CHAPTER – III
DESIGN OF THE STUDY AND METHOD OF INVESTIGATION

3.1 INTRODUCTION

Any research programme should really add to the fund of knowledge and also provide possible best solutions to some of the vital issues in the society. In any given investigation, it is necessary to use the proper research methods. The decision about the methods to be employed depends upon the nature of the problem selected and the kind of data necessary for its solution.

Even though a lot of research had already been done in the use of ICT for the education of the children with special needs, it seems that certain issues in this area remain untouched. Most of the studies were related to the usage of ICT devices among people with disabilities, or the comparison of technologies used in these ICT devices. Few studies had been conducted regarding the use of ICT in education of the visually impaired. They also did not evaluate the effectiveness of ICT for the education of the children with visual impairment over traditional method, viz, Braille method. The ICT usage dimension covered in a majority of the research studies has been limited to one or two aspects. As a result, there is ample scope to go deep into finding the effectiveness of ICT in the education of the people with visual impairments. Using appropriate ICT tools and techniques, the visually disabled students could be properly educated, trained, and directed according to our desired expectations. This chapter presents details regarding the following:
1. Clearly defining the word “Information and Communication Technology”.

2. Selection of the Dependent Variables (DVs) and Categorical Variables (CVs).

3. Selection of a suitable research design.

4. Preparation of the content for the study with suitable delivery mechanism.

5. Construction of tools to measure the Achievement in Environmental Education.

6. Methods of establishing the reliability and validity of the tools constructed.

7. Designing suitable technological set up with necessary hardware and software requirements.

8. Selection of the sample for the study.

9. Conducting the Experiment and Data Collection.

### 3.2 IMPORTANCE OF ICT

ICT or Information and Communication Technology is important for the modern teaching-learning process. Its major purpose is to promote the efficiency of education by improving the quality of teaching, and educational research. It can be used for the following purposes:
For preservation of knowledge: Modern ICT gadgets provide tremendous capabilities to preserve knowledge/information for future uses including print medium. Information can be preserved in the form of audio-video programmes, computer software, videodisc, etc.

For effective instruction: Research in instructional media reveals that motivated students can learn a great deal from any of the media. ICT can improve the effectiveness of instruction.

For facilitating individual differences: ICT facilitates individual students to learn according to their requirements and pace of learning. Individual students interact with instructional materials and pursue their learning task by themselves at their own rate of learning, and are presented with opportunities to obtain information about their progress. Thus ICT individualizes instruction.

For providing equal educational opportunities: ICT is needed to provide equal educational opportunities to all. For instance, educational radio and television programmes are being broadcast all over the country catering to unlimited number of students. Thus every student gets equal quality of instruction, irrespective of his place of study (Rural/Semi Urban/ Urban), Sex, Caste and Creed.

For imparting quality education: Because of advance planning and involvement of experts available in the area of study, ICT mediated teaching imparts quality education to unlimited number of students.
For solving problems of education: ICT is needed to provide free primary education and to serve the educational needs of the increasing population of India.

For educational planning: ICT helps in overall social planning and is concerned with qualitative and quantitative design of a community’s entire education system. A systemic approach to teaching-learning includes specification of objectives, designing and structuring content, determining evaluation techniques, etc.

### 3.3 SELECTION OF THE VARIABLES

#### Dependent Variable

To estimate the effect of certain treatments, and to test the equality of their effects, measurements are taken in respect of the variable on each and every experimental unit. In this experiment, the Achievement on Environmental Science is taken as the dependent variable. The students’ achievement was tested prior to the experiment through a Pre-Test and after the treatment through a Post-Test. The difference between the Post-Test and the Pre-Test is the gain score. In this study, the following variables are taken as dependent variables.

1. Pre-Test Scores
2. Gain Scores
Independent Variables of the Study

Independent Variable (IV) is the one that is manipulated by a researcher to see its effects on an experimental unit. Mercer et al. in their study indicate that developmental history, socio-economic status, and teacher perception of skill deficits are strong predictors of later learning deficiency (Mercer et al. 1970). In one study, it was found that Braille readers may be better able to process oral information than large print readers (Brothers, 1971). Anater’s study found that haptic perception is sustained over time, suggesting that concrete hands-on experiences might enhance learning (Anater, 1980). LaGrow's (1981) examined the effects of a CCTV on the reading rates of six college-bound students who were visually impaired using a multiple-baseline (across subjects) single-subject research design to control for and demonstrate the effectiveness of the intervention. The study found that the reading rates of each participant increased after systematic instruction. The data that were reported (that is, the mean reading rates) made it possible to measure the effectiveness of the intervention.

