Methodology
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CHAPTER III
METHODOLOGY

3.1 INTRODUCTION
This chapter deals with the description of methodology followed by the investigator to study the 'Effectiveness of certain instructional strategies on the achievement of learning difficulty students with different learning styles'. The methodology used in the present study is discussed under the following heads namely, statement of the problem, objectives of the study, hypotheses of the study, identification technique of students with learning difficulties and their learning styles, reliability and validity of the tools used in the study and statistical treatment.

3.2 STATEMENT OF THE PROBLEM
To study the effectiveness of different instructional strategies to overcome the learning problems of the students with different learning styles. The investigator has taken up the research problem entitled 'EFFECTIVENESS OF CERTAIN INSTRUCTIONAL STRATEGIES ON THE ACHIEVEMENT OF LEARNING DIFFICULTY STUDENTS WITH DIFFERENT LEARNING STYLES'. This study attempts to compare the achievement performance among students in learning of Environmental science concepts through Conventional Teaching (CT) Computer Assisted Teaching Learning (CATL) and Experiential learning (EL) instructional strategies.
3.3 **OBJECTIVES OF THE STUDY**

1. To adopt tools and assess learning styles of students at the primary level.

2. To identify students with learning difficulties and assess learning styles of students at the primary level.

3. To develop certain Instructional Strategies [Computer Assisted Teaching Learning (CATL), Experiential Learning (EL) and Conventional Teaching (CT)] to teach Environmental science concepts to the students with learning difficulties.

4. To study the significance of different Instructional Strategies (CATL, EL and CT) on the post test achievement of students with learning difficulties especially with regard to their learning styles (Auditory, Visual and Kinesthetic).

5. To study the significance of different Instructional Strategies (CATL, EL and CT) on the retention ability of students with learning difficulties especially with regard to their learning styles. (Auditory, Visual and Kinesthetic).

6. To study the significance of the difference in the mental ability of the students with learning difficulties with regard to their learning styles (Auditory, Visual and Kinesthetic).
7. To study the significance of the relationship between mental ability and academic achievement (Post test scores) of the students with learning difficulties with different learning styles (Auditory, Visual and Kinesthetic).

3.4 HYPOTHESES OF THE STUDY

1. There will not be significant difference in the post test achievement of the students with learning difficulties with Auditory Learning Style learnt through different Instructional strategies [Conventional Teaching (CT), Computer Assisted Teaching Learning (CATL) and Experiential Learning (EL)].

2. There will not be significant difference in the post test achievement of the students with learning difficulties with Visual Learning Style learnt through different Instructional strategies [Computer Assisted Teaching Learning (CATL), Experiential Learning (EL) and Conventional Teaching (CT)].

3. There will not be significant difference in the post test achievement of the students with learning difficulties with Kinesthetic Learning Style learnt through different Instructional strategies [Experiential Learning (EL), Computer Assisted Teaching Learning (CATL) and Conventional Teaching (CT)].

4. There will not be significant difference in the retention test achievement of the students with learning difficulties with Auditory Learning Style learnt through different Instructional
strategies [Conventional Teaching (CT), Computer Assisted Teaching Learning (CATL) and Experiential Learning (EL)].

5. There will not be significant difference in the retention test achievement of the students with learning difficulties with Visual Learning Style learnt through different Instructional strategies [Computer Assisted Teaching Learning (CATL), Experiential Learning (EL) and Conventional Teaching (CT)].

6. There will not be significant difference in the retention test achievement of the students with learning difficulties with Kinesthetic Learning Style learnt through different Instructional strategies [Experiential Learning (EL), Computer Assisted Teaching Learning (CATL) and Conventional Teaching (CT)].

7. There will not be significant difference in the mental ability of the students with learning difficulties with regard to their different learning styles (Auditory, Visual and Kinesthetic).

8. There will not be significant relationship between mental ability and academic achievement (Post test scores) of the students with learning difficulties with Auditory Learning Style.

9. There will not be significant relationship between mental ability and academic achievement (Post test scores) of the students with learning difficulties with Visual Learning Style.
10. There will not be significant relationship between mental ability and academic achievement (Post test scores) of the students with learning difficulties with Kinesthetic Learning Style.

3.5 IDENTIFICATION OF THE STUDENTS WITH LEARNING DIFFICULTIES

The identification process of students with learning difficulties involved

a. Observation of academic achievement score
b. Intelligence assessment
c. Sensory screening
d. Observation of socio– economical status

A. Observation of Academic Achievement Score

Out of 370 matriculation schools of Coimbatore district, Tamilnadu, the investigator randomly selected 21 schools. A total of 3 terminal examinations achievement scores of V standard students were collected from the school record. Among them, students with below average academic achievement were selected for further screening related to learning difficulties. In addition, the investigator calculated mean and standard deviation values for the entire class in science examination. From the calculation, the students whose scores lie below minus one standard deviation (less than -1 S.D) from the group mean score were considered as students with learning difficulties (SLD) and chosen for further diagnosis.
B. Intelligence Assessment

British Psychologist Charles Spearman argued that all activities share a common factor called general intelligence; assessment requires the construction of general intelligence without becoming clouded by the specific abilities. Ideally such a test should be highly abstract and free of cultural biases. The most successful such test of intelligence is Raven’s Progressive Standard Matrices. Hence the Raven’s Progressive Standard Matrices were selected to assess the intelligence of pupils. The sample item is included in Appendix I.

