CHAPTER IV

METHODOLOGY

4.1 INTRODUCTION

Research methods are of utmost importance in a research process, as the success of the study depends on the suitability of the methods adopted. A pre-planned and well-designed methodology provides the researcher a scientific and feasible plan for solving the problem under analysis. It is the methodology which lays out the way that formal research is to be carried out and outlines the detailed descriptions of the research variables and procedure (Barr, 1998). It helps the researcher to explore different trends in the field and adequately measure them so as to satisfy the requirement of the investigation. The method adopted, the data gathering instruments, the selection of the sample, the procedure for data collection and outlines of the statistical techniques employed in the analysis of data are described under appropriate heads in this chapter.

4.2 METHOD ADOPTED

For collecting relevant data for the study, survey and experimental methods were used. A survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. "Survey studies are conducted to collect detailed descriptions of existing phenomena with the intent of employing data to justify current conditions and practices or to make more intelligent plans for improving them" (Koul, 1984).
In the present study, survey method was adopted for understanding the infrastructural facilities and instructional resources available in primary teacher training institutions and also for collecting the opinion and awareness of student teachers and the opinion and views of teacher educators at primary level regarding the use of modern instructional strategies.

The experimental method was adopted for measuring the achievement of student teachers in using modern instructional strategies. In an experimental study, the researcher is on the action from the very beginning: the researcher forms or selects the groups, decides what is going to happen to each group, tries to control all relevant factors besides the change that she or he has introduced and observes or measures the effect on the group at the end of the study (Gay, 1996). The design employed for the experimental part of the study was pre-test – post-test – parallel group design.

4.3 VARIABLES IN THE EXPERIMENT

"Variables are the conditions or characteristics that the experimenter manipulates, controls or observes" (Best, 1992).

In the present study, independent and dependent variables play a significant role.

4.3.1 Independent Variable

"Independent variables are the variables the experimenter manipulates or changes" (Nation, 1997). These are the conditions or characteristics that the experimenter manipulates or changes in his or her attempt to ascertain their relationship to observed phenomena.
In the present study, the independent variable is the instructional strategy with three levels of treatment, namely, co-operative learning, computer-assisted instruction and the conventional lecture method.

4.3.2 Dependent Variable

A dependent variable is defined as what the experimenter actually measures (Nation, 1997). It is a measure of the behaviour of the subject. The dependent variable is measured before and after the manipulation of the independent variable. The dependent variable considered in the present study is the achievement of student teachers at primary level.

4.3.3 Extraneous Variables

The extraneous variables are those that operate in the experimental situation in addition to the independent variables such that it is difficult to determine the effects of each (Gay, 1996). In the present study, sex, basic qualification, socio-economic status, motivation, anxiety or boredom of the student teachers and management of the teacher education institution are considered as the extraneous variables affecting the experiment. Attempts were made to control extraneous variables by comparing groups that are homogeneous with respect to these variables.

4.4 TOOLS AND TECHNIQUES USED

The following tools and techniques were used for the present study:

1. Checklist

2. Awareness Test
3. Opinionnaire
4. Interview Schedule
5. Raven's Standard Progressive Matrices (SPM)
6. Achievement Test
7. Computer-Assisted Instructional Software
8. Co-operative Learning Package
9. Delayed Memory Achievement Test

The details regarding the preparation of the tools and techniques employed for the present study are outlined below.

4.4.1 Checklist

Accessibility to sufficient infrastructural facilities and rich instructional resources is a stimulant factor in adopting modern instructional strategies. Hence it was decided to prepare a checklist to find out the infrastructural facilities and instructional resources available in teacher training institutes for adopting modern instructional strategies. A checklist consisting of 14 major categories and subcategories was prepared based on the norms stipulated by the National Council for Teacher Education (NCTE) and the investigator's consultation with teacher educators. The criteria for distinguishing institutions having sufficient facilities and resources in libraries and institutions not having sufficient facilities and resources were fixed for the items after consulting with teachers, teacher educators and librarians.
4.4.1.1 Preliminary Tryout of the Checklist

The tryout of the checklist was done with a small sample of three teacher training institutions, with due representation of Government, Aided and Unaided sectors.

4.4.1.2 Preparation of the Final Checklist

After the tryout, necessary revisions were made in the checklist by eliminating two items which were duplicated in the first draft. The following 9 major categories with subcategories were selected for the final checklist.

1. Library
2. Reading Room
3. Science Laboratory
4. Social Science Laboratory
5. Psychology Laboratory
6. Language Laboratory
7. Educational Technology Display Room
8. Computer Software
9. Web-based Technology

A copy of the Checklist is given as Appendix-A.

4.4.2 Awareness Test

One of the objectives of the study was to assess the awareness of student teachers regarding the use of modern instructional strategies. For preparing items for the awareness test, the existing reference materials in the area of modern instructional strategies were consulted. The investigator made
an in-depth study of literature which included books, journals, periodicals, research abstracts, encyclopaedias and many other relevant sources. She made visits to the libraries of pioneering educational institutions like NCERT, IGNOU, Jawaharlal Nehru University, New Delhi and RIE, Mysore.

4.4.2.1 Preliminary Draft

The following aspects involved in modern instructional strategies were given due weightage in the awareness test:

1. Awareness about the theoretical bases of modern instructional strategies
2. Awareness about the significance and use of multisensory equipments and projection devices
3. Awareness about self-learning strategies
4. Awareness about E-learning and web-based technology
5. Awareness about group-learning strategies
6. Awareness about the characteristics of instructional strategies suitable for primary classes and the role of teachers.

In the preliminary draft of the awareness test, forty items were included.

4.4.2.2 Pilot Study

The awareness test was administered to a sample of 36 student teachers of the second year TTC course in DIET-TTI, Kottayam. Necessary instructions were given to student teachers before the commencement of the test. The time taken for the test was noticed. After analysing the answer
scripts, the investigator noticed that some items in the test were ambiguous, some were very easy and some were too difficult for them. The defects noticed were rectified. The pilot study enabled the investigator to fix the time needed for the completion of the test. Then the items of the test were edited properly and the instructions for the test were worded clearly.

