Chapter 4

METHODOLOGY

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CHAPTER 4

METHODOLOGY

Research methodology describes the various steps of the plan of attack to be adopted in solving a research problem such as the manner in which the problem is formulated, the definition of terms, the choice of subjects for investigation, the validation of data gathering tools, the collection, analysis and interpretation of data and the process of inferences and generalizations.

Research methods are of utmost importance in a research process. Method is the way of approaching the problem. A pre-planned and well described method will provide the researcher a scientific and feasible plan for attacking and solving the problem under investigation.

4.1 Method Adopted for the Study

The study was conducted to ascertain the effectiveness of two types of pedagogy, Electronic Media Based Instructional Strategy and the Present Activity Oriented Approach in creating Environmental Awareness among the Secondary School pupils of Kerala.

The current research study was experimental in nature, with exact and powerful method for discovering and developing an organized body of scientific knowledge which attempts to provide a precise answer to a precise question. The purpose of experimentation is to derive verified functional relationship among
phenomena under controlled conditions. From an operational point of view, it is a matter of verifying the independent variable in order to study the effect of it on the dependant variable.

The experimental research is not considered as a precise method of research in the field of education because of the complex nature of the human beings and because of the problems of controlling the extraneous variables. However, experimentation has been put to various uses in solving educational problems. It is used to determine and evaluate the adequacy and effectiveness of the educational and instructional objectives through the measurement of outcomes.

4.2 Design Selected

In this study, Investigator has adopted the Pre-test-Post-test Non-equivalent Group Design. This design is used in the classroom experiments when experimental and control groups are taken as regular intact classes. The reason for this is that in a school situation, it is practically not possible to upset class schedules, to gather subjects for obtaining a sufficiently large sample or to recognize classes in order to employ randomization procedure for getting equivalent control and experimental groups.

The present study utilized two groups, the group which was exposed to the experimental treatment is the experimental group and the other group which is exposed to the Present activity Oriented Approach was the control group.
The Investigator in the present study made use of two non-equivalent intact classroom groups, one experimental group and one control group. To compensate for the lack of equivalency between the two groups, the Investigator has applied the technique of Analysis of covariance. A pre test was conducted to the two groups at first. These groups were then randomly assigned to treatments. The experimental treatment was administered to experimental group and the control group was treated with the present activity oriented approach. Then the post test was given to the two groups. The pre-test and post-test were designed to indicate students’ mastery of environmental awareness before and after the application of the Instructional strategies. The difference between the pre and post test scores was compared with the help of appropriate statistical technique to ascertain the effectiveness of experimental treatment and the Present Activity Oriented Approach. The layout of the Design is:

Experimental Group | O1 | X | O2

Control group | O3 | C | O4

In this design,

O1 and O3 are the Pre tests and O2 and O4 are the post tests

X is the experimental group which is instructed using Electronic Media Based Approach and C is the control group which is instructed using Present Activity Oriented Approach.
4.3 Sample Selected for the Study

The population of the study consisted of secondary school students of Kerala following State syllabus. The Investigator adopted simple random sampling technique for the sample selection. Six divisions of Standard VIII students of three schools from Thrissur District of Kerala were selected for the study. St. Aloysious High School, Elthuruth, Little Flower GHS, Olarikkara, and High School Arimpur were the selected Schools. Thus the sample consisted of 215 students from all the three schools in which 90 students were in each experimental and control groups. The layout of the Experimental set up shown in the figure 4.1.

![Figure 4.1 Layout of the Experimental Set up](image-url)
4.3.1. Variables in the Study

A variable is an aspect of a testing condition that can change or take on different characteristics with different conditions. Reducing a phenomenon to variables focuses the researcher’s attention on specific events out of the many that may be related to the phenomenon (Mc Burney, 2001). In this study, independent and dependant variables play a vital role.

4.3.2. Independent Variables

Independent variables are the conditions or characteristics that the experimenter manipulates, or controls in his or her attempts to ascertain their relationship to observed phenomena (Best, 2006). Two strategies of instruction, the Electronic Media Based Instructional Strategy (EMBIS) and Present Activity Oriented Approach (PAOA) were the independent variables in the present study.