The intelligence test may be administered individually (or) in a group to any age group and from any culture. The Raven’s Progressive Standard Matrices test consisted of 60 problems divided into five sets of 12. In each set, the first problem is easy as possible and self evident, the problems, which follow, become progressively more difficult. The five sets provide five opportunities for grasping the method and the total score obtained out of sixty has to be referred in norm table.

Pencil, record (answer sheets) and test books were distributed to the students and the students were asked to fill in the particulars about themselves on the record forms. A sample item is included in Appendix II (response sheet). They were asked not to open the books until every one was ready. The investigator opened a book for the group to see and explained the first problem and its answer. The explanation was given until doubts were cleared. The instruction given in the manual was strictly followed. Comfortable seating
arrangements were made while conducting the test. The pupils were asked to take their own time for completing the test items.

The scoring key and norm table for different age group given in the manual were referred to the classification of the student’s ability. The norms for Raven’s Progressive Matrices scales are given in five grades as follows.

**Grade:**

I  ‘Intellectually superior’
II ‘Definitely above average in intellectual capacity’
III ‘Intellectually Average’
IV ‘Definitely below Average in intellectual capacity’
V ‘Intellectually defective’

According to the norms given in the test manual, the students were classified. The students whose score was average (or) above average in mental ability were selected for further screening.

C. Sensory Screening

**Visual Acuity**

To assess visual acuity of students identified as SLD, the Snellen’s chart was used. The Snellen’s chart consisted of rows of letters.

In the Snellen’s chart the E’s are arranged in various position and the person’s task is to indicate what direction the ‘legs’ of the Es are facing. Each row corresponds to the distance at which person with
normal vision can discriminate the direction of E’s. Pupils are normally tested at the 20 feet distance. If they can distinguish the direction of the letters in the 20 feet row, they are said to have 20/20 central visual acuity for far distances. The specimen copy of Snellen’s chart in reduced size is given in the Appendix III.

**Hearing Ability**

To assess hearing ability of students, those who were selected as SLD are subjected to undergo logical testing. For assessing hearing ability automatic audiometer was used. The pure – tone test was conducted for both the ears and their hearing ability was ascertained. For this study, the students whose hearing ability was found at or below 20 db were considered as normal. The investigator was assisted by an ENT specialist in using the Audiometer to know the hearing ability of the students. The specimen copy of audiogram recording sheet is given in the Appendix IV.

For practical purpose the student whose intellectual capacity was average or above average and their academic achievement below average of the class achievement score was considered as SLD and considered for further diagnosis. In the subsequent diagnosis, such students were subjected to undergo sensory screening (visual acuity test & Hearing ability test). To understand their socio – economical status and cultural aspects, their background information was taken into account before confirming them as SLD.
While identifying the SLD in a class, mental ability score and their continuous academic achievement marks for three occasions and deviation of academic achievement from group mean score was analysed. For screening their sensory ability, appropriate apparatus and scientific procedure were followed. Further, the information regarding background variables and socio-cultural aspects were studied carefully for confirming a student as student with learning difficulties.

D. Observation of Socio Economical Status

In order to understand the variables of the sample, it was decided to make use of a personal data sheet. The personal data sheet includes information regarding socio-economical status, age, sex, parent's educational qualifications, family income and family size. The specimen copy of bio-data form is given in the Appendix V.

The information obtained through this data sheet was made use of for making certain data analysis, the following procedure was adopted to equate the three groups of CT, CATL and EL.

Age

The age of the three groups such as CT, CATL and EL were considered with the help of information gathered from data sheet.
Sex

The number of Boys and Girls selected for CT, CATL and EL groups of different learning styles were gathered from data sheet.