4.4.2.3 Validation of the Awareness Test

The final manuscript of the draft was then submitted to experts in information and communication technology, instructional strategies and teacher education. The investigator also made discussions with these experts. Necessary modifications were made in the light of expert opinion and suggestions. The language used in the awareness test was made simple and precise, so that it would be comprehensible to all student teachers, thereby adding to the validity of the test.

4.4.2.4 Preparation of the Final Test

Out of the 40 items included in the tryout, 30 items were selected for the final awareness test. The time limit for answering the test was fixed to be 60 minutes. The final test was printed in booklet form and necessary instructions were provided in it. Along with each test item, space for answering was provided. Additional papers were provided for writing answers, if necessary. The maximum score of the awareness test was 90. A maximum score of three marks were assigned to the response of each question.
4.4.2.5 Scoring of the Test Items

For each question, the scores obtained were categorised into the following levels of awareness:

- Marks between 0 to 1 - poor awareness
- Marks 1+ to 2 - average awareness
- Marks 2+ to 3 - good awareness

4.4.2.6 Reliability of the Awareness Test on Modern Instructional Strategies

Split-half method was used for determining the reliability of the awareness test. In this method, the scores obtained by each individual in the test were divided into two groups by pooling odd number items and even number items. Correlation was found for the half-tests. From the reliability of the half-tests, the reliability coefficient of the whole test was estimated by the Spearman-Brown Prophecy formula

\[ r_{11} = \frac{2r_{11}/2_{11}}{1+r_{11}/2_{11}} \]

Where \( r_{11} \) = reliability coefficient of the whole test and
\[ r_{11}/2_{11} = \text{reliability coefficient of the half-test found experimentally.} \]

The reliability coefficient of the test was found to be 0.75 and inferred that the tool is reliable for the population.

4.4.2.7 Validity of the Awareness Test on Modern Instructional Strategies

Validity involves "the appraisal of theoretically expected patterns of relationships among item scores or between test scores and other
measures" (Messick, 1995). For an awareness test, content validity, construct validity and empirical validity or statistical validity are important.

### 4.4.2.8 Content Validity

Content validity is the situation included in the test which is representative of the group of situations that the test is supposed to sample (Travers, 1964). Six different areas were given due weightage in the awareness test. The items related to all the areas were finalised on the basis of the suggestions of experts in the subject. The content validity of the test was thus ensured. Table 4.1 shows the areas of modern instructional strategies and the number of test items included in each area.

#### Table 4.1

**Areas of Modern Instructional Strategies and the Number of Test Items**

<table>
<thead>
<tr>
<th>Area of modern instructional strategies</th>
<th>Number of test items included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Theoretical Bases of Modern Instructional Strategies</td>
<td>5</td>
</tr>
<tr>
<td>2. Significance and Use of Multisensory Equipments and Projection Devices</td>
<td>7</td>
</tr>
<tr>
<td>3. Self-learning Strategies</td>
<td>5</td>
</tr>
<tr>
<td>4. E-learning and Web-based Technology</td>
<td>3</td>
</tr>
<tr>
<td>5. Group learning Strategies</td>
<td>6</td>
</tr>
<tr>
<td>6. Instructional Strategies Suitable for Primary Classes</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### 4.4.2.9 Concept or Construct Validity

The problem of preparing a test that has concept or construct validity is that of bringing the gap from general concept to specific tangible
tasks or test items. For this, the test items must be specific, concrete and precise. So, specific, concrete and precise test items were prepared to ensure construct validity. The draft from of the Awareness Test (English version) is given as Appendix C and its final form is given as Appendix-D. The Malayalam version of the Awareness Test (draft and final form) are given in the CD-ROM as Appendix E. The valuation key of the Awareness Test is given as Appendix-F.

4.4.3 Opinionnaire

The inquiry that attempts to assess the attitude or belief of an individual is known as an opinionnaire (Freeman, 1965). To study and analyse the opinion of student teachers regarding the use of modern instructional strategies, an opinionnaire was prepared and its details are given below.

4.4.3.1 Selection of the Items

A large number of statements which express opinion or feeling towards the use of modern instructional strategies were collected. Both positive and negative statements were included.

For screening the statements, the criteria suggested by Edward and Kilpatric (1957) and Likert (1932) were applied. Modifications were made in the opinionnaire in the light of expert criticism and suggestions.

4.4.3.2 Tryout

The preliminary draft of the scale was administered to a sample of 100 students who were selected from the population for which the scale was constructed. Each item, or statement in the opinionnaire was followed by five responses, one of which was checked by the subject. The responses
indicating the degree of strength of attitude are ‘Strongly Agree’ (SA), ‘Agree’ (A), ‘Undecided’ (U), ‘Disagree’ (D) and ‘Strongly Disagree’ (SD).

4.4.3.3 Scoring of the Statements

For scoring, numerical values were assigned to the five categories of the responses as indicated below in the table (4.2).

Table 4.2
Assignments of Scores on the Opinion

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive or favourable</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Negative or unfavourable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

The scores of each individual were computed by summing up the weightage of the individual responses.

4.4.3.4 Item Analysis

Item analysis according to Ferguson (1952) is one of the many processes by which one can find which items differentiate and which items do not differentiate between constructing criterion groups.

The total score obtained for each individual was calculated and the response sheets were arranged in the order of magnitude of the total score. Then the highest 27 percent and the lowest 27 percent were taken out for analysis since 27 percent provides the best compromise between two desirable
and inconsistent aims: (1) to make extreme groups as large as possible and
(2) to make extreme groups as different as possible (Ebel, 1965).

The 100 response sheets collected were arranged in the
descending order of the total scores. The top 27 percent in the group (the top
27) when arranged in the descending order of the total scores and the bottom
27 percent (the bottom 27) response sheets alone were used as extreme
groups for item analysis. The scores obtained for each item in these extreme
groups were used for calculating the discriminating power of each item. The
discriminating power was obtained by calculating the critical ratio ‘t’ using the
formula

\[ t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum (X_H - \bar{X}_H)^2 + \sum (X_L - \bar{X}_L)^2}{n(n-1)}}} \]

(Edwards & Kilpatrick, 1957)

where

- \( \bar{X}_H \) = the mean score on a given statement for the high group
- \( \bar{X}_L \) = the mean score on the statement for the low group
- \( X_H \) = the score for a given individual for a given statement in the high group
- \( X_L \) = the score for a given individual for a given statement in the low group
- \( n \) = number of subjects in the criterion group

The ‘t’ values of the items in the opinionnaire are shown in Table 4.3.


