility for
getting service that their children need. Physicians, Psychologists and Educators depend on parents for feedback, cooperation and reinforcement.

Hence it is essential that the parents be aware of the disorder, Learning Disability and they should trust their children in their academics. For this, an awareness programme on ‘Learning Disability and Achievement’ was conducted for the parents at Mount Carmel College of Teacher Education for Women, Kottayam. The programme focussed on Learning disability, different types- Dyslexia, Dysgraphia, Dyscalculia and its impact on achievement. The parents of the 228 students identified with Learning disability were invited for the programme. Only 79 parents responded and attended the programme.

The parents were informed about the free classes arranged in the summer vacation for children with Learning disability as part of the research study. They were requested to send their children for the same. Parents of these students expressed their willingness to send their children for the summer classes.

PHASE III

4.3.3 Testing the effectiveness of the developed Multi Sensory Strategy

The present study was conducted to find out the effectiveness of Multi Sensory Strategy on academic achievement of children with Learning Disability at the primary level. Though parents of 79 students with learning disability attended the awareness programme, only 70 attended the summer classes. These students were grouped into two similar group based on their
previous achievement marks. One group was considered as the experimental group and the other as control group, each having 35 students. The experimental group was taught using lesson transcripts based on Multi Sensory Strategy and the control group was taught using lesson transcripts based on Conventional Activity Oriented Method. Since the experimentation could not be carried out in intact classroom situation, the classes were conducted during summer vacation. The experiment was carried out in Mount Carmel College of Teacher Education for Women, Kottayam for thirty working days during summer vacation. The Academic Achievement Tests on English, Malayalam and Mathematics were administered as pre-tests and post-tests to compare the effectiveness of the methods of teaching. The procedure adopted for the experiment is as follows:-

1. Administration of Pre-tests
2. Learning by Experimental group
3. Learning by Control group
4. Administration of Post tests

**Administration of Pre-tests**

The experiment was started with 70 students having Learning Disability at primary level. Since the sample consisted of students from different schools, the investigator approached the authorities of Mount Carmel College of Teacher Education for Women, Kottayam and sought their
permission to conduct the classes in their institution during summer vacation. Before beginning the experimentation, the Academic Achievement Tests on English, Malayalam and Mathematics were administered as the pre-tests for both the groups. The rules and procedure for the tests were strictly followed. The response sheets were collected back after the allotted time and were scored.

**Learning by Experimental group**

The present study focuses on the achievement of children with Learning Disability. After administering the pre-test to the experimental group, they were taught using Multi Sensory Strategy (MSS).

Before starting the treatment, students in experimental group were categorised into three tiers on the basis of their reading, writing and arithmetic skills. Hence the study followed a multi-tier approach, Response to Intervention (RTI). A teacher modifies instruction (intervention) to help a struggling child, and then checks the child’s progress regularly (called progress monitoring) to see if the intervention is working. If the intervention is working, the problem is solved. If the intervention is not working, then change the intervention and monitor progress. This process continues until the child improves. This approach does not rely on diagnosing the child, but focuses on whether the child has a “skill deficit” or a “performance deficit,” and provides help until the child gets better (Hale, 2008). For the
experimental group a preliminary class was conducted to ensure the attainment of basic concepts of learning.

During the treatment, the students who improved in their performance were moved to higher tier and those who lag behind were moved to lower tier. This helped the investigator to plan for each child in the classroom. Twenty lesson transcripts each for English, Malayalam and Mathematics were prepared based on Multi Sensory strategy and classes were taken with the help of a special educator. Every day the classes began with Brain-Gym exercises to enhance their whole-brain learning. Attention ‘e’ test was also administered every day to promote attention skill of the students. These activities also helped to enhance their interest to attend the class regularly.

**Learning by Control group**

After administering the pre-tests to the control group, they were taught using Conventional Activity Oriented Method (CAOM). This method includes learning through some hands-on activities. The purpose is to link learning to real life. Here students are active learners rather than passive recipients of information. Hence the lesson transcripts were planned with learner centred activities which could arouse students’ interest. Lesson transcripts for English, Malayalam and Mathematics were prepared based on CAOM and classes were taken with the help of a special educator. Students’ previous knowledge was tested before introducing new topic.
Experimental and control group were taught on the same day by allotting forenoon and afternoon sessions for each group. Each session lasted for two hours. The sessions were switched on alternate days to ensure both group same opportunity (nullify the fatigue factor).

**Administration of Post tests**

After the completion of the lessons, the investigator administered the same achievement tests to the experimental and control group as post-tests i.e., Achievement Test in English, Achievement Test in Malayalam and Achievement Test in Mathematics. Prior information on the dates on which the achievement tests will be administered, was given. The tests were administered to both the groups on the same day. Specified time was given to both groups and the response sheets (question paper with space provided to answer) were collected back.

**Scoring**

Only 66 response sheets were finally taken for scoring after eliminating incomplete response sheets and those students who were absent continuously. These 66 response sheets were scored using scoring key. The scores thus obtained were subjected to statistical analysis.

**4.4 STATISTICAL TECHNIQUES**

The pre test scores and the post test scores of the experimental and control groups were consolidated for statistical analysis. The important statistical measures pertaining to central tendency and dispersion of the pre
test and post test scores were calculated to study the nature of the scores. As the aim of the study was to test the effectiveness of the Multi Sensory Strategy (MSS), paired ‘t’ test was done using the pre test and post test scores. Since the experiment was conducted using intact, non equated groups, Analysis of Covariance (ANCOVA) was applied for analysing the final scores. The relationships between the achievements in the languages were calculated using Pearson’s Product moment correlation.