Parent’s Educational Qualification

The Parent’s educational qualifications of the three groups were matched with the help of information received from the data sheet. There were three categories of qualification as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Illiterate</td>
</tr>
<tr>
<td>B</td>
<td>School level</td>
</tr>
<tr>
<td>C</td>
<td>Above school level</td>
</tr>
</tbody>
</table>

Family Income

The Family income of three groups was matched with the help of information received from the data sheet. There were three categories of family income as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low income</td>
<td>Less than Rs. 10000</td>
</tr>
<tr>
<td>Middle income</td>
<td>More than Rs. 10000 and less than Rs 20000</td>
</tr>
<tr>
<td>High income</td>
<td>Above Rs. 20000</td>
</tr>
</tbody>
</table>
Family Size

The Family size of the three groups was matched with the help of information received from the data sheet. There were three categories of family size as follows.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small family</td>
<td>Upto 4 members</td>
</tr>
<tr>
<td>Medium family</td>
<td>5 to 6 members</td>
</tr>
<tr>
<td>Large family</td>
<td>Above 6 members</td>
</tr>
</tbody>
</table>

3.6 IDENTIFICATION OF LEARNING STYLES OF STUDENTS WITH LEARNING DIFFICULTIES

‘Learning Style is the way each person begins to concentrate on, absorb, process, and retain new and difficult information and skills’ (R.Dunn). Every human being has a Learning Style regardless of their I.Q., achievement level, or socio economical status and there are no good or bad learning styles.

Although styles can change overtime as a result of maturation and practices, strong preferences change only slightly over the years, and when students are taught in ways that complement their styles, a significant increase in their academic achievement, improved attitudes, motivation and better adjusted behavior are the result.
Identification

To identify the Auditory, Visual and Kinesthetic Learning styles of the students, the investigator developed a tool and used in this study.

The Auditory – Visual – Kinesthetic Learning styles model provides a very easy and quick reference inventory by which to assess people’s preferred learning styles, and the most importantly, to design learning methods and experiences that match pupil’s preferences.

The learning style inventory consisted of 30 questions totally; each category of Auditory, Visual and Kinesthetic Learning style consisted of 10 questions. The item of each category consisted of three alternatives and its scores are awarded 1, 2, 3 respectively based on the response given in the Table 3.1.

Table 3.1 Details of scores of Learning style Identification test

<table>
<thead>
<tr>
<th>Scores</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Never applies to me</td>
</tr>
<tr>
<td>2</td>
<td>Sometimes applies to me</td>
</tr>
<tr>
<td>3</td>
<td>Often applies to me</td>
</tr>
</tbody>
</table>

The learning style inventory was distributed to Students with learning difficulties (SLD). A sample item is included in Appendix VI (learning style inventory). The investigator explained the questions to the students. Comfortable seating arrangements were made while
conducting the test. The students were asked to take their own time for completing the test items.

**Scoring instructions**

Add the total number of responses for each learning style. The area with the highest number of responses is probably the primary mode of learning.

Some people have very strong preferences, even to the extent that they have little or no preference in one or two of the styles. Other pupils have more evenly balanced preferences, with no particularly strong style. The point is simply to try to understand as much as you can about yourself and your preferred learning style or styles.

### 3.7 EXPERIMENTAL DESIGN

The experimental design of Pre test, Post test and Retention test was used in the study to know the relative effectiveness of Instructional strategies. The dependent variables of this experiment are retention of information gained by SLD learnt through different Instructional strategies (CT, CATL and EL).

The total number of 3762 V standard students were selected from 21 Matriculation schools. Among 3762 students, 427 Students with learning difficulties were identified. Further, the identification of learning styles of all 427 SLD was done.
Among 427 SLD, 102 students were with Auditory learning style, 120 students were with Visual learning style, 162 students were with Kinesthetic learning style and 43 students were with mixed learning styles.

Out of 427 SLD with different learning styles, Mixed learning styles of 43 students were discarded. Only 285 SLD have been selected randomly from remaining 384 SLD, 94 students of Auditory learning style, 95 students of Visual learning style and 96 students of Kinesthetic learning style were considered for the study. The distribution of sample is given in the Table 3.2. The Table 3.3 is the self explanatory of the students with different learning styles considered for three different instructional groups.

**Table 3.2 Distribution of Sample of SLD with Different Learning Styles**

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>Groups</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CT</td>
<td>CATL</td>
</tr>
<tr>
<td>1. Auditory</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>2. Visual</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>3. Kinesthetic</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>285</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 3.3 Distribution of Boys and Girls of Different Learning Styles

<table>
<thead>
<tr>
<th>Learning styles</th>
<th>Instructional Strategies</th>
<th>No. of Boys</th>
<th>No. of Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory</td>
<td>CT</td>
<td>15</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>CATL</td>
<td>17</td>
<td>13</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>EL</td>
<td>15</td>
<td>16</td>
<td>31</td>
</tr>
<tr>
<td>Visual</td>
<td>CT</td>
<td>16</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>CATL</td>
<td>17</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>EL</td>
<td>14</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>CT</td>
<td>17</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>CATL</td>
<td>15</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>EL</td>
<td>17</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>285</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Pre Test was administered for all groups of students with Auditory, Visual and Kinesthetic Learning Styles to know the previous knowledge about the content, which was selected for the treatment.