<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>'t' value</th>
<th>S.No. in the final draft</th>
<th>Remarks</th>
<th>Sl.No.</th>
<th>'t' value</th>
<th>S.No. in the final draft</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1</td>
<td>18.03</td>
<td>1</td>
<td></td>
<td>-26</td>
<td>4.66</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>7.86</td>
<td>2</td>
<td></td>
<td>-27</td>
<td>11.85</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>-3</td>
<td>4.47</td>
<td>3</td>
<td></td>
<td>+28</td>
<td>21.27</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>+4</td>
<td>11.18</td>
<td>4</td>
<td></td>
<td>+29</td>
<td>1.02</td>
<td>-</td>
<td>Rejected</td>
</tr>
<tr>
<td>-5</td>
<td>8.05</td>
<td>5</td>
<td></td>
<td>+30</td>
<td>2.31</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>+6</td>
<td>7.03</td>
<td>6</td>
<td></td>
<td>+31</td>
<td>1.01</td>
<td>-</td>
<td>Rejected</td>
</tr>
<tr>
<td>+7</td>
<td>15.91</td>
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<td></td>
<td>-32</td>
<td>9.25</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>+8</td>
<td>3.11</td>
<td>-</td>
<td>Rejected</td>
<td>-33</td>
<td>9.24</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>-9</td>
<td>6.67</td>
<td>8</td>
<td></td>
<td>+34</td>
<td>6.47</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>-10</td>
<td>12.18</td>
<td>9</td>
<td></td>
<td>+35</td>
<td>14.35</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>+11</td>
<td>21.88</td>
<td>10</td>
<td></td>
<td>+36</td>
<td>2.82</td>
<td>-</td>
<td>Rejected</td>
</tr>
<tr>
<td>+12</td>
<td>8.67</td>
<td>11</td>
<td></td>
<td>-37</td>
<td>14.44</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>+13</td>
<td>18.35</td>
<td>12</td>
<td></td>
<td>+38</td>
<td>2.02</td>
<td>-</td>
<td>Rejected</td>
</tr>
<tr>
<td>-14</td>
<td>1.25</td>
<td>-</td>
<td>Rejected</td>
<td>+39</td>
<td>11.00</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>+15</td>
<td>9.04</td>
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<td></td>
<td>+40</td>
<td>1.48</td>
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<td>Rejected</td>
</tr>
<tr>
<td>+16</td>
<td>14.50</td>
<td>14</td>
<td></td>
<td>-41</td>
<td>14.82</td>
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<td></td>
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<td>11.58</td>
<td>15</td>
<td></td>
<td>+42</td>
<td>11.05</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>-18</td>
<td>22.35</td>
<td>16</td>
<td></td>
<td>+43</td>
<td>1.91</td>
<td>-</td>
<td>Rejected</td>
</tr>
<tr>
<td>-19</td>
<td>8.86</td>
<td>17</td>
<td></td>
<td>-44</td>
<td>9.87</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>+20</td>
<td>1.19</td>
<td>18</td>
<td></td>
<td>+45</td>
<td>10.02</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>-21</td>
<td>15.12</td>
<td>19</td>
<td></td>
<td>+46</td>
<td>8.23</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>+22</td>
<td>1.52</td>
<td>-</td>
<td>Rejected</td>
<td>+47</td>
<td>10.12</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>+23</td>
<td>10.20</td>
<td>20</td>
<td></td>
<td>-48</td>
<td>9.53</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>-24</td>
<td>1.52</td>
<td>21</td>
<td></td>
<td>-49</td>
<td>11.51</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>+25</td>
<td>1.66</td>
<td>-</td>
<td>Rejected</td>
<td>+50</td>
<td>7.85</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
4.4.3.5 Selection of Items and Preparation of the Final Draft

For the preparation of the final opinionnaire, 40 items with ‘t’ value equal to or greater than 1.75 were selected as the value of ‘t’ is a measure of the extent to which a given statement differentiates between the high and low groups. Six statements having ‘t’ values lower than 1.74 and four other statements having comparatively lower ‘t’ values were rejected from the draft form. The remaining 21 positive statements and 19 negative statements were retained in the final form. “As a crude and approximate rule of thumb, we may regard any ‘t’ value equal to or greater than 1.75 as indicating that the average response of the high and low groups to a statement differs significantly, provided we have 25 or more subjects in the high group and also in the low group” (Edwards, 1971).

The classification of the statements in the final tool is given in Table 4.4.

Table 4.4

Classification of Statements in the Opinionnaire

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>No. of Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Characteristics and advantages of modern instructional strategies</td>
<td>11 (1-4, 6-9, 11, 18, 35)</td>
</tr>
<tr>
<td>2</td>
<td>Relevance and use of self-learning strategies</td>
<td>7 (10, 15, 20-22, 31, 37)</td>
</tr>
<tr>
<td>3</td>
<td>Role of teachers in modern instructional strategies and the training to be given to them</td>
<td>6 (5, 12, 13, 16, 17, 24)</td>
</tr>
<tr>
<td>4</td>
<td>Nature of interaction in group learning strategies</td>
<td>12 (19, 23, 25-28, 30, 32-34, 36, 40)</td>
</tr>
<tr>
<td>5</td>
<td>Role of information and communication technology in classroom teaching</td>
<td>4 (14, 29, 38, 39)</td>
</tr>
</tbody>
</table>
In each category, an equal number of positive and negative statements as far as possible were arranged at random. The statements were arranged on a five point scale with the responses, strongly agree, agree, undecided, disagree and strongly disagree.

The draft form of the Opinionnaire (English version) is given as Appendix G and its final form is given as Appendix-H. The Malayalam version of the Opinionnaire (draft and final form) are given in the CD-ROM as Appendix-E.