Sprenger (1999) in his study found that students with vision impairment tend to use their memory to a greater extent than their sighted counterparts, practical experience is even more crucial to concrete their learning. Students learn by processing materials via different ‘lanes’ to the brain, and experimenting in a familiar and trusted environment allows blind students to use multiple lanes to the brain, including the physical senses, experiences, and emotional reinforcement, aiding comprehension. Two studies found that training in and use of low vision devices increases oral comprehension reading speed (oral and silent), and the amount of reading accomplished (Corn, Wall, & Bell, 2001; Smith & Erin, 2002)
Various studies conducted by the researchers around the world have indicated that the Achievement is correlated with Age group, Gender, Locality, Type of School, and Socio-Economic Status. A study conducted by the NCPEDP in 2004 disclosed shocking facts of discrimination against those with disabilities. It found that 20% of the schools polled were not aware of the Disability Act at all. The study found that the situation is better in certain religion and community backgrounds. As the present study is concerned with the visually impaired students, the researcher proposed that Religion and Community also may affect the achievement. So, Religion and Community were taken as independent variables. As the study involves ICT in educating the visually impaired students, ICT awareness was also taken as an independent variable. The visually impaired students are of two types: Born or natural blind and those who were born with eyesight and became blind in the middle. They are called born blind and middle blind in medical terminology. Among visually impaired students, there are so many varieties; Partially sighted, Low vision, Color blindness, Legally blind and Totally blind. All these categories are not similar. There is a lot of variations in their behaviour. The researcher had discussions with many experts in the field. Many of the experts opined that Nature of Blindness whether Born blind / Middle blind, and the Type of blindness whether Total blindness / Low vision are potential variables which may affect the study. So, the Nature of blindness and Type of blindness were also included. In total, the following Independent Variables had been taken for the study:

1. Age Group
2. Gender
3. Locality
4. Type of School
5. Socio-Economic Status
6. Religion
7. Community
8. Nature of Blindness
9. Type of Blindness
10. Technology Awareness

3.4 EXPERIMENTAL DESIGN

Design of experiments is a discipline that has very broad application across all the natural and social sciences and engineering. In general usage, experimental design is the design of any information-gathering exercise where variation is present, whether under the full control of the experimenter or not. However, in statistics, these terms are usually used for controlled experiments. Formal planned experimentation is often used in evaluating the effectiveness of a system or method. Computer experiments, opinion polls, statistical surveys (which are types of observational study), natural experiments and quasi-experiments are different types of experimentation. There are specific distinction between these types of experiments or studies. The experimenter is often interested in the effect of some process or intervention (the "treatment") on some objects (the "experimental units"), which may be people, parts of people, groups of people, plants, animals, etc. Experiments, if conducted correctly can enable a better understanding of the relationship between a causal hypothesis and a particular phenomenon of theoretical
or practical interest. One of the biggest challenges in research is deciding which research methodology to use. In research and evaluation, a true experimental design (also known as random experimental design) is the preferred method of research. It provides the highest degree of control over an experiment, enabling the researcher the ability to draw causal inferences with a high degree of confidence.

In the simplest type of experiment, two groups that are "equivalent" to each other are created. One group (the programme or treatment group) gets the programme and the other group (the comparison or control group) does not. In all other respects, the groups are treated the same. They have similar people, live in similar contexts, have similar backgrounds and so on. The programme would be isolated from all the other potential causes of the outcome if the evidence for the above propositions were given. If differences in outcomes between these two groups are observed, then the differences must be due to the only thing that differs between them; which one got the programme and the other didn't. Random sampling and the probabilistic equivalence improve the internal and external validity of the experiment.

A Pre-Test, Post-Test, Equivalent Control Group, Experimental Group, quasi-experimental design had been adopted in this study. The Control group and the Experimental group were made as equivalent as possible, by matching followed by random assignment to the Experimental and Control treatments. Both the samples were taken from the same population. It ensures that both groups are equivalent in many, if not possible all variables and makes certain that the two groups differ on the Post-test scores altogether independently of any other effects and thus the
difference will vary directly with the difference between the total population from which the selection was made. The experimental design is depicted in Table 3.1

Table 3.1

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Test</th>
<th>Treatment</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>O₁</td>
<td>X</td>
<td>O₂</td>
</tr>
<tr>
<td>Control</td>
<td>O₁</td>
<td>B</td>
<td>O₂</td>
</tr>
</tbody>
</table>

Note:
‘O₁’ means Pre-Test
‘O₂’ means Post-Test
‘X’ means experimental treatment to be given
‘T’ means traditional treatment to be given (Braille)

3.5 Preparation of the Content

3.5.1 Environmental Education and its Importance

Environmental studies deals with every factor that affects a living organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impact on its integrity.

1. Environmental education is a way of implementing the goals of environmental protection.

2. It is a process that equips human beings with awareness, knowledge, skills, attitudes and commitment to improve environment.
3. It is a process providing learning experiences to obtain knowledge, understanding, skills and awareness with desirable attitudinal changes about man's relationship with his natural and manmade surroundings which includes the relation of population, pollution, resources allocation, transportation technology and urban and rural planning to the total human environment.

4. It is a process of recognising value and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness of man, his culture and his biophysical surroundings.