4.3.3 Dependent Variables

The dependant variables are the conditions or characteristics that appear, disappear or change as the experimenter introduces removes or changes independent variables (Best, 2006). In this study the dependent variable were the Environmental awareness and Environmental Ethics of Secondary School pupils.
4.4 Tools, Techniques and Materials used for the Study

The instrument employed for collecting data are called tools. The selection of tool is of vital importance for success of a research. It depends up on the nature of the problem and the kind of data required for the study.

The tools used for the present study are:

1. Electronic Media Based Instructional Materials
2. Present Activity Oriented Teaching Materials.
3. Environmental Theory Awareness Test (ETAT)
4. Environmental Application Awareness Test (EAAT)
5. Environmental Ethics Scale (EES)
6. Intelligence Test.

4.4.1 Preparation of Electronic Media Based Instructional Material

All effective instruction requires careful planning. Teaching with instructional media is certainly no exception. A group of academicians Heinich, Molenda and Smaldino in U.S.A (1982) propose a procedural model to which they have given the acronym ASSURE, because it is intended to assure effective use of media in instruction. This model is for designing, Planning and delivering instructions that incorporates electronic media in the actual class room use.
The ASSURE model, a procedural guide for planning and conducting instruction that incorporate media assumes that training really is required, because training is the most obvious solution to performance problem. A full blown process of instructional development would begin with a need assessment to determine whether instruction is truly required. It is meant for use by the individual instructor in planning every day classroom use of media. The acronym ASSURE stands for six steps for designing an instructional procedure such as

a. Analyse Learner
b. State Objective
c. Select Media and Materials
d. Utilize Media and Materials
e. Require Learner Participation
f. Evaluate and Revise

If instructional media are to be not used effectively, there must be a match between the characteristics of the learners and the content of the lesson and its presentation. The first step in the ASSURE model, therefore, is analysis of the learner.

**Analyse Learner**

The first step in the planning is to identify the learners. The learner may be student or trainee; we must know our students to select the best medium to meet the objectives. The audience can be analyzed in terms of
General characteristics (2) Specific entry competencies – knowledge, understanding, skills, attitudes about the topic, and (3) Learning style.

It is not feasible to analyze every psychological or educational trait of the learner. Several factors of the learners, however, are critical for making good media and method decisions. First in the category of general characteristics is broad identifying description such as age, grade level and cultural or socio economic factors. General characteristics are factors that are not related to the content of the lesson. These factors help to determine the level of the lesson and select content, contexts, and examples that will be meaningful to the learner.

Heterogeneous group including learners varying widely in their conceptual sophistication or in their on their first hand experience with the topics can profit especially from an audio visual experience such as a film or videotape. Such media presentations provide a common experimental base that can serve as an important point of reference for subsequent group discussion and individual study.

In the present study, the Investigator analysed the learner’s intelligence and scholastic achievements. To check the intelligence, a Non-verbal intelligence test- The Standard Progressive Matrices (Raven, 1938) was used. The Standard Progressive Matrices has five sets A, B, C, D, and E. each set provides five progressive assessment of a person’s capacity for intellectual activity. 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 super imposing a
stencil-marking key, which also given with the matrices. The Standard Progressive Matrices with 60 problem guides to the Standard Progressive Matrices, answer form and key were made available from the Department of Psychology, University of Kerala. The scale has a re-test reliability varying with age from 0.83 to 0.93.

**State Objectives**

The second step in the ASSURE model for using instructional media is to state the objectives of instruction. In the first place, the teacher must know the correct selection of media and methods. Knowing the objectives will also force to create a learning environment in which the objectives can be reached.

A well stated objective starts by naming learners for whom the behaviour or capability to be learned and the conditions under which the capability will be observed. The objectives may be derived from a need assessment or a course syllabus, stated in a text book, taken from curriculum guide, or developed by the instructor. Where ever they came from, they should be stated in the form of what the learner will be able to do as a result of instruction. Detailed review of related literature, previous experiences and studies of Investigator and the present environmental problem related to various environmental issues were help to state the objectives.
Select Media and Materials.

A systematic plan for using media certainly demands that media be selected systematically in the first place. The selection process will be presented in two steps.1. choosing the appropriate media format and 2. Selecting, modifying or designing specific materials within that format.

Choosing a media format can be a very complex task considering the vast array of media available, the variety of learners and the many objectives to be pursued within most media selection models, the instructional situations or settings, (e.g. large group, small group, or self instruction), learner variables (reader, non reader, or auditory preference) and the nature of objectives. The presentation capability of each media is also to be considered.