4.4.3.6 Reliability

The reliability of the opinionnaire was found out by following the method of equal appearing intervals as obtained by split half method. Authors like Edwards (1971) suggested the use of split half method for finding out the reliability of opinionnaire. The reliability coefficient of the opinionnaire obtained by the application of Spearman-Brown Prophecy formula was found to be 0.74. It is inferred that the tool is reliable for the population.

4.4.3.7 Validity

Content Validity: As mentioned in the step involved in the construction of the opinionnaire, the tool prepared was subjected to the scrutiny, criticism and comment of the experts in the field of Education, Psychology and Educational Technology. The tool was modified in the light of their comments and suggestions.

Item Validity: Item validity emphasises the extent to which an item predicts segregation of tests into 'High versus Low' criterion scores. As mentioned
earlier, item analysis was done and 't' value was calculated for all the items to establish item validity.

4.4.4 Interview Schedule

An interview schedule is essentially the oral in-person administration of a questionnaire to each member of a sample and filled in by the interviewer in a face to face situation with another person (Gay, 1996). For the present study, the interview was meant for getting information about the training that the teacher educators have received in adopting modern instructional strategies, their views and opinions regarding the implementation of the same and the difficulties they face in this regard, if any. An interview schedule was prepared which consisted of 25 questions. These questions were edited and printed. They were given to experts for their suggestions and modifications were made in the light of relevant suggestions.

4.4.4.1 Try out

The tryout was made on a small sample of teacher educators as pilot study before using it for actual investigation.

4.4.4.2 Preparation of the Final Interview Schedule

Feedback from the tryout was used to revise questions that were apparently unclear and did not solicit the desired information. In the final interview schedule, 14 questions were included. Questions from the following areas were included in the interview schedule.

(1) The nature of training, especially the computer training, teacher educators have received in using modern instructional strategies:
(2) Availability of modern technological aids and equipments in teacher training institutions;

(3) Infrastructural facilities available in TTls for using modern instructional strategies;

(4) Technological aids and equipments that are not in working condition in teacher training institutions;

(5) Use of LCD projector in TTls;

(6) Extent of adoption of brainstorming, seminar, debate, project, panel discussion, co-operative learning, instructional module and computer-assisted instruction as instructional strategies;

(7) Availability of library and laboratory facilities;

(8) Training given to student teachers in making teaching aids;

(9) Time allotted for modern instructional strategies in the TTC course;

(10) Awareness of student teachers who qualify the TTC course regarding modern instructional strategies;

(11) Adoption of modern instructional strategies during practice-teaching;

(12) Co-operation and support from the head of the institution in using modern instructional strategies;

(13) Limitations of modern instructional strategies;

(14) Suggestions for making improvement in the use of modern instructional strategies.

A copy of the interview schedule is given in Appendix-I.
4.4.5 Raven's Standard Progressive Matrices (SPM)

In order to measure the general mental ability of the sample, the investigator decided to administer a non-verbal test of intelligence. Experts agreed upon that a good intelligence group test should have at least the following qualities:

(1) It should be valid and reliable;
(2) It should be adjusted in difficulty to the age of the subjects;
(3) It should be objective;
(4) The test items should be graded properly;
(5) The test should be adequately standardised as a representative sample of the population;
(6) The test should be interesting to subjects;
(7) The length of the test should be adequate;
(8) The test should possess simplicity of responses and scoring.

Considering the above-mentioned factors, the investigator decided to use Raven's Standard Progressive Matrices sets A, B, C, D and E for measuring the general mental ability of student teachers in the experimental and control groups.

Raven's Standard Progressive Matrices published in 1938 is a non-verbal group test administered to measure a person's capacity to apprehend meaningless figures presented for observation, see the relations between them, conceive the nature of the figures completing each system of relations presented and so develop a systematic method of reasoning. The
test consists of 60 problems divided into five sets of 12 each. In each set, the first problem is the easiest one and the consecutive problems become gradually difficult.

The order of the test provides the standard training in the method of working. The five sets provide five opportunities for grasping the problem and the five progressive assessment of a person's capacity or intellectual activity. The tests are meant to evaluate the person's ability to discern and utilise a logical relationship presented by non-verbal materials. The problem requires in varying degrees, in analytical and integrating operations of the kind called 'insight through visual activity'. The test is intended to cover the whole range of intellectual development of a child. Everyone irrespective of his age is given exactly the same series of problems in the same order and was asked to work at his own speed without interruption from the beginning to the end of the test.

4.4.5.1 Reliability

From the original studies on Standard Progressive Matrices, Raven (1948) found reliabilities ranging from 0.83 to 0.93 with the higher values being associated with younger subjects (under age 30). The test has retest reliability varying with age from 0.83 to 0.93. It correlates 0.86 with the Term and Merrill Scale and has been found to have a 'g' saturation of 0.82 (Raven, 1962). For the age under 30, the mean score is 48 and the retest reliability is 0.93.
4.4.5.2 Marking

A person's score on the scale is the total number of problems solved correctly when allowed to work quietly through the series from the beginning to the end. A person's total score provides an idea of his intellectual capacity, whatever be his nationality or education.

To record the answers, a record form is available with matrices. The standard record form is arranged so that it can be quickly and accurately marked by superimposing a stencil marking key which is also given with the matrices. A copy of the score card of Raven's Standard Progressive Matrices is given as Appendix-J.

4.4.6 Achievement Test

An achievement test was prepared on the Cognitive Development theories of Piaget, Bruner and Gagne included in the second year TTC curriculum. This test was used as the pre-test and the post-test. Various aspects involved in the content were given due weightage by analysing it properly. This helped the investigator to have an objective-based achievement test giving due weightage to content. Multiple choice items were included in the test under each content subunit.

4.4.6.1 Preparation of the Blueprint

Preparation of the blueprint helped the investigator to have an objective-based achievement test, giving due weightage to objectives, content and form of questions. Blueprint of the achievement test is given in Table 4.5.
Table 4.5

Blueprint of the Achievement Test

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Content Subunits</th>
<th>Objectives</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>K</td>
<td>U</td>
</tr>
<tr>
<td>1.</td>
<td>Piaget’s theory of cognitive development</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Piaget’s stages of cognitive development</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>The relevance of Piaget’s theory of cognitive development</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>Bruner’s theory of cognitive development</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5.</td>
<td>Gagne’s hierarchy of learning</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

K – Knowledge; U – Understanding; A – Application

4.4.6.2 Construction of Test items

The draft question paper consisted of 30 multiple choice items. Questions of easy, average and difficult levels were included. Test items were shown to expert teacher educators to verify the suitability of the items for the target group. The items were modified after scrutiny by experts and arranged according to their expected level of difficulty.