3.5.2 Preparing Content for the Control Group

In these circumstances, the researcher had taken Environmental Science as the content to be taught to both the experimental and control groups. He prepared the Environmental Sciences content suitable for classes IX and X by combining the Tamil Nadu Text Book Society's text books for classes VI to X. The material available was slightly edited according to the needs of the study. The content includes the following topics: Ecosystem, Components of ecosystem, Types of Ecosystem, Ecosystem - Structure and Function, Energy Flow in Ecosystems, Food Chain and Food Web, Ecological Pyramids, Environmental Pollution, Land or Soil Pollution, Air Pollution, Water Pollution, Noise Pollution, Green House Effect, Global Warming, Acid Rain, Soil Erosion and Causes of Soil Erosion, Depletion of Ozone Layer, and Ozone Hole. The topics cover various concepts related to Biology, Environmental Science and Ecology. The content was sufficient for 30 days (25 hours) teaching. The content was then converted into Braille using Braille printers.
available at various Institutes for Visually Impaired. Sufficient number of copies were prepared to cover various experimental sites. Ultimate care was taken for maintaining the quality of the content. Frequent evaluation questionnaires were also prepared along with the content.

3.5.3 Preparing Content for JAWS Method

A screen reader is a software application that attempts to identify and interpret what is being displayed on the screen, or, more accurately, sent to standard output, whether a video monitor is present or not. This interpretation is then re-presented to the user with text-to-speech, sound icons, or a Braille output device. Screen readers are a form of assistive technology (AT) potentially useful to people who are blind, visually impaired, illiterate or learning disabled, often in combination with other AT, such as screen magnifiers. A person's choice of screen reader is dictated by many factors, including platform, cost, and the role of organizations like charities, schools, and employers. There are many screen reader software available with existing Operating Systems (OS). They are given below:

Microsoft Windows OS : Microsoft Narrator light-duty screen reader
Apple Inc. Mac OS X : VoiceOver, a feature-rich screen reader
Console-based Oralux Linux : Emacspeak, Yasr and Speakup
BlackBerry 10 devices : Built-in screen reader
Open source screen readers : Orca for Unix-like systems & Non Visual for Windows

76
**Job Access with Speech (JAWS)**

JAWS (Job Access With Speech) is a computer screen reader program for Microsoft Windows that allows blind and visually impaired users to read the screen either with a text-to-speech output or by a Refreshable Braille display. JAWS is developed by the Blind and Low Vision Group of Freedom Scientific, St. Petersburg, Florida, USA and available for cost. JAWS being the pioneer among screen reader software available are more popular among the visually impaired students. JAWS works for English with an Eloquence Text to Text Speech (TTS) Synthesizer and TTS with Indian English ascent is also provided these days. And, it provides magnification software Magic for Low vision students.

With a refreshable Braille display, JAWS can also provide Braille output in addition to, or instead of, speech. The following array of versatile features and customizable options lets the users to tailor JAWS for their individual needs and preferences:

- Works with almost every Windows Application and for browsing Internet content in English
- Talking Installation - fast and easy
- Two multi-lingual speech synthesizers - Eloquence™ and RealSpeak™ Solo Direct with great natural-sounding speech
- DAISY-formatted basic training in text and audio
- Fully compatible with MAGic screen magnification software; and
The key features of JAWS are:

1. Dual cursor design, eliminating the need for Review Mode.

2. Built-in Auto-speak Macro keys that make decisions and read the screen automatically.

3. Both audible and visible pop-up menu system.

4. Logically designed Speech pad allowing single-handed operation.

5. Windows for selective screen reading.
6. Screen enhancements which recognize monochrome or color automatically.

7. Numerous voice configurations.

8. Special Help Mode which makes learning the keyboard quick and easy. It is a process that equips human beings with awareness, knowledge, skills, attitudes and commitment to improve environment.

**Figure - 3.2**

*Functions of JAWS Screen Reader Program*

The content was divided into 30 equal parts and converted into Word documents. Each individual module is called an episode. So, in total, there were 30 episodes. They were fed into the computers installed with JAWS software. The software was able to convert the text into voice which was easy for the visually impaired students to understand easily. The JAWS software was very suitable for the present study. It provides all the features and facilities necessary for visually
impaired students to learn from text to speech. Thus the content for the experimental study was prepared. The researcher set up the necessary hardware and software necessary for running the course at the concerned schools. He tested all the hardware and software well in advance. All the participants in the experimental group were provided with the computer systems pre-installed with JAWS software. The students were well instructed to operate the necessary hardware and software systems, so that they may participate effectively in this study.

3.5.6 Try-Out of the Programmes

After selecting and uploading the programmes, the investigator attempted for the individual try-out on the representative students for whom the programmes were prepared. There are many studies, which indicate that the students initially found it difficult to understand the technological features, navigation, audio-video controls, and other feedback mechanisms embedded in technology enabled courses. There may be some language problems also. JAWS software generally come with different styles and accents of English. Then also, all the accents are basically suitable to native English speaking people. Unless the Indian students train in listening to them carefully, it is difficult to understand them. Even within the same language also, there are many dialects. To avoid these problems, the investigator selected some participants from both genders, different economic strata, age groups, localities, type of blindness, nature of blindness and technology experience. He arranged a trial class to them using JAWS. This try-out gave the investigator an opportunity to study the reaction of the learners immediately after the completion of the exposure. On the basis of the feedback received from the students, and experts, some corrections were
made in the programmes. The difficulties experienced by the participants were either removed or made easy.