Obtaining the appropriate materials generally involve three alternatives.

Selecting available materials.

Modifying existing materials

Designing new materials.

Today electronic media based instructional materials has been recognized by the teacher and educationist as indispensable and integral component of instructional materials despite both formal and informal education. Besides, several, researches have explored the contribution of filmstrips to learning. Various types of video classes and television transmissions are also available.
Their findings provide scientific support for the impression long held by many teachers on the basis of their day-to-day observation. Electronic media based instructional materials are used by teachers for variety of educational purposes. In the present study the Investigator designed and prepared video lessons as the instructional materials.

4.4.2 Preparation of Video Lessons

Like films, the video medium incorporates images, sound and movement. Although relatively a young member in the instructional media family, the video medium has become most popular media option with teachers. The medium has somewhat revolutionized the instruction and has made significant contribution in the area of formal and nonformal education. As the Instructional material choice, video lessons were selected by the present study. In the preparation of video lesson, three main phases are included.

1. Pre-production stage
2. Production stage
3. Post production stage

Pre Production Stage

The Pre production stage is the first stage in video production. It is a critical process that is the most important elements to assure in production. Basic decisions of the production approach are made and planning is initiated during this period. The pre production stage included the following steps.
a) Preparation of Draft Script

b) Preparation of Script

c) Preparation of Story board

During the initial stage of video production, the Investigator in consultation with the guide prepared a video production project outline. After the theoretical modifications, Investigator consulted with a video production specialist about the technical aspects of video production. Then the Investigator prepared an outline of content based on the topics related to Environmental Science in Standard VIII.

**Preparation of Draft Script**

Draft script preparation is the second paper work stage of video production. In this stage the Investigator prepared a brief outline about topics based on the objectives defined. Biosphere, Energy Flow, Environmental problems are the three major area developed for video production. Each major area was divided into different major concepts.

**Preparation of Rough Script**

Script is considered as the software of any video programme. It is considered as the producer’s version of words of play or scenes and words of film. The depth of the script determines the quality of the video programme.
For developing the script, the Investigator analyzed the major concepts of the three major areas of the subject. The major concepts are as follows.

1. The Earth
2. Living and non living things in the earth
3. The Environment
4. Food chain
5. Food Web
6. Relationship of Animals and Plants in the Earth
7. Ecological Balance
8. Environmental Pollution
9. Global Warming

The layout of Content analysis for Video Script Preparation shown in the figure 4.2
Development of Two Columns Script

In video production, the simple facts are known as ideas. The rough scripts were collected and analyzed by the Investigator and developed it into ‘ideas’. Based on the idea the two column script was developed. In the two column script, the first column was used for visual treatment and the second column for audio narration. The video visuals are only rough imaginary sketches of the scene. This two column script was the base of working script or the Story Board. The Sample of two column Script is given in the Figure.4.3.
4.4.3 Preparation of Story Board

Story board is otherwise known as the working script of the video production. It contained a detailed view of no. of shots, types of shots, duration of shots, sound to record, special effects, and spoken words. With the help of story board, a cameraman can shoot the video very easily.
The Investigator developed the story board based on the two column script and consulted with video programme expert and content experts. The edited the story board with the help of these experts. Sample of Story Board given in the figure. 4.4 and the Final Lesson Transcript of Media Based Instructional Strategy is given in Appendices XIV and XV.

<table>
<thead>
<tr>
<th>SL. No</th>
<th>Idea</th>
<th>Type of shots</th>
<th>visuals</th>
<th>narration</th>
<th>music</th>
<th>Special effects</th>
<th>duration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water pollution</td>
<td>LS,MS,CS</td>
<td></td>
<td>Water pollution is one of the main pollution</td>
<td>Natural Sound</td>
<td>Slow</td>
<td>1.minute</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Flow of river</td>
<td>MS,ELS CP</td>
<td></td>
<td>The origin of river is from the Mountains</td>
<td>Natural sound</td>
<td>normal</td>
<td>40/sec</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.4. A sample of Story Board
Methodology

Identification of Topic

Content Outline

Draft Preparation

Rough Script Preparation

Two Column Script

Preparation of Story board Card

- Visual
- Explanation

Discussion

- Story Board cards and notes

Modification

- Art work,
  Computer Design,
  explanatory notes

Figure 4.5. Layout of the process of the Pre-Production stage of Video production
Production Stage