4.4.6.3 Standardisation of the Achievement Test

For tryout, the achievement test was administered to a stratified sample of 35 student teachers of St. Thomas TTI, Palai. Students were given enough time to complete the test. The average time taken was 30 minutes, which was fixed as the time limit for the final test. In scoring, two-point credit was given for each correct response.
4.4.6.4 Item Analysis

Item analysis provides for each item of the test two indices – one of its difficulty and another of its power to discriminate between the good and the bad performers on the test. From the arranged answer sheets, the top 27 percent and the bottom 27 percent of the answer sheets were separately taken. The proportions of the two groups passing a given item were found. Entering Flanagan’s table with the proportion of successes in the two groups, the Biserial ‘r’ from the intersecting column and row in the table were read. The Biserial ‘r’ would take the discriminating power and the mean of two proportions would be the difficulty index (Garrett, 1962). Items with discriminating power of 0.20 or more and difficulty index of 0.40 to 0.60 are regarded as satisfactory. For the final test, items having difficulty indices between 0.25 and 0.75 and discriminating power above 0.25 were selected for the final test.

4.4.6.5 Preparation of the Final Test

Out of the 35 items included in the tryout, 25 items were selected for the final test based on the difficulty index and the discriminating power of the items with a maximum score of 50. The selected items were arranged according to the difficulty level. The final test was printed with all necessary instructions. A copy of the achievement test (English version) and its scoring key are given in Appendices-K and L respectively. The Malayalam version of the Achievement Test is given in the CD-ROM as Appendix-E.

4.4.6.6 Reliability of the Achievement Test

Split-half method was used for determining the reliability of the test. In this method, the scores obtained for each individual was divided into two groups by pooling the odd number items and even number items. The
reliability of the test was determined by using the Spearman-Brown Prophecy formula. The obtained score is 0.75 and this shows that the test has high reliability.

4.4.6.7 Validity

As far as an achievement test is concerned, content validity, construct validity and empirical or statistical validity are important.

Content Validity

Freeman (1965) says that each test item should be a sampling of knowledge or performance which the test purports to measure. Content validity is estimated by evaluating the relevance of the test items, in relation to instructional objectives and actual subject matter studied, individually and as a whole. To ensure content validity, the different subunits of the content were carefully examined and from each of the subunits, items were included. The content validity was established by the judgement of experts in Educational Psychology.

Construct Validity

Construct validity of a test is the extent to which the test may be said to measure “theoretical construct or trait” (Anastasi, 1961). This implies that construct validation relies to a large extent on psychological theory that indicates the constructs underlying a set of tests of measures. Construct validity of a test is concerned not only with the test itself, but also with the theory which seeks to explain or to account for the results which are obtained when the test is used.
In the present achievement test, the content was organised in a logical order. Adequate representation was given to sub-concepts. Incomplete sentences were avoided and instead, sentences that convey simple complete idea were incorporated. Words were effectively used for giving precise meaning.

**Empirical or Statistical Validity**

The empirical validity of the test was calculated by correlating the scores obtained in the test with the marks obtained in the first terminal Educational Psychology examination. The correlation coefficient obtained was 0.81. The obtained value shows that the test has good empirical validity.

**4.4.7 Computer-Assisted Instructional Software**

The investigator selected computer-assisted instruction as one of the instructional strategies for conducting the experimental study and developed interactive, user-friendly computer-assisted instructional software as the learning material. In the context of computer-based materials, the term software refers in general to computer programmes and their accompanying documentation (Heinich, Molenda & Russell, 1993).

For preparing the instructional software, 'Cognitive Development theories of Piaget, Bruner and Gagne' included in the second year TTC course of the Kerala State were selected. The content was divided into three units. Each unit was split up again into lessons and in each lesson, the content was analysed in terms of behavioural objectives. The learning material was presented to each individual learner in the form of visual, auditory and kinaesthetic inputs. Care was taken to ensure that learning was interactive and
interesting. After the mastery of each lesson, the learner was required to take a test which was self-administrative. Immediate feedback was provided to the learner about his level of performance. He was allowed to proceed to the next lesson only after qualifying the test. If he did not qualify, he was directed to go back to the original lesson for further mastery and qualify the same test. All the lessons in the software were arranged in this way. A number of references in Educational Technology and Interactive Computer-Assisted learning were made use of in the preparation of the software. Technical assistance in computer language for the preparation of the computer software was obtained from a software consultant. It was then validated by subject experts. The instructional software was then edited and tested on twenty-five student teachers of DIET-TTI, Kottayam.

4.4.7.1 Steps Involved in the Development of Computer-Assisted Instructional Software

The steps taken to develop the instructional software are given below.

(1) Selection of the Topic

The developmental approach to learning – Cognitive Development theories of Piaget, Bruner and Gagne included in Educational Psychology of second year TTC course were selected for developing the Computer-Assisted instructional material. The topic was subdivided into three subunits which were again divided into lessons.

(2) Formulation of Curricular Objectives

The curricular objectives of each lesson were formulated and stated in terms of specific observational and behavioural outcomes. For
example, in the lesson 'Concept Attainment Techniques of Bruner', the learner identifies the five steps involved in concept attainment and the techniques needed for developing a concept. The objectives were analysed to check their sequential order and to find out whether there were any gaps or overlaps among themselves.

(3) Development of Content Framework

The content framework suitable for the attainment of objectives was developed for each lesson. The following units and lessons were included under the content framework.