3.6 DEVELOPING THE INSTRUMENTS FOR THE EXPERIMENT

This topic deals with the instruments used to collect data and the methods used to find out its reliability, validity, discrimination index, and difficulty index. These measures strengthen the experiment. The primary methodological tool for the present study is:

1. Achievement test in Environmental Science.

The development and validation of the tool is described here.

Entry and Exit Behaviour of the participants

For the present study, the investigator constructed a Pre-Test to assess the entry behaviour and a Post-Test to assess the terminal behaviour. The entry behaviour is the previous knowledge of the content, which is already possessed by the students prior to the experiment. The terminal behaviour refers to the knowledge of the content after the experiment. Even though it is very difficult to predict the end result of the experiment, the investigator assumed the following terminal behaviour:

At the end of this programme,

1. The participants’ achievement in Environmental Science will increase due to different teaching methods, and
2. The students might have got some positive attitudes towards ICT in education.

Achievement test in Environmental Science

Measuring knowledge is important. There are many Indian and foreign studies, which suggest that due to Educational Technology, there is significant gain in the knowledge. [McLuhan (1969), Kumar (1978), Selvam (1981), Samant (1983), Jaiswal (1988), Behera (1991), etc.]. There are some studies, which found there were no significant gains. [Kumari and Ali (1991), Martin and Rainey (1993), Thomas Russel (1994)].

The investigator consulted Environmental Science teachers working in Teacher Education Institutions to identify the concepts familiar to the students. On the basis of their recommendations, the pre-test and post-test in Environmental Science were constructed. The contents of the tests are given in the separate Supplement. The questions mostly were intended to test different skills of the students, i.e., knowledge, understanding, application, etc.

The questions were of choose the correct answer type. In each test, there were 25 multiple choice items. Each question was provided with 4 answers. The student has to select the correct response. Each correct response was given a score of ‘1’ and there was no mark for a wrong response. There was no negative scoring. The sum of scores obtained in all the items was considered as the total score and utilized for further analysis. The minimum score was 0 and the maximum possible score was 25. Two similar achievement test questionnaires, one for pre-test and one for post-test were prepared and used in the experiment. All these tests, pre-test and post-test
question papers were similar in content, typology, scoring, toughness and discrimination power. All these question papers were pilot tested, with 50 students and the reliability, validity, difficulty index, and discrimination index were found. Subject experts were consulted to validate the questions. Items which were ambiguous, tough or wrong were modified or replaced with correct ones. The question papers were shown to language experts to correct language and syntax errors and the final draft of the question papers were prepared. The reliability of the question was estimated by Cronbach alpha. The difficulty index and discriminating power were estimated by applying suitable formulae. Their values are given in Table 3.2. The investigator consulted some college professors who were teaching the subjects to identify the concepts which are familiar to the students on the basis of which the final drafts were made. The specimen copy of the Pre-test, Post-test, Retention test papers and their scoring keys are given in Appendices.

**Scoring Procedure**

The Pre-Test and Post-Test consists of 25 items. Each question was of choose the correct answer type. Each question was provided with four probable responses, out of which one was the correct answer. Each correct response was given 1 mark and no negative mark was given to the wrong answers. The sum of all the marks for individual correct responses was the total score. The maximum possible score is 25. The sum of scores of all items for each participant was calculated. This score has been used for further analysis.

**Pilot Study**

A pilot study was conducted to determine the suitability of various test items, to find out whether all the students understand the test items, and to select the best
items with proper discrimination and difficulty indices. The completed tests were subjected to a pilot study on a sample of 50 students. Sufficient time for all the testees to attempt every item was allowed in the Pilot study. The Difficulty index was determined by using the formula \( P = \frac{PH + PL}{2} \). Item – wise analysis was made to find out the proportion of the pupils answered each item correctly in the high and the low groups, PH and PL. The item discrimination D was obtained by using the formula: \( D = (PH – PL) \). An item with the Index of discrimination 0.35 and up, and difficulty levels between 0.40 and 0.60 were considered for the final instrument.