The production stage determined the type of equipments used and transportation facility. In this stage the Investigator selected only the CCD handy cam. With the help of a Sony digital Handy cam, DCR-36 with sufficient no .of mini digital video cassettes, the Investigator recorded the video footages from the nature. For editing the video, Investigator selected high speed Computer with XP professional software having 180GB hard disc, and 2GB of RAM. In addition to that, a licensed semi professional video editing software U-LEAD were also loaded in the computer. For audio capturing Sony Sound forge-8 software was used. A professional SLR camera was used to take still pictures. The equipments used for the preparation Electronic Media Based Instructional Material are given in figure 4.6

![Figure. 4.6. The Equipments used for the Preparation of Electronic Media Based Instructional Material](image-url)
Shooting

Shooting is the taking of footages based on the story board. Story board determined the type of shots to be taken. It include Extreme long shot (ELS), Very long shot (VLS), Medium long shot (MLS), Medium shot (MS), Medium close up (MCU), Close up (CU), Big Close up (BCU) and Extreme Close up (ECU). The angle of shot include High angle (H/A), Low angle (L/A) Bird eye etc. The Investigator had shot different types of footages from the nature based on the story board. The major scenes are taken from Kerala. The samples of shots are given in the figure 4.7.

![Figure 4.7. Samples of Different types of shots taken for the preparation of Video lesson](image_url)

During travelling, the Investigator collected most of the footages, with his handy cam. In addition to that, some video portions were collected from the recorded video discs, internet and Television Channels. Still pictures were also
used for developing the programme. During the production stage, it is very important to keep the shots list card. So Investigator prepared the shots list card to avoid the repeating of shots. Samples of different types shooting are given to the figure 4.8

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**Figure. 4.8. Samples of shooting**

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**Figure. 4.9. Layout of the Process of the Production Stage of Video Production**
Post Production

Post production stage is the third or last stage of video production. After the shooting the video data were processed in this stage. This stage is divided into four sub stages.

   a) Footage review
   b) Editing
   c) Dubbing
   d) Master print development

Footage Review

In this stage, the recorded digital video cassettes were collected and the data were transferred to the computer format. For transferring digital signals from the handy cam, Investigator used a fire wire cable and the capturing cards. This technique was used for avoiding the loss of clarity of the video. The transferred footage was in the form of AVI format. This data were stored in the hard disc of the computer for further analysis. The converted AVI files were viewed by the Investigator to check the quality of the video and removing the dropout footages.

4.4.4 Editing of Video

The editing of video production included two steps, the rough cut of video and the second is linier editing. For editing, U-lead editing software was used. With the help of timeline sorted the good footages. The footages or shots were arranged in a developmental way based on the story board. These different shots
are united to form a sequence. After sequencing the shots, corrected the colours, depth etc. Then sounds separated from the video to audio track present on time line. This technique was used to control the unwanted sounds. Only ten minute duration video data were edited at a time because if the data file has high GB rate it will affect the proper working of the computer. In addition to the video taken by the Investigator, certain still pictures were also included in the video production. Some of the video cuttings from recorded CDs were included in the production. The video Editing stage is given in the figure 4.10.

Figure. 4.10. Video Editing Stage
1. Footage Review

2. Time line and Transition Setting

3. Sound Splitting

4. Sound Mixing

5. Special Effects

6. Title setting

Figure 4.11. Different Stages of Video Production
Dubbing or Sound Editing

A good sound video production included a good sound track. It contained narrated sounds, natural sounds and background sounds. With the help of the sound editing software Sony –Sound Forge, the Investigator recorded the appropriate background music and natural sounds.

Dubbing of Narration

The narration of the visual is very important in a video production the sound modulation is very important. For dubbing the sound track, Investigator viewed the scene and gave the narration simultaneously. After dubbing the narration the volume of sound tracks were adjusted according to the importance of the lesson. All the narration was done by Investigator himself.

Figure. 4.12. Dubbing Stage of Video production
Evaluation / Final Editing of Video Lessons

The edited video and sound file were converted to a temporary drive and it was evaluated by the experts including subject experts and technical experts. After their suggestions the Investigator edited again for rectification of the video.