Before finalizing the three groups, their Pre – Test scores were subjected to ‘F’ Test, to understand the level of significant difference among three groups. Therefore, the investigator equated these three groups on the basis of their Pre – test score and background variables. Details are given in the Tables 3.4, 3.5 and 3.6.
Table: 3.4 ‘F’ Values of Pre test scores of SLD with Auditory Learning Style – CT, CATL and EL groups

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Group</td>
<td>70.14</td>
<td>2</td>
<td>35.07</td>
<td>1.89</td>
<td>Ns</td>
</tr>
<tr>
<td>Within Group</td>
<td>1680.28</td>
<td>91</td>
<td>18.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1750.42</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ns - Not significant at 0.05 level

Table: 3.5 ‘F’ Values of Pre test scores of SLD with Visual Learning Style – CT, CATL and EL groups

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Group</td>
<td>10.18</td>
<td>2</td>
<td>5.09</td>
<td>0.25</td>
<td>Ns</td>
</tr>
<tr>
<td>Within Group</td>
<td>1858.72</td>
<td>92</td>
<td>20.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1868.90</td>
<td>94</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ns - Not significant at 0.05 level

Table: 3.6 ‘F’ Values of Pre test scores of SLD with Kinesthetic Learning Style – CT, CATL and EL groups

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Group</td>
<td>24.93</td>
<td>2</td>
<td>12.46</td>
<td>0.62</td>
<td>Ns</td>
</tr>
<tr>
<td>Within Group</td>
<td>1868.80</td>
<td>93</td>
<td>20.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1893.74</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ns - Not significant at 0.05 level
It is found from the table that the calculated ‘F’ value is 1.89, 0.25, and 0.62 with regard to the Auditory, Visual and Kinesthetic learning style respectively. The ‘F’ values of Pre test were not significant at 0.05 level.

This process proved that the three groups have been equally divided with same entry behaviour. An achievement test was conducted for all the three groups immediately after the treatment of CT, CATL and EL instructional strategies. This test was termed as Post Test. The same achievement test was administered after one month as the retention test.

3.8 VARIABLES

Independent Variables

Independent variables are those, which determine the effects in which the investigator is interested. There is one type of independent variable consisting of experimental variables, which are controlled by the investigator.

In this study, the experimental variables are the different types of instructional strategies such as CT, CATL, and EL. In addition to these variables the investigator intended to study the relationship between mental ability and academic achievement (post test scores) of students with different learning styles and to study the relationship between mental ability of SLD with their different learning styles.
**Dependent Variables**

Dependent variables were the retention of information gained by the SLD on the achievement test designed to measure the effectiveness of 3 different kinds of instructional strategies such as CT, CATL, and EL. Thus, the dependent variables are the measured changes in pupil’s performance attributable to the influence of the independent variables.

### 3.9 PROCEDURE ADOPTED FOR EQUATING THE GROUP

285 SLD were split into 3 groups based on their learning styles such as Auditory, Visual and Kinesthetic and these 3 groups of each learning style is further divided into 3 groups on the basis of instructional strategies (CT, CATL and EL) applied. The Pre test was administered for all groups of students with Auditory, Visual and Kinesthetic learning styles to know the previous knowledge about the content which was selected for treatment. The instructional strategies of CT, CATL and EL were administered for the equated groups to study the effectiveness of instructional strategies.

**Entry Behaviour and Pretest**

The investigator had identified the different learning styles of 285 SLD such as Auditory, Visual and Kinesthetic learning style. For identification of different learning styles, a tool was used, developed by the investigator. The learning style inventory consisted of 30 questions totally, each category of Auditory, visual and kinesthetic learning style consisted of 10 questions, three alternatives and its scores for each category were provided for identification.
The highest score of a particular learning style is considered as a preferred learning style of the students based on the scores obtained by all SLD. They were divided into 3 groups, such as students with Auditory learning style (SALS), students with Visual learning style (SVLS) and students with Kinesthetic learning style (SKLS).

Further, each learning style group was split into 3 groups based on the instructional strategies applied for treatment such as CT, CATL and EL. To know the previous knowledge about the content, the investigator prepared a pretest question paper consisted of 50 questions based on Environmental science concepts. The pre test was conducted for all groups and pretest scores were subjected to ‘F’ test for finalizing the groups.

The ‘F’ values of SALS, SVLS and SKLS were 1.89, 0.25 and 0.62 respectively. The ‘F’ values of the Pre test were not significant at 0.05 level.

3.10 SAMPLE FOR THE STUDY

Around 350 Matriculation schools of Coimbatore district, Tamilnadu, the investigator randomly selected 21 Matriculation schools, 3762 V standard students were studied in the 21 Matriculation schools. Among 3762 students, 427 students with learning difficulties (SLD) were identified. The entire 427 student’s learning styles were assessed with the help of appropriate tool. Out of 427 SLD, with different learning styles, mixed learning styles of 43
students were discarded only 285 SLD have been selected randomly from remaining 384 SLD.