Unit I
Lesson 1 - Piaget’s theory of cognitive development
Lesson 2 - Piaget’s stages of cognitive development
Lessons 3 - Relevance of Piaget’s theory of cognitive development

Unit 2
Lesson 4 - Concept attainment techniques of Bruner

Unit 3
Lesson 5 - Gagne’s hierarchy of learning

(4) Analysis of Content (Learning materials)

The learning materials selected were analysed thoroughly to match with the curricular objectives and arranged sequentially.
(5) Development of the Computer-Assisted Instructional Software

The learning materials were developed as an interactive, self-instructional computer software. Animation, illustrations, colour, audio and video effects were induced in the software to make it self-learning and interesting to the learner. At the end of each lesson, test and immediate feedback of the learner’s performance are provided. The software was developed with the following tools:

1. HTML
2. Java script
3. Macromedia Flash as animation tool
4. Adobe Photoshop as image editing tool
5. Macromedia Dreamweaver as editor.

The following are the hardware requirements of the software for the best performance to users.

1. Internet Explorer 5.0 or later
2. Pentium III processor or later
3. 128 MB RAM (recommended)
4. Speaker or headphone
5. Best viewed under 800 x 600 pixels resolution.

4.4.7.2 Tryout of the Computer-Assisted Instructional Software

The computer-assisted instructional software was tried on a group of twenty five student teachers of DIET-TTI, Kottayam. It was finally edited
based on the results from the tryout and suggestions from teacher educators and other experts.

4.4.7.3 Validity and Reliability of the Computer-Assisted Instructional Software

For developing the computer-assisted instructional software, various aspects like its relevance to objectives, specific outcomes of learning, problem-solving ability, conceptual analysis, accuracy of information, seeking clarifications, and visualising in three dimensions and in motion-virtual-reality environments, raising simulation to a multi-sensory level were considered. This procedure helped to establish the construct validity of the computer-assisted instructional software. The instructional software prepared in accordance with the second year TTC syllabus was evaluated on the basis of opinion of a number of experts in Educational Psychology and Educational Technology. This helped to ensure the content validity of the instructional software prepared.

The reliability of the computer-assisted instructional software was established using the Evaluation Schedule by the experts who evaluated it. Their observations and ratings indicate that the instructional software was highly reliable and practicable. The English version of the Computer-assisted Instructional Software in printed form (selected area) is given as Appendix-M. The Computer-Assisted Instructional Software (Malayalam and English versions) is given in the CD-ROM attached as Appendix-E. Copies of the list of experts and the Evaluation Schedule are given as Appendices-N and O respectively.
4.4.8 Co-operative Learning Package

Learning to work co-operatively is an important activity as well as outcome ability for students (Caren, 1993). In co-operative learning, peer interaction can foster cognitive development by allowing children to retain new skills and recognise new ideas through discussion. Co-operative learning students tend to:

- have higher proficiency in critical reasoning strategy and abilities;
- actually work cooperatively in small group setting towards attaining a common goal;
- have higher levels of intrinsic motivation to learn;
- engage in more and with higher quality on task, academic and group interaction behaviours (Stahl, 1996).

Plowden Report (1967) had advocated group work as a cost effective use of teacher time when compared with the use of individualised programmes. In Kerala, group discussion and group work are used as effective strategies for curriculum transaction in primary classes. The investigator developed a cooperative learning package as an instructional strategy for experimentation. The strategy used was Student Teams Achievement Division (STAD). STAD is an excellent strategy for teachers new to cooperative learning (Slavin, 1990).

The topic selected was 'Cognitive Development Theories of Piaget, Bruner and Gagne'. The prepared cooperative learning package consists of:
Planning, preparing and implementing the co-operative learning package based on the STAD strategy included the following components:

(1) **Clear Student Outcome Objectives**

Student outcome objectives were formulated in terms of what learners were to learn and what needed to be able to do it with the content at the end of the unit of study.

(2) **Pre-instruction Preparation**

The pre-instructional preparation involved splitting up the membership of the co-operative learning teams, determining base scores and selecting and preparing work sheets, answer sheets and outcome aligned quizzes. The co-operative learning group of 12 student teachers was assigned to three heterogeneous STAD teams after computing the initial base scores. They were informed as to the structure and steps in the STAD strategy and the rewards for teams that meet the standards for high achievement.

The teacher announced the outcome objectives of the unit, team expectations and class management rules. Each team assigned their members task roles – specific individual behaviours that were required to carry out the team’s tasks. The roles student teachers carried out were Initiator,
Contributor, Co-ordinator, Encourager and Summariser. The teacher provided guidelines for completing their major roles.

(3) **Student encounter with outcome-aligned content**

The teacher used a number of ways to ensure that students had contact with the outcome-aligned content. For the unit 'Cognitive Development Theory of Piaget', the teacher used transparencies and other visual and auditory aids to explain Piaget's theory of cognitive development. Student teachers' comprehension was assessed by asking questions at strategic points.

(4) **Completion of co-operative learning tasks**

Time for co-operative team work and the major tasks of team members were announced. The teacher handed out worksheets that saved to focus the must-learn content and skills on the concerned topic. The teacher structured the teams' activity in the following way:

(a) All team members placed their pencils in the middle of the table;
(b) A student teacher reads the first problem, question or task;
(c) All student teachers brainstormed the answer using all available resources;
(d) The team's coordinator checked to see that all comprehended and agreed with the answer;
(e) When everyone agreed, all students picked up their pencils and wrote the answer;
(f) The next person took the next problem or question and the procedure was repeated.
The team members discussed their ideas, shared and reflected experiences, completed worksheets and appreciated others. When a team finished the worksheet, the teacher provided answer sheet (scoring key) to them. Team members checked the accuracy of their work. They discussed and collected any wrong answers and explained the specific reasons why the right answers were right and why and how wrong answers needed to be revised.

(5) Monitoring Team Interaction and On-task Work

While the students were working in teams, the teacher monitored team interaction on specially prepared monitoring sheets. Students became aware that they were not graded but helped to improve their team's efforts.

(6) Individual Tests/Quizzes

After the content had been encountered and mastery of the to be learnt skills had been achieved, students took an individual test. These tasks ensured that students were held individually accountable for what they had to learn.

(7) Individual and Team Improvement Points

Each student's improvement points were calculated by how much the student's test score succeeded his or her base score. The improvement points for all members of the team were added to get the team's total points.
(8) Public Team Recognition and Rewards

Teams earned certificate or other rewards when their average team improvement point exceeded a pre-determined number of points. All teams could earn the highest number of points available.