Production of Final Video Lesson

The edited video files were converted to MPEG format with the help of converting tool present in the software. For the final video production Investigator selected DVD format. Because the clarity of video and sound were better than the VCD file and space can be reduced. The final Video Lessons are given in the Appendix XVI. The layout of the Process of the post production Stage of video production is given in the figure 4.14.
Figure 4.14. Layout of the process of the Post-Production Stage of Video Production

- Footage review
- Editing-I
  (Rough Cut)
- Editing-II
  (Set time line and Split Sound)
- Visual Special Effect
- Dubbing narration
- Musical Special effect and Sound Synchronization
- Evaluation
- Final Editing
- Master Print to CD
4.5 Present Activity Oriented Lesson Transcript

An activity which is planned well in advance, results in successful classroom teaching. Lesson transcript is an Outline of different types of lesson arranged in the order in which they are to be presented to students by the teacher. The present Activity Oriented Lesson transcript prepared based on the theory of Constructivism. According to constructivism, learning viewed as an interaction between the learner and the learning environment.

For the present study, Investigator prepared two column model Activity Oriented lesson plans based on the topic under study. The control group was taught with the help of these lesson transcripts.

4.6 Environmental Awareness Tests

To measure the performance of the students before and after the experiment, two awareness tests (1) the Environmental Theory Awareness Test and (2) the Environmental Application Awareness Test were constructed by the Investigator based on the following topics.

1. Earth for future

2. Relationships in the Earth

3. Environmental Pollution

The test items were objective type consisting of only multiple choice questions. The tests were to assess the student’s environmental awareness level,
which were of 60 minutes duration and carried a maximum weightage of 40 marks each. The same tests were used as pre test and post test. The procedure of test development process included the following steps.

The preparation and standardization of the environmental awareness tests consisted of four major phases such as planning, construction, qualitative evaluation and validation. Each of the four phases had several sub steps.

**4.6.1 Phase 1. Designing the Test plan**

Test development required writing a test plan that operationalizes the test objective which specifies the characteristics of the test, including an operational definition of the construct and content to be measured. (The testing universe), the format for the questions (what items and test formats or layout should be used), and the administration.(why, Where, and How should the test be given), and scoring the test(How should the completed test papers be scored and evaluated). The major steps included in this phase are (1) Defining test universe, target audience and test purpose (2) defining the construct and content to be measured and (3) preparing the blue print.

**1. Defining test universe, target audience and test purpose**

The testing universe is the body of knowledge or behaviour that the test represents, the target audience is the group of individuals to be tested, and the purpose of the test is the information that the test will provide to the test user.
To define the testing universe, the Investigator identified what the students learn from the instruction. The Investigator considered the relative importance of the objectives determined not only what materials should be included in the test, but also specify the form of test.

While defining the target audience, the Investigator made a list of characteristics of the persons who will take the test. Here the target audience was the secondary School pupils of Kerala.

Defining the test purpose includes not only what the test measures but also how the test users will use the test scores.

2. Defining the Construct and Content to be Measured

After reviewing the literature about the construction of the test and other available tests, the Investigator wrote a concise definition of the construct which includes operationalizing the construct in terms of observable and measurable behaviour.

The definition also provided boundaries for the test domain by specifying what should be excluded that is not appropriate for testing. In the present study, the Investigator selected the cognitive domain as the major construct for the development of environmental awareness tests.

Based on the educational objectives of Environmental Education put forwarded by UNEP (1975) such as Knowledge, Understanding (Awareness),
Application, Skill, Interest and participation an outline of the educational
objectives to be measured in the Environmental Awareness Tests were prepared.

4.6.2 Phase 2. Preparation of the Draft Tests

After analyzing the content of the topics and in consultation with guide
and biology teachers in the field, prepared several questions lying under the
objectives knowledge, Understanding and the same were converted in to
application level.

Preparation of the Test Items

Multiple choice questions were prepared for the tests because such
question can be easily objectively graded than essay or short answer type
questions and more difficult to answer correctly without the required knowledge
than true- false questions. Scores on multiple choice items are less affected by
guessing than scores on the other objective questions. Furthermore, useful
diagnostic information may be obtained from an analysis of the incorrect option
selected by examinees such as items are less- time consuming and easier to
complete, and scoring and processing simpler (Babbic, 1975; Gron Lund,1993).
Hence, the multiple choice format was chosen in the present study.