The academic marks obtained by 3762 students of 21 schools were subjected to the statistical analysis. The mean and standard deviation were calculated for all the 3762 students in the academic achievement test were considered. Those scores lie below the one standard deviation from the group mean were considered as learning difficulty and further diagnosis was planned. Therefore systematic procedure with scientific method was followed in this study to confirm a student as a student with learning difficulty in learning of Environmental science concepts.

A total of 285 students were identified as SLD and they were selected for the study. To select these students, the investigator used purposive sampling technique these 285 students were distributed in V standards of 21 matriculation schools in Coimbatore District.

The sample consisted of 94 students with Auditory learning style (SALS), 95 students with Visual learning style (SVLS) and 96 students with Kinesthetic learning style (SKLS). These groups (SALS, SVLS and SKLS) further divided into 3 groups each based on the instructional strategies (CT, CATL and EL) applied.
1. The students with Auditory Learning Style (SALS) consisted of 94 students. They were further splitted into 3 groups based on their instructional strategies namely
   - CT group consisted of 33 students
   - CATL group consisted of 30 students
   - EL group consisted of 31 students

2. The students with Visual Learning Style (SVLS) consisted of 95 students. They were further splitted into 3 groups based on their instructional strategies namely
   - CT group consisted of 33 students
   - CATL group consisted of 32 students
   - EL group consisted of 30 students

3. The students with Kinesthetic Learning Style (SKLS) consisted of 96 students. They were further splitted into 3 groups based on their instructional strategies namely
   - CT group consisted of 32 students
   - CATL group consisted of 33 students
   - EL group consisted of 31 students
The following table 3.7 is the detail of the sample distribution for this study.

**Table 3.7 Distribution of Sample of SLD and their background variables**

<table>
<thead>
<tr>
<th>Back Ground Variables</th>
<th>CT</th>
<th>CATL</th>
<th>EL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>V</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>V</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>V</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Years to 9 years 6 months</td>
<td>18</td>
<td>17</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>9 Years 7 Months to 10 Years 2 Months</td>
<td>15</td>
<td>16</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Girls</td>
<td>19</td>
<td>17</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td><strong>Parent’s Educational Qualification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>School Level</td>
<td>14</td>
<td>17</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Above School level</td>
<td>10</td>
<td>9</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td><strong>Family Income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Than Rs. 12,000</td>
<td>21</td>
<td>18</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>12,000 to 24,000</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>24,001 and above</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Family Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 4 Members</td>
<td>20</td>
<td>16</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>5 to 6 Members</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Above 6 members</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
3.11 TOOLS AND INSTRUMENTS USED FOR THE STUDY

For collecting new, unknown data required for the study of any problem, one might use various devices. These devices (or) instruments employed in the collection of data are called tools. Each tool is particularly appropriate for certain sources of data, yielding information of the kind and in the form that would be most effectively used. A large number and variety of tests have been standardized and are available for a relatively small cost. The following tools and the instruments used for the present study are

1. Achievement test
2. Mental ability test (Raven’s Standard Progressive Matrices (RSPM))
3. Learning Style Identification Test (LSIT)
4. Socio – economical information form
5. Snellen’s Chart (For Visual acuity testing)
6. Audiometer (For Hearing ability testing)

1. Achievement Test

The investigator developed the achievement test. It consisted of 50 questions related with Environmental science concepts. The questions were selected from the area of 'Adaptation of aquatic animals and aquatic plants, Adaptation of animals in deserts, Adaptation of plants and animals in mountainous regions, Special adaptation of birds for aerial mode of life, Reproduction in plants – Dispersal and Germination of seeds'. Further, the investigator prepared the scoring key for the test.
The pattern of questions of objective type consisted of three answer choices. The investigator clearly explained the questions to make the students to mark the answers correctly. The students were instructed to study the questions and choices carefully. The perfect seating arrangements were made for conducting the achievement test.

Pilot Study and Item Analysis

To prepare the Pre-Test question paper, the investigator prepared a test paper termed as pilot study test paper. It consisted of 75 multiple choice questions based on Environmental science concepts. Each question carries one mark for the correct answer.

The questions were prepared and issued to 50 students of V standard. The duration of the test was 45 minutes. A specimen copy of pilot study question paper and the scoring key is enclosed in the Appendix VII and VIII respectively.

The pilot study question paper was distributed to 50 students and they were asked to answer the questions given in the Pilot study question paper. Their responses were collected and valuated.

Before giving a final shape to the Pre test question paper, the investigator consulted with senior science teachers from a school and a lecturer in science from the college of education. Incorporating their valuable suggestions and Item analysis index, 25 questions were discarded and only 50 questions were kept for the final study. Therefore, the final pre – test question paper consisted of 50 questions.
A specimen copy of achievement test question paper and the scoring key is enclosed in the Appendix IX and X.