**Reliability and Validity**

Reliability refers to the accuracy and internal consistency of the instrument and the validity refers to the degree to which the test actually measures which it purports to measure. Face validity, content validity, and construct validity were found out by giving the test instruments to the experts. The reliability was found out by finding the Cronbach’s Alpha. The reliability coefficients of various test instruments are given in Table 3.2

<table>
<thead>
<tr>
<th>Test Instrument</th>
<th>Number of Samples</th>
<th>Number of Items</th>
<th>Cronbach’s Alpha Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>50</td>
<td>25</td>
<td>0.8657</td>
</tr>
<tr>
<td>Post-Test</td>
<td>50</td>
<td>25</td>
<td>0.8291</td>
</tr>
</tbody>
</table>

The specimen copy of the Pre-test and Post-test papers and their scoring keys are given in Appendices.
3.7 POPULATION AND SAMPLE OF THE STUDY

Population

A population can be defined as including all people or items with the characteristic one wish to understand. As there is very rarely enough time or money to gather information from everyone or everything in a population, the goal becomes finding a representative sample (or subset) of that population. Although the population of interest often consists of physical objects, sometimes we need to sample over time, space, or some combination of these dimensions. In other cases, the 'population' may be even less tangible. The population from which the sample is drawn may not be the same as the population about which we actually want information. Often there is large but not complete overlap between these two groups due to frame issues etc. In the present experiment, all the students with visual impairment studying IX or X standard in State Board / Matriculation / C.B.S.E system is the population. The students may be studying in Government / Aided / Private schools. Students with the above mentioned characteristics studying in these schools are the population for the present study.

Sample

Sampling is a device which makes one able to draw inferences about the whole population, simply by observing or measuring a few of the sampling units. A finite set of population or a sub-set of a set of sampling unit selected by some process usually by deliberate selection with the objective of investigating properties of parent population or set is called a sample. The reliability of results depends more on the quality of the sample. If the sample is the true representative of the
population, the results obtained from it are very near to the true value. A random sample can always be deemed as a true representative of the population.

**Sampling Procedure**

Random sampling is a sampling technique where we select a group of subjects (a sample) for study from a larger group (a population). Each individual is chosen entirely by chance and each member of the population has a known, but possibly non-equal, chance of being included in the sample. By using random sampling, the likelihood of bias is reduced. This randomization helps to minimize experimental errors. Four blind schools from various places within Tamil Nadu were selected for the study. The students in the schools were chosen for the study in proportionate to the total strength in that school. The selected students were assigned into Experimental group and Control group randomly. Thus one hundred and forty four students (144) out of this population have been selected as the sample. Seventy two students were randomly selected for the Experimental group and another 72 students were selected for the control group. Utmost care was taken in selecting the sample. Both the experimental and control groups were almost similar in their gender, social economic status, etc. Finally the sample consists of 72 students in Experimental group and 72 students in Control group.

**3.8 DESCRIPTIVE ANALYSIS OF THE SAMPLE**

Percentage analysis is one of the statistical measures used to describe the characteristics of the sample or population in totality. Percentage analysis involves computing measures of variables selected for the study and its findings will give easy interpretation for the reader.
### Table - 3.3
Sample Demography of Experimental and Control Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juniors (12 – 14)</td>
<td>28</td>
<td>38.89</td>
<td>25</td>
</tr>
<tr>
<td>Seniors (15 – 17)</td>
<td>44</td>
<td>61.11</td>
<td>47</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>51</td>
<td>70.83</td>
<td>46</td>
</tr>
<tr>
<td>Girls</td>
<td>21</td>
<td>29.17</td>
<td>26</td>
</tr>
<tr>
<td><strong>Locality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-Urban</td>
<td>19</td>
<td>26.39</td>
<td>20</td>
</tr>
<tr>
<td>Urban</td>
<td>53</td>
<td>73.61</td>
<td>52</td>
</tr>
<tr>
<td><strong>Type of School</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aided</td>
<td>36</td>
<td>50.00</td>
<td>36</td>
</tr>
<tr>
<td>Government</td>
<td>36</td>
<td>50.00</td>
<td>29</td>
</tr>
<tr>
<td><strong>Socio-Economic Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>36</td>
<td>50.00</td>
<td>36</td>
</tr>
<tr>
<td>Moderate</td>
<td>14</td>
<td>19.44</td>
<td>14</td>
</tr>
<tr>
<td>High</td>
<td>22</td>
<td>30.56</td>
<td>22</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindu</td>
<td>45</td>
<td>62.50</td>
<td>39</td>
</tr>
<tr>
<td>Christian</td>
<td>15</td>
<td>20.83</td>
<td>17</td>
</tr>
<tr>
<td>Muslim</td>
<td>12</td>
<td>16.67</td>
<td>16</td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>17</td>
<td>23.61</td>
<td>7</td>
</tr>
<tr>
<td>BC</td>
<td>29</td>
<td>40.28</td>
<td>30</td>
</tr>
<tr>
<td>MBC</td>
<td>16</td>
<td>22.22</td>
<td>15</td>
</tr>
<tr>
<td>SC/ST</td>
<td>10</td>
<td>13.89</td>
<td>20</td>
</tr>
<tr>
<td><strong>Nature of Blind</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Born blind</td>
<td>45</td>
<td>62.50</td>
<td>43</td>
</tr>
<tr>
<td>Middle blind</td>
<td>27</td>
<td>37.50</td>
<td>29</td>
</tr>
<tr>
<td><strong>Type of Blind</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total blind</td>
<td>36</td>
<td>50.00</td>
<td>47</td>
</tr>
<tr>
<td>Low vision</td>
<td>36</td>
<td>50.00</td>
<td>25</td>
</tr>
<tr>
<td><strong>Technology Awareness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aware</td>
<td>28</td>
<td>38.89</td>
<td>N/A</td>
</tr>
<tr>
<td>Unaware</td>
<td>44</td>
<td>61.11</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The list of schools selected for the study with the place wherein they are situated is given below.