A multiple choice an item are designed for objective measurement
and contain a stem and four responses, one of which is the best answer (Airasian,
1994). An items must have at least three distracters or answers to be classified as
multiple choice.(Thorndike, 1991).although three answers are acceptable to
decrease guessing, (Gronlund, 1993), four answers were included in the present study. The choice of distracters is important as it permits control of item difficulty (Thorndike et al., 1991). A test taker who does not know the correct answer for a multiple choice item with four responses has ‘one in four’ (25%) chance of guessing the correct answer.

The stems of items were constructed as questions and statements (Gronlund, 1993). The rules for item construction were applied in drafting the items. Clarity, precision and relevance of items and avoiding double barred and biased items were some of the requirements that the Investigator paid much attention. The items were also constructed in a manner to ensure that information given in one did not provide an answer to another. The distribution of answers to the four alternatives was also positioned randomly to ensure that each alternative was equally represented as the correct answer (Thorndike et al., 1991). A critical factor in determining the effectiveness of multiple choice items is the selection of distractors. Here the Investigator employed rational approach in selecting the appropriate distracters.

**Assembling the Test**

The prepared tests were again reviewed and edited by experts in the field of Environmental Science and Basic science teachers. The list of experts who reviewed tests was attached in the appendix VI. According to their valuable suggestions the Investigator made changes for improving the items. Before assembling the test, appropriateness of the length of the test for the time limit
were also considered. The information regarding the test directions were also included in the information page. Based on the suggestions put forwarded by the experts, the Investigator developed the first draft of the Environmental Theory awareness Test which contain seventy multiple choice items with adequate instruction. The same procedure was followed in the preparation of Environmental Application Awareness Test

4.6.3 Qualitative Evaluation of Items by Experts

Items so prepared were given to another panel of experts along with the operational definition to see whether the given items really match to the particular levels of objectives and content areas. The nature and meaning of questions converted from the objective Understanding to Application level also evaluated here. The experts are selected from the field of Biology teachers and Environmentalists. The list of experts is given in the appendix VI.

The review panel checked whether the task is clear in each item and gave necessary direction for the modification and changing the structure of each item. This part of the review before the pilot study helped the Investigator to avoid difficulties in sentence making during the question framing, complexity of language, selection of distracters etc. The Investigator made correction and modifications in the items based on the suggestions from the experts and developed the final draft of Environmental Awareness tests containing sixty multiple choice questions.
Preparation of Scoring Key

In order to maintain objectivity the scoring procedure, a scheme of evaluation was prepared by the Investigator. This includes a scoring key for the draft tests, showing the number of items and correct answers. The scoring scheme of the test was one mark for each correct answer and zero score for every incorrect answer. (The Tests and Scoring key of the draft tests were given in the appendices I -IV).

4.6.4 Phase 3. Qualitative Evaluation

Pilot testing – Item Tryout.

After test item was drafted and properly reviewed, they were subjected to pilot testing in order to demonstrate that they are suitable for use with the intended population of students. The drafted item may contain an error or subtle ambiguity or may be too hard or too easy for the students. Only a pilot testing can reveal whether the item will work as intended.

Here the Investigator administered the draft of Environmental Theory Awareness Test and Environmental Application Awareness Test in order to identify the appropriateness of the items in the tests. Govt. high School Poonkunnam and Sri Ramakrishna Asramam high school, Thrissur were selected for the item try out.

After getting the permission from the school authorities, the Investigator with the help of subject teacher administered the draft Environmental Theory
Awareness Test to one hundred 9th standard students who was already learned the topics. Enough time was given to the students so as to enable them to complete the list. After two hours the Investigator administered the draft Environmental Application Awareness Test to the same pupils. The response sheets were collected and scored strictly in accordance with the prepared scheme of evaluation.

The pilot study helped the Investigator to find out the difficulty of each item; to identify distracters which do not appear plausible; to assist in determining the precision of the test and suggests the number of the test item for the final test; to establish the contribution of each item to the discrimination between candidates who achieve at a high level and those who do not; to check the adequacy of the administration instruction and the time required for most students to complete the test; and to identify misconception held by the students through the analysis of students responses.

**Item Analysis**

The item analysis is an important phase in the test construction. If an item is too easy, too difficult, failing to show a difference between skilled and unskilled examinee or even scored incorrectly, an item analysis will reveal it. Item analysis involves the statistical analysis of the results of the item try out to identify which item can be retained and which need to be either revised or discarded. (Nunnally, 1972). Only those items meeting the analysis criteria were retained for the final test. Gronlund, (1993) indicated that the item analysis
procedure for norm-referenced tests should provide information on item difficulty, discrimination power of item and effectiveness of each alternative.