2. **Mental Ability Test**

   British Psychologist Charles Spearman argued that all activities share a common factor called general intelligence; assessment requires the construction of general intelligence without becoming clouded by the specific abilities. Ideally such a test should be highly abstract and free of cultural biases. The most successful such test of intelligence is Raven’s Standard Progressive Matrices. Hence the Raven’s Standard Progressive Matrices were selected to assess the intelligence of pupils. The specimen copy of the RSPM is given in the Appendix I and II.

3. **Learning Style Identification Test**

   To identify the Auditory, Visual and Kinesthetic Learning styles of the students, the investigator developed a tool and used in this study. The Auditory – Visual – Kinesthetic Learning styles model provides a very easy and quick reference inventory by which to assess people’s preferred learning styles, and the most importantly, to design learning methods and experiences that match pupil’s preferences.

   The learning style inventory consisted of 30 questions totally, each category of Auditory, Visual and Kinesthetic Learning style consisted of 10 questions. The item of each category consisted of three alternatives and its scores are awarded 1, 2, 3 respectively based on the response. The specimen copy of the Learning style Identification test is given in the Appendix VI.
4. **Socio–economical information form**

   The following aspects were considered for Socio- economical status information of SLD.

   **Age** - The age of the three groups such as CT, CATL and EL were considered.

   **Sex** - The number of Boys and Girls selected for CT, CATL and EL groups of different learning styles were considered.

   **Parent’s Educational Qualification** - The Parent’s educational qualifications of the three groups were matched with the help of information received from the data sheet.

   **Family Income** - The Family income of three groups were matched with the help of information received from the data sheet.

   **Family Size** - The Family size of the three groups were matched with the help of information received from the data sheet. The specimen copy of the format used to collect socio – economical information is given in the Appendix V.

5. **Snellen’s chart (Visual screening)**

   To assess visual acuity of students identified as SLD, the Snellen’s chart was used. The Snellen’s chart consisted of rows of letters.
In the Snellen’s chart the E’s are arranged in various position and the person’s task is to indicate what direction the ‘legs’ of the Es are facing. Each row corresponds to the distance at which person with normal visual can discriminate the direction of E’s. Pupils are normally tested at the 20 feet distance. If they can distinguish the direction of the letters in the 20 feet row, they are said to have 20/20 central visual acuity for far distances. The specimen copy of Snellen’s chart in reduced size is given in the Appendix III. This is an effective device used in the clinic to assess the Visual acuity of the individuals.

6. Audiometer (Auditory Screening)

To assess hearing ability of students, those who were selected as SLD were subjected to undergo logical testing. For assessing hearing ability automatic audiometer was used. The pure – tone test was conducted for both the ears and their hearing ability was ascertained. For this study, the students whose hearing ability was found at or below 20 db were considered as normal hearing individuals. The investigator was assisted by an ENT specialist in using the Audiometer to know the hearing ability of the students. The specimen copy of audiogram recording sheet is given in the Appendix IV. It is a reliable and standard instrument used in the medical field.

3.12 RELIABILITY OF THE TOOLS USED IN THE STUDY

(i) Achievement Test

In this study, odd even method was used to establish the reliability of the achievement test for SLD. For this the investigator conducted an achievement test for 50 students by using achievement
test developed by him. The Test consisted of 50 questions, the scores of odd number items and even number items were separately calculated by using split half method of reliability formula.

For this, the Spearman Brown Formula was applied. The coefficient correlation obtained was 0.71. This value shows that the reliability value for achievement tests is highly significant.

(ii) Raven's Standard Progressive Matrices (RSPM)

Raven's Standard Progressive Matrices (RSPM) was developed by J.C. Raven. He established reliability for the RSPM, by using Test-Retest method. The scale has a retest reliability varying, with age from 0.83 to 0.93. It indicates that the reliability of the tool is highly significant.

(iii) Learning Styles Identification Test

The investigator developed Learning Style Identification Test for this study. To establish reliability of this test, the investigator used test–retest method and the reliability correlation coefficient was 0.69. It indicates that the reliability of test is highly significant.

3.13 VALIDITY OF THE TOOLS USED IN THE STUDY

(i) Achievement Test

The investigator used concurrent validity to validate the test paper. The test marks were correlated with the quarterly examination science marks of SLD and the correlation coefficient was 0.79. In this context, the investigator consulted senior science teachers and the
senior lecturers in the field of psychology and education, the valuable suggestions provided by them were incorporated. It was concluded that the tool selected for the study was a valid one. Hence the investigator applied both the Judgement Validity and the concurrent validity to select the tool for the study.

(ii) **Raven’s Standard Progressive Matrices (RSPM)**

Raven’s Standard Progressive Matrices (RSPM) was developed by J.C. Raven. He established Reliability varying, with age, from 0.83 to 0.93, by using Test - Retest method. It correlates 0.86 with the Terman- Merril scale. Therefore, the Reliability and validity of the tool is highly significant.