1. IAB Hr. Sec. School for the Blind, Madurai (Aided)
2. Govt. High School for the Blind, Palayamkottai (Government)
3. Govt. High School for the Blind, Thanjavur (Government)
4. IELC High School for the Blind, Bargur (Aided)
Figure - 3.3
Age Group-wise Distribution of the Experimental Group sample

Figure - 3.4
Gender-wise Distribution of the Experimental Group sample

Figure - 3.5
Locality-wise Distribution of the Experimental Group sample

Figure - 3.6
Type of School-wise Distribution of the Experimental Group sample
Figure - 3.7
SES-wise Distribution of Experimental Group sample

Figure - 3.8
Religion-wise Distribution of the Experimental Group sample

Figure - 3.9
Community-wise Distribution of Experimental Group sample

Figure - 3.10
Nature of Blindness-wise Distribution of Experimental Group sample
From Fig. 3.3, in the experimental group, 39% of the participants are in the age group (12 - 14) and 61% of them are in the age group (15 - 17). Hence, the senior students are more in number than the junior students.

From Fig. 3.4, in the experimental group, 71% of the participants are males and 29% of them are females. Hence, the males are more in number than females.

From Fig. 3.5, in the experimental group, 26% of the participants are from Semi Urban localities and 74% of them are from Urban localities. Hence, majority of the participants are from Urban localities.

From Fig. 3.6, in the experimental group, 36% of the participants are studying in Government Aided schools and 50% of them are studying in
Government schools. Hence, the participants from Aided and Government schools are equal in numbers.

From Fig. 3.7, in the experimental group, 50% of the participants are from Low Socio Economic Status, whereas 19% are from Moderate and 31% are from High Socio Economic Status respectively. Hence, most of the participants are from Low Socio Economic Status.

From Fig. 3.8, in the experimental group, 62% of the participants are from Hindu religion, 21% are Christians and the remaining 17% are from Islam. Hence, Hindus form the majority of the sample followed by Christians and Muslims.

From Fig. 3.9, in the experimental group, 24% of students belong to Forward Class, 40% of them are from Backward classes, 22% are from Most Backward classes and the rest of them, (14%) belong to SC/ST communities. The Backward class students are more in number.

From Fig. 3.10, in the experimental group, 62% of students are born blind and 38% of them became blind in the middle. Hence, the majority of the participants are born blind.

From Fig. 3.11, in the experimental group, 50% of students are totally blind and the remaining 50% are with low vision. Hence, both groups are equal in numbers.

From Fig. 3.12, in the experimental group, 39% of students are aware of recent technologies and 61% of them are not aware about the recent technological inventions in education. It is to be noted that the majority of the participants are not aware about the latest technologies used in education.
Figure - 3.13
Age Group-wise Distribution of the Control Group sample

Figure - 3.14
Gender-wise Distribution of the Control Group sample

Figure - 3.15
Locality-wise Distribution of the Control Group sample

Figure - 3.16
Type of School-wise Distribution of the Control Group sample
Figure - 3.17
SES-wise Distribution of Control Group sample

Figure - 3.18
Religion-wise Distribution of the Control Group sample

Figure - 3.19
Community-wise Distribution of Control Group sample

Figure - 3.20
Nature of Blindness-wise Distribution of Control Group sample
From Fig. 3.13, in the control group, 35% of the participants are in the age group (12 - 14) and 65% of them are in the age group (15 - 17). Hence, the senior students are more in number than the junior students.

From Fig. 3.14, in the control group, 64% of the participants are males and 36% of them are females. Hence, the males are more in number than females.

From Fig. 3.15, in the control group, 28% of the participants are from Semi Urban localities and 72% of them are from Urban localities. Hence, majority of the participants are from Urban localities.

From Fig. 3.16, in the control group, 60% of the participants are studying in Government Aided schools and 40% of them are studying in Government schools.
Hence, the participants from Aided schools are more in number than those from Government schools.

From Fig. 3.17, in the control group, 50% of the participants are from Low Socio Economic Status, where as 19% are from Moderate and 31% are from High Socio Economic Status respectively. Hence, most of the participants are from Low Socio Economic Status.

From Fig. 3.18, in the control group, 54% of the participants are from Hindu religion, 24% are Christians and the remaining 22% are from Islam. Hence, Hindus form the majority of the sample followed by Christians and Muslims.

From Fig. 3.19, in the control group, 10% of students belong to Forward Class, 41% of them are from Backward classes, 21% are from Most Backward classes and the rest of them, (28%) belong to SC/ST communities. The Backward class students are more in number.