In this step statistical methods were used to identify the test items that are not working well, the three statistics were used in the item analysis were (1) the item difficulty, which is a measure of the proportion of examinees who responded to an item correctly. (2) Item discrimination, which is a measure of how well the item discrimination between examinees who are knowledgeable in the content area and those who are not. 3. Distracter analysis which is a measure of how well each of the incorrect option contribution to the quality of a multiple choice item.

**Item - Difficulty Index**

The item difficulty index indicates the percentage of respondents who answer an item correctly. (Nunnally, 1972, Thorndike et al., 1991) it was calculated so that only the item with suitable difficulty indices were included in the list. For the present study the procedure and formula suggested by Ebel and Frisbie (1991) were used to determine the difficulty index and discrimination power of each item in the draft test.

\[
\text{Difficulty index (p)} = \frac{U + L}{2N}
\]

Where, \( U \) and \( L \) are the number of the right answers in the upper and lower group and \( N \) is the number of students in each group.
The p value of the item difficulty provided an accurate indication of how difficult item was for the test takes in the pilot study. The difficulty index, the proportion of students answering correctly, can range from 0.00 to +1.00. For multiple choices Test consisting of four or more alternatives, item in the range between 0.35 and 0.85 should be selected (Nunnally, 1972,). This criterion was used in the test. All items found to be easy or proved to be too difficult were excluded.

**Item Discrimination**

The discrimination power was calculated by using the formula

\[
\text{The discrimination power } U-L/N, \text{ where,}
\]

\[
U=\text{correct responds in the upper group}
\]

\[
L=\text{correct responds in the lower group}
\]

\[
N = \text{Number of students in each group}
\]

For this calculation, the Investigator divided each (environmental theory awareness and Application awareness) test takers in to three groups according to the scores on the test as a whole, an upper group consisting of 27%, who had the highest scores, a lower group consisting 27%, who had the lowest scores, and a middle group consisting of the remaining 46%.
Murphy and David Shofer, (1994) suggest that any percentage from 25% to 35% may be used to form the extreme groups with little difference in the resulting discriminating index. The discriminating index is determined by subtracting the number of students who answered the item correctly in the lower group, from the number of students who answered the item correctly in the upper group and dividing the difference by the respondent number in the group (Thorndike et al., 1991). The item for which has a discrimination index of below 0.20 are poor discrimination and were eliminated. Item having difficulty index between 0.40 and 0.60 and discriminating power above .4 were taken for the final test. The Difficulty Index and Discrimination power of draft tests were given in the appendix V.

**Distracter Analysis**

One important element in the quality of a multiple choice item is the quality of the item distracters. However, neither the item difficulty nor the discrimination index considers the performance of the incorrect response options or distracters. A distracter analysis addresses the performance of the incorrect response option. It was mentioned in the developing item section, that distracter must be plausible. This suggests that for norm referenced tests, some students should be attracted to every distracter, ideally; at least one person should select each one of the incorrect options. If does not happen, the option should be reviewed for plausibility.
The percentage of respondents who indicated each of the alternatives- a, b, c, d as their answer were computed to determine the distracting ability of the alternatives. If a distracter appears so unlikely that almost no examinee will select it, it is not contributing the performance of the item, in fact, the presence of one or more implausible distracters in a multiple choice item can make the item artificially for easier than it ought to be. The proportion of examinees who selected each of the distracters was very informative. A useful standard to apply, regardless of the number of the alternatives, is to replace those alternatives which are not choose by at least 5% of the respondents by a more plausible alternatives, as that alternatives could not be regarded as a good distracter.(Nunnally,1972). Hence, alternates which were not chosen by 5% or less of the respondents were discarded in the study.

4.6.5 Preparation of Final Tests

After the tryout of the draft test, the final tests in Environmental Theory Awareness and Environmental Application Awareness were developed based on the Environmental educational objectives. In the final tests forty multiple choice questions are included.

Weightage to the Objectives

The tests were designed to assess the Environmental Theory Awareness and Environmental application awareness. The objectives selected by the Investigator for construction of Environmental Theory Awareness Test were
Knowledge and Understanding. Out of forty scores, nineteen scores were for knowledge and twenty one for understanding. For Environmental Application Awareness Test, Investigator