(iii) **Learning Styles Identification Test**

To establish Validity of the Learning Style Identification Test, the investigator used concurrent validity procedure. For this, the investigator collected Learning style information by using Learning style inventory developed by Jonelle A. Beatrice from 30 High school students of a matriculation school of Coimbatore. The same 30 High school students were again approached by the investigator and collected learning style information with the help of ‘Learning Style Identification Test’ developed for this study. The scores obtained by using these two different tests were subjected to the statistical analysis and correlation value was calculated. The correlation value was found as 0.66 and it is highly significant. Therefore, the validity of the Learning style identification test was established by using concurrent validity.
3.14 CHOICE OF MATERIAL FOR TEACHING

After equating the 3 groups of Auditory, Visual and Kinesthetic learning styles. The investigator selected appropriate instructional strategies to match the Learning styles of the students.

Conventional Teaching (CT) and Lesson Plan

A key to excellence in teaching is an acceptance and understanding of all students and their individual differences. The essence of best teaching is that the subjects matter has to be communicated to the students to make them understand the basic ideas.

Effective communications can be positive with words to some extent. Our traditional ‘Chalk and Talk’ method can motivate the learners with limitations. The conventional teaching is a one way process and child is not provided with much activities. This type of teaching is teacher oriented. But, if the conventional teaching is supported with active participation of students in the learning process the conventional teaching method also can become a dynamic one and it facilitates the two way process of learning.

Lesson Plan

A lesson plan for 45 minutes duration was prepared to teach Environmental science concepts. Totally, 3 lesson plans were prepared for teaching a particular lesson, which covered all the aspects in the content matter selected for treatment. The copy of the lesson plans are enclosed in the Appendix XI.
**Computer Assisted Teaching Learning (CATL)**

The investigator, senior science teachers from the school and a senior lecturer in science from the college of education were asked to preview a number of software related to different science concepts available in Encarta 2004 Encyclopedia. Keeping all information from several sources in mind, from the Encyclopedia, Environmental science concept was selected by the investigator and it was used to teach Environmental science concepts for this study. This software was shown to a panel which consisted of two senior science teachers and a senior lecturer in science from college of education. Their valuable suggestions were considered for selecting the software on Environmental science.

**Experiential Learning (EL)**

To develop Experiential Learning instructional materials, the investigator previewed a number of instructional aids and activities suggested in the books. The investigator selected some of the teaching material such as specimens of plants and animals to teach Environmental science concepts available in the market. Some of the practical activities were also planned by the investigator for experiential learning task. These were shown to a panel consisting of senior science teachers of the school and a senior lecturer in Science from the college of education. Their valuable suggestions were incorporated to improve the instructional materials and learning activities planned for this study.
3.15 PRE-TRY OUT OF INSTRUCTIONAL AIDS

A group of 29 students of V standard was taught with the help of Instructional aids prepared by the investigator and assigning experiential activities related to the content. The students were enquired by the investigator about the clarity of different teaching aids and experiential activities used for teaching the Environmental science concepts.

Almost all the students felt satisfied with the instructional Aids and experiential activities. The important materials viz., software and specimens of plants and animals used for SLD to teach Environmental science concepts were validated with the help of views collected from the students. The science teachers and senior lecturer of education validated the Instructional Aids. They provided some valuable suggestions about the Instructional Aids and they were incorporated.

3.16 DATA GATHERING PROCEDURE

The investigator involved himself in data collection. He visited 21 Matriculation schools and met all the heads of the institution and convinced them for conducting the study. He was permitted to train their teachers to teach Environmental science concepts by using different Instructional strategies (CT, CATL and EL). The investigator was allowed to give the training in the leisure time and good rapport was established with Head teachers and students of the schools before administering the tool for data collection.
The data were collected from V standard students of 21 schools. The 285 students with learning difficulties were identified and selected for the study. The whole group was divided into 3 groups based on their learning styles namely, Auditory learning style group consisted of 94 students, Visual learning style group consisted of 95 students, Kinesthetic learning style group consisted of 96 students. Each learning style group was further divided into three groups based on the Instructional strategies (CT, CATL and EL) applied. Details are given in the table 3.8.

Table 3.8 Distribution of SLD based on their learning styles and instructional Strategies

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>Groups</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CT</td>
<td>CATL</td>
</tr>
<tr>
<td>1. Auditory</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>2. Visual</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>3. Kinesthetic</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>285</strong></td>
<td></td>
</tr>
</tbody>
</table>

While classifying the nine groups, the Pre - test was considered and equated group design was followed. That means variables and previous knowledge about the content matter had been taken into consideration and 9 groups were equated accordingly.
Administration of the Pre-Test

The Pre Test question paper consisted of 50 questions. They were framed to assess the previous knowledge about the content matter, which had been selected for treatment. Each question carries one mark and total marks fifty. The duration of the test was 45 minutes. The Pre test question paper was issued to all 285 SLD with different learning styles. After collecting the Pretest answer sheet, a careful analysis was made and the marks obtained by SLD were subject to ‘F’ test.