From Fig. 3.20, in the control group, 60% of students are born blind and 40% of them became blind in the middle. Hence, the majority of the participants are born blind.

From Fig. 3.21, in the control group, 65% of students are totally blind and the remaining 35% are with low vision. Hence, both groups are equal in numbers.

3.9 EXPERIMENTAL PROCEDURE

Prior to the experiment, the investigator contacted the participants personally and explained about the proposed study to them. He had prepared the questionnaires
in the Braille format and the ordinary Paper-Pencil format also. The participants were seated comfortably. For each student, scribes were assigned. The scribes explained the students about the content of the questionnaire and got the answer from the participants and entered them in the paper. First the researcher collected the personal data from them. Then the participants were seated comfortably and were distributed the Pre-Test Questionnaire. The researcher explained about the questionnaire and asked them to answer. Sufficient time was given to them to answer. He collected the answer sheets after the participants completed the Pre-Test questionnaire. The answer scripts of the participants were evaluated and the scores were recorded for further processing. Then the experimental procedure started.

3.9.1 Technology Infrastructure

The researcher ensured sufficient number of Desktop computers for the experimental set up. The experimental software JAWS for Windows needs minimum hardware requirements for proper operation. The computers had Pentium V Processor with 80 GB Hard Disk and 2 GB RAM. They had inbuilt audio cards, high quality speakers and a microphone for clear voice. The computers were pre-loaded with JAWS software. Each system was well tested prior to the experiment. As most of the schools nowadays have a good computer lab, providing required number of systems for the experiment was not a big problem for the researcher. Thus technology did not pose any problem for the smooth conduct of the experiment.

3.9.2 Conduction of the Experiment and Data Collection

The researcher visited the above mentioned two schools, and met the students belonging to both the groups separately and charted out the programme and the course of study with the help of the concerned headmasters and the local subject
teachers. A proper time table was drawn out for traditional group of students in each school. He made sure that the place of study was conducive for learning to both the groups. A study manual was prepared with the required materials for the control group students both in Braille and paper form. At each venue, the researcher taught to the control group students 1 hour every day for 30 days. After finishing the course, Post-Test was conducted. The scores obtained in various tests were taken for analysis. The experiment was conducted during May - December 2013.

The researcher also verified the technology facilities available in the experimental sites. He used the JAWS software for teaching the participants from the experimental group. Utmost care was taken to provide computer systems to the students. In one site, there were 24 computers. So, it was not a problem to provide individual systems to the participants. In another school, the number of systems was less than the number of participants. So, the researcher decided to allot 2 students per system in that situation. Anyhow, he ensured that all the students learn through JAWS software. The western accent of the English pronunciation was initially a problem. But, as days went on, the students felt comfortable with the accent of the pronunciation rendered by the software. At each venue, the experimental group students were taught one hour every day for one month. At the end of the course, a Post test was conducted and the scores obtained in various tests were taken for analysis. The experiment was conducted during May - December 2013.

3.9.3 Experimental Errors

Internal Validity

It refers to a study’s ability to determine if a causal relationship exists between one or more independent variables and one or more dependent variables. Researchers must be aware of aspects that may reduce the internal validity of a study
and do whatever they can to control for these threats. These threats, if left ignored, can reduce validity and the entire study becomes invalid. The major threats to internal validity are described here:

a. **History:** It refers to any event outside the research study that can alter or effect subjects’ performance. Subjects often experience environmental events that are different from one another which can play a role in their performance and must therefore be addressed. Using randomization procedures can often minimize this risk, assuring that outside events that occur in one group are also likely to occur in the other also.

b. **Maturation:** It can play a major role in longer-term studies. It refers to the natural physiological or psychological changes that take place as we age. It must be addressed through subject matching or randomization.

c. **Testing:** When subjects, especially in single group studies, are given a test as a pretest and then the same test as a posttest, the chances that they will perform better the second time due merely to practice is a concern. For this reason, two group studies with a control group are recommended.

d. **Statistical Regression:** Statistical regression, or regression to the mean, is a concern especially in studies with extreme scores. It refers to the tendency for subjects who score very high or very low to score more toward the mean on subsequent testing.

e. **Instrumentation:** If the measurement devices used in the study change during the course of the study, changes in scores may be related to the instrument rather than the independent variable. For this reason, it is recommended that pre- and posttests be identical or at least highly correlated.
f. **Selection:** Selection refers to the manner in which subjects are selected to participate in a study and the manner in which they are assigned to groups. If there are differences between the groups prior to the study taking place, these differences will continue throughout the study and may appear as a change in a statistical analysis. These differences can be addressed through subject matching or randomization.

g. **Experimenter Bias:** The researchers may be biased toward the results they want. This bias can effect the observations and possibly even result in blatant research errors that skew the study in the direction the researcher wants. Using an experimenter who is unaware of the anticipated results works best to control for this bias.

h. **Mortality:** Mortality, or subject dropout, is always a concern to researchers. They can drastically affect the results when the mortality rate or mortality quality is different between groups. Subject matching and taking the duration of the study within the control limits can minimize the effects of mortality. The subjects who dropout during the research should be omitted from the research. The major threats to internal validity and the method to reduce them are given in Table 3.4.