4.4.8.1 Validation of Co-operative Learning Package

The co-operative learning package was shown to subject experts in the field and was validated.

4.4.8.2 Tryout of the Co-operative Learning Package

The cooperative learning package was tried on a group of twenty-five student teachers of DIET-TTI, Kottayam. It was then finally edited based on the results from tryout and suggestions from teacher educators and other experts.

4.4.8.3 Reliability and Validity of the Cooperative Learning Package

For developing the cooperative learning package, various aspects like relevance of objectives, specific outcomes of learning, conceptual analysis, face to face interaction, individual accountability, accuracy of information, development of social skills and collaborative thinking at a higher level were considered. This procedure helped to establish the construct validity of the cooperative learning package. The cooperative learning package prepared in accordance with the second year TTC syllabus was evaluated on the basis of opinion of a number of experts in Educational Psychology and Educational Technology. This helped to ensure the content validity of the learning package prepared.
The reliability of the co-operative learning package was established by experts using the Evaluation Schedule. Their observations and ratings indicate that the learning package is highly reliable and practicable. A copy of the Co-operative Learning Package (English version) is given as Appendix-P and its evaluation schedule is given as Appendix-Q. The Malayalam version of the Co-operative Learning Package is given in the CD-ROM as Appendix-E.

4.4.9 Delayed Memory Achievement Test

A delayed memory achievement test helps to find out the retention capacity of the subjects of study. For the present study, a delayed memory achievement test was prepared to check the retention capacity of experimental groups and the control group. The test prepared is almost equivalent to the achievement test with respect to the weightage given to objectives and content. There is slight change in the order and the wording of questions. Standardisation of the delayed memory achievement test was done by following the same procedure adopted for the standardisation of the achievement test. A copy of the Delayed Memory Achievement Test (English version) is given as Appendix-R and its Malayalam version in the CD-ROM as Appendix-E. A copy of the Scoring Key of the delayed Memory Achievement Test is given as Appendix S.

4.5 SAMPLE FOR THE STUDY

"Sampling is the process of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which
they were selected" (Gay, 1996). The sample for the survey part of the study consists of 530 primary level student teachers and 53 teacher educators in the 14 primary teacher training institutes of the Kottayam District. The whole population of the 14 teacher training institutes were included for the study. The sample selected were from aided, government, DIET and unaided teacher training institutes, comprising of both male and female student teachers with qualification of plus two, graduation and above.

The details of the sample selected for the survey with the names of institutions are given in Table 4.6.

Table 4.6
Details of the Sample Selected for the Survey

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Institution</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Govt. TTI, Kottayam</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Govt. TTI, Ettumanoor</td>
<td>38</td>
</tr>
<tr>
<td>3.</td>
<td>CNI TTI, Kottayam</td>
<td>38</td>
</tr>
<tr>
<td>4.</td>
<td>BI TTI, Pallam</td>
<td>39</td>
</tr>
<tr>
<td>5.</td>
<td>St. Teresa's TTI, Changanacherry</td>
<td>36</td>
</tr>
<tr>
<td>6.</td>
<td>B.B.M.TTI, Mundakayam</td>
<td>39</td>
</tr>
<tr>
<td>7.</td>
<td>St. Thomas TTI, Palai</td>
<td>40</td>
</tr>
<tr>
<td>8.</td>
<td>St. Joseph's TTI, Mutholy</td>
<td>39</td>
</tr>
<tr>
<td>9.</td>
<td>V.K.P.M.N.S.TTI, Edammatam</td>
<td>37</td>
</tr>
<tr>
<td>10.</td>
<td>DIET-TTI, Kottayam</td>
<td>38</td>
</tr>
<tr>
<td>11.</td>
<td>St. John, The Baptist TTI, Nedumkunnam</td>
<td>40</td>
</tr>
<tr>
<td>12.</td>
<td>Al-Rashid TTI, Changanacherry</td>
<td>41</td>
</tr>
<tr>
<td>13.</td>
<td>Mangalam TTI, Ettumanoor</td>
<td>45</td>
</tr>
<tr>
<td>14.</td>
<td>Mahadeva TTI, Vaikom</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>530</strong></td>
</tr>
</tbody>
</table>
The distribution of the sample according to sex, management, educational qualification and locale are given in Table 4.7.

Table 4.7

Distribution of the Sample with regard to their Characteristics

<table>
<thead>
<tr>
<th>Category</th>
<th>Status</th>
<th>Number (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>106</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>424</td>
<td>80.00</td>
</tr>
<tr>
<td>Management</td>
<td>Government</td>
<td>134</td>
<td>25.28</td>
</tr>
<tr>
<td></td>
<td>Aided</td>
<td>230</td>
<td>43.39</td>
</tr>
<tr>
<td></td>
<td>Unaided</td>
<td>166</td>
<td>31.33</td>
</tr>
<tr>
<td>Educational qualification</td>
<td>Plus two</td>
<td>303</td>
<td>57.16</td>
</tr>
<tr>
<td></td>
<td>Graduation and above</td>
<td>227</td>
<td>42.84</td>
</tr>
<tr>
<td>Locale</td>
<td>Rural</td>
<td>289</td>
<td>54.52</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>241</td>
<td>45.48</td>
</tr>
</tbody>
</table>

4.5.1 Sample Selected for the Experimental Study

For the study, experimental and control groups were selected from three primary teacher training institutes. Due care was given to representation of factors like locale, sex and type of management. The three categories of teacher training institutions namely aided sector, government sector and DIET sector were given due representation by selecting one institution from each category. The experimental study was comprehensively done in each institution with two experimental groups and one control group. The institutions chosen and the number of student teachers in each of the subsample are given in Table 4.8.
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Methodology

Table 4.8

Institution-wise Break up of the Sample Selected for the Experimental Study

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of School</th>
<th>Management</th>
<th>No. of student teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>C. N. I. TTI, Kottayam</td>
<td>Aided</td>
<td>36</td>
</tr>
<tr>
<td>2.</td>
<td>Govt. TTI, Ettumanoor</td>
<td>Government</td>
<td>36</td>
</tr>
<tr>
<td>3.</td>
<td>DIET-TTI, Kottayam</td>
<td>DIET</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>108</strong></td>
</tr>
</tbody>
</table>

4.6 PROEDURE ADOPTED FOR DATA COLLECTION

The finalised tools of the survey part, i.e., the awareness test and the opinionnaire were administered to a sample of 530 student teachers, taking into account all the necessary precautions to be followed in a survey. Proper instructions were given to them to respond to the items in the tools. The filled in awareness test and opinionnaire were collected back on the day itself.