The investigator found that the ‘F’ values of Student with Auditory, Visual and Kinesthetic learning style were 1.89, 0.25 and 0.62 respectively. It was not significant at 0.05 level. On the basis of analysis of 285 SLD were divided into 9 equated groups based on the learning styles and instructional strategies (CT, CATL and EL) applied.

In this study, the investigator trained the teachers of the 21 different matriculation schools which were selected for the study. They were trained to teach Environmental science concepts using instructional strategies, such as CT, CATL and EL.

Treatment of CT Group

The concerned science teachers of concerned schools selected for this study were asked to give the instruction about the Environmental science concepts to the SLD of CT group. The instructional aids and blackboard were used wherever it was felt
necessary. The lesson plan prepared earlier by the investigator was used to teach. The entire lesson was divided into three blocks (each block with 45 minutes duration).

The teacher motivated the students and taught the lesson clearly and cleared the questions and doubts raised by the students. Soon after the completion of each block, revision was done with the help of thought provoking questions.

The time taken for teaching of CT programme was 135 minutes (Each block 45 minutes duration and one block for one day). The seating arrangement were specially arranged, so that each student could listen the teaching clearly.

**Treatment of CATL Group**

The concerned science teacher who was trained by the investigator in CATL programme started to give instruction about the CATL programme to the CATL Group students. The teacher also gave a short introduction about the context matter to be learnt through CATL programme. The SLD students of CATL group were exposed to observe the software named Encarta 2004 on Environmental science concepts. The teacher gave a short introduction about the lesson. Blackboard, overhead projector, charts and slides were used wherever it was necessary.

All the students of this group were given equal opportunities to work with the computer and allowed to interact with the teacher.
The teacher cleared the questions and doubts raised by students before, after and during the instruction time, the entire lesson was divided into three blocks. Soon after completion of each block, revision was done with the help of thought provoking questions.

**Treatment of EL Group**

The science teacher concerned who was trained by the investigator in EL programme started to give instruction about the EL programme to the EL group students. The specially designed instructional aids and experiential activities were set ready. The teacher gave a short introduction about the content matter to be learnt through EL programme. Each child of this class provided suitable specimens for learning Environmental science concepts and made them to involve in the activity under the supervision of the science teacher concerned.

The students of this group were given full freedom to involve in the experiential activities and to work with other students in the classroom. The entire lesson was divided into three blocks, after completion of each block, activities were given to the students.

The following activities were given to the students in EL programme

- Observation of different animals in the surroundings. Find out where they live, how they move and what they eat. Also observe the different plants like a shrub, tree or a creeper.
• Observation of fish movement in the water and its special features for adaptation.

• Identification of different types of aquatic plants in a pond.

• Collection of information on the basis of pictures about the adaptation of desert and mountain animals and birds from the library and other sources.

• Observation of germination of seeds of pea and bean etc.

• Demonstration, through pictures about the importance of sunlight for the growth of the plants.

• Display of the difference in growth between the two plants growing in saw dust and loamy soil.

• Visit to nurseries and to find the difference in the growth of different plants there.

Administration of the Post-Test

Immediately after completing the CT, CATL and EL instructional strategies, the post test was administered. A special attention was given to supervise the test. The same Pre Test question paper was used as Post-test question paper. The students were asked to write the answers for the questions in the same question paper. The duration of the test was 45 minutes. After completing the test, all
the papers were collected and scored against the criteria laid. No penalty was made for the wrong answers; these scores were combined along with the information gathered through the personal data sheet.

**Administration of Retention Test**

The same SLD groups with different learning styles were again asked to answer the same test paper for retention test after one month period. The same question paper of which was used for Pre-Test and Post-Test was used.

The three treatments were scored objectively and the scores were transferred to the data sheets, all the scores were sorted to yield various tables for statistical analysis, the scores of Pre – test, Post – test and Retention – test of three groups are enclosed in Appendix XII.

Thus the research design had covered the phases namely

- Identification of SLD
- Identification of Learning styles of SLD (Auditory, Visual and Kinesthetic)
- Splitting the groups for treating with different instructional strategies (CT, CATL and EL)
- Preparation of software and instructional aids for different instructional strategies (CT, CATL and EL)
• Administrating the Pre test, Post test and Retention test and collecting the data.

3.17 STATISTICAL ANALYSIS OF DATA

In a research, the statistical treatment is an important aspect. The investigator employed the parametric statistics such as Differential analysis and Correlation method to process the data collected from the sample. The ‘F’ test and ‘Students t-test’ were used to find out the difference among CT, CATL and EL strategies as per the classification of the variables. The correlation coefficient procedure was employed to find out the relationship between mental ability and academic achievement of SLD with different learning styles. Therefore, the investigator employed the descriptive analysis, differential analysis and correlation methods to process the data collected from the sample.

A detailed analysis of data is presented in Chapter IV.