**External Validity**

External validity refers to the generalizability of a study. Threats to external validity can result in significant results within a sample group but an inability for this to be generalized to the population at large. The major threats are discussed below:
a. **Demand Characteristics:** Subjects are often provided with cues to the anticipated results of a study. When subjects become wise to anticipated results (often called a placebo effect), they can begin to exhibit performance that they believe is expected of them. Making sure that subjects are not aware of anticipated outcomes (referred to as a blind study) reduces the possibility of this threat.

b. **Hawthorne Effects:** Similar to a placebo, research has found that the mere presence of others watching the participants' performance causes a change in their performance. Addressing this issue can be tricky but employing a control group to measure the Hawthorne effect of those not receiving any treatment can be very helpful. In this sense, the control group is also being observed and will exhibit similar changes in their behavior as the experimental group therefore negating the Hawthorne effect.

c. **Treatment Interaction Effects:** The term interaction refers to the fact that treatment can affect people differently depending on the subject’s characteristics. Potential threats to external validity include the interaction between treatment and any of the following: selection, history, and testing. The selection itself may have placed higher motivated subjects in one group and lower motivated students in the other. If the work groups earn higher grades in the first semester, we can't truly say it was caused by the experiment alone. It is likely that the motivation caused both the work experience and the higher grades. To avoid this effect, both the groups should be motivated similarly and it is better to seclude the experimental group from the control group, so that each group do not know each other.
Both groups were treated at different places, the control group at one place in the school and experimental group at another place within the school at various timings. So, this effect could not have arisen.

d. **Imitation of treatment:** In case the subjects under various information levels communicate with each other, then the differences in responses under various treatment levels gets compromised. To overcome this problem, the researcher had not allowed the subjects to meet and discuss with one another about the topics under the study.

**Table - 3.4**

**Controlling for Threats to Internal Validity**

<table>
<thead>
<tr>
<th>Threats to Internal Validity</th>
<th>Controlling Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Random selection, random assignment</td>
</tr>
<tr>
<td>Maturation</td>
<td>Subject matching, randomization</td>
</tr>
<tr>
<td>Testing</td>
<td>Control group</td>
</tr>
<tr>
<td>Statistical Regression</td>
<td>Omit extreme scores, randomization</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>Instrumental consistency, assure iterative form reliability</td>
</tr>
<tr>
<td>Selection</td>
<td>Random selection, random assignment</td>
</tr>
<tr>
<td>Experimenter Bias</td>
<td>Double blind study</td>
</tr>
<tr>
<td>Mortality</td>
<td>Subject matching and omission</td>
</tr>
</tbody>
</table>
Table 3.5

Controlling for Threats to External Validity

<table>
<thead>
<tr>
<th>Threat to Internal Validity</th>
<th>Controlling Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Characteristics</td>
<td>Blind study, control group</td>
</tr>
<tr>
<td>Hawthorne Effect</td>
<td>Control group</td>
</tr>
<tr>
<td>Order Effects</td>
<td>Counterbalancing treatment order, multiple</td>
</tr>
<tr>
<td>Treatment Interaction Effects</td>
<td>Subject matching, naturalistic observation</td>
</tr>
</tbody>
</table>

After the teaching for both groups for one month, the researcher conducted a Post-test and collected the Post-test scores. The marks obtained were tabulated and were analyzed for further analysis.

3.10 ORGANISATION OF THE DATA AND ITS ANALYSIS

Analysis of the data is as important as any other components of the research process and the analysis and interpretation of data involves the objective material in the possession of the researcher and his subjective reactions and desires to derive from the data, the inherent meaning in their relation to the problem. However valid, reliable and adequate the data may be, it does not serve any worthwhile purpose unless it is carefully edited, systematically classified and tabulated, scientifically analyzed, intelligently interpreted and rationally concluded.

The data collected from the sample were analyzed by using SPSS 16.0 version. Initially, the data were fed in the excel worksheet and then transferred to SPSS. The statistical analysis such as ‘t’ test, ANOVA, Correlation, Regression, and chi-square were used in the present study. The analysis has been categorized as
Descriptive Analysis and Inferential Analysis. The Descriptive Analysis discusses the mean, sample size, frequencies, standard deviation etc. The inferential statistics is used for testing various hypotheses.

3.11 CONCLUSION

This chapter has outlined the design of the present study, the procedures followed and the nature of sample and tools used. The hypotheses to be tested have been formulated and the methods of analysis have also been planned. The methodology adopted for the study is described in this chapter. The scores obtained by the Ninth standard students were analyzed using statistical analysis. The following statistical analysis is carried out.

1. Descriptive analysis.
2. Differential analysis
3. One way ANOVA

The gain scores are analyzed with respect to the demographical variables such as gender, method of teaching, area in which the school is situated and the type of school using SPSS packages. One way analysis of variance is also done to study. The next chapter presents details of statistical analysis.