The investigator collected data regarding the infrastructural facilities and instructional resources available in the 14 Teacher Training Institutes (TTIs) of Kottayam district using the checklist prepared. Views and opinions of 53 teacher educators regarding the use of modern instructional strategies in TTIs were gathered by conducting personal interview with them.

4.6.1 Experiments Conducted

Experimental method was adopted for finding out the effectiveness of modern instructional strategies like computer-assisted instruction and cooperative learning. Three experiments were conducted for
comparing the effect of the strategies selected for the study, with that of the conventional lecture method in learning by student teachers at primary level. The details of the procedure adopted for the experiment are given below.

The subsamples of the study were student teachers of aided, government and DIET management. The total sample of the study was 108 student teachers and each subsample consisted of 36 student teachers. Each subsample was again divided into three groups, considering the previous achievement of student teachers. These groups were Experimental group I, Experimental group II and Control group. The Raven's Standard Progressive Matrices was administered to find out the intelligence level of student teachers in all the three groups. They were all pre-tested with the achievement test prepared by the investigator. The experimental and control groups were taught during the usual hours assigned in the time table for teaching Educational Psychology.

Student teachers in Experimental group I used cooperative learning as the instructional strategy. The Cooperative Learning Package prepared by the investigator was used for adopting this strategy. In Experimental group I, student teachers worked in teams based on the guidelines given. Each team was given worksheets. Team members had to play different roles as contributor, seeker, co-ordinator, encourager and summariser. Each student had the responsibility to make sure that his or her team mates had learnt the material. When the co-operative learning teams had finished their worksheets, the teacher provided answer sheets (scoring key) so that they could check the accuracy of their work. Team mates were expected to discuss and correct any wrong answers and explain the specific reasons why the right answers were right and why and how wrong answers needed to be revised. While the student teachers were working in teams, monitoring of team interaction was done by the teacher on specially prepared monitoring sheets.
When each team member has mastered the content, the instructional phase of co-operative learning strategy was brought to a close.

In Experimental group II, Computer-assisted Instruction was adopted as the instructional strategy. In this group, each student teacher was given a computer-assisted instructional software prepared by the investigator on CD-ROM which could be individually run on a personal computer. They were asked to learn the instructional material. Care was taken to ensure that each student teacher used the computer and the software individually. They were asked to learn at their own pace, the lessons included in the instructional software. They had to qualify a test at the end of each lesson. Immediate feedback was provided to them and they were allowed to proceed to the successive lessons only after successfully qualifying the preceding tests.

In the control group, the investigator herself presented the lessons and made conceptual analysis of the content. She confined her teaching to textual illustrations, examples and explanations whenever possible.

The experiment was conducted for 30 days separately in the three teacher training institutions as detailed under the section ‘Institution-wise Break up of the Sample Selected for the Experimental Study’.

Just after the experiment, student teachers in the three groups were tested using the same achievement test (post-test). In order to compare the retention of student teachers on the topic already learned, a delayed memory achievement test was administered to experimental groups and the control group.
4.7 STATISTICAL TECHNIQUES ADOPTED

The main objective of the study is to assess the awareness and achievement of student teachers regarding the use of modern instructional strategies. For this, the responses and scores obtained through all the tools were consolidated and analysed statistically. Availability of facilities and resources in TTIs and its extent of use were treated statistically using percentages. Items regarding the working condition of the different devices available in the Language Laboratory were included in the Checklist. Since those devices were not available in all the TTIs, it was not statistically analysed. Percentages of responses obtained from the items in the Checklist and the data collected through the interview were also treated statistically.

The chi-square ($\chi^2$) values of the scores obtained for the items included in the awareness test and opinionnaire were found out to understand the awareness and opinion of student teachers regarding the use of modern instructional strategies. The good awareness and poor awareness of the various subgroups of student teachers were tested for significance of difference using 't' test.

In order to find out the achievement of student teachers in the use of modern instructional strategies, 't' test was done using the pre-test, post-test and retention test scores. The classroom intact groups may be similar, but they are not equivalent groups. Since the experiment was conducted using classroom intact groups, Analysis of Covariance (ANCOVA) was applied for analysing the final scores.
CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

- INFRASTRUCTURAL FACILITIES AND INSTRUCTIONAL RESOURCES RELATED TO MODERN INSTRUCTIONAL STRATEGIES AVAILABLE IN PRIMARY TEACHER TRAINING INSTITUTIONS
- AWARENESS OF PRIMARY LEVEL STUDENT TEACHERS ABOUT THE USE OF MODERN INSTRUCTIONAL STRATEGIES
- OPINION OF PRIMARY LEVEL STUDENT TEACHERS ABOUT THE USE OF MODERN INSTRUCTIONAL STRATEGIES
- VIEWS AND OPINION OF TEACHER EDUCATORS ABOUT THE USE OF MODERN INSTRUCTIONAL STRATEGIES IN PRIMARY TEACHER TRAINING INSTITUTES (TTIs)
- COMPARISON OF ACADEMIC ACHIEVEMENT OF PRIMARY LEVEL STUDENT TEACHERS WHO LEARNT THROUGH MODERN INSTRUCTIONAL STRATEGIES AND THOSE WHO LEARNT THROUGH THE CONVENTIONAL LECTURE METHOD
- COMPARISON ON DELAYED MEMORY ACHIEVEMENT OF PRIMARY LEVEL STUDENT TEACHERS WHO LEARNT THROUGH MODERN INSTRUCTIONAL STRATEGIES AND THOSE WHO LEARNT THROUGH THE CONVENTIONAL LECTURE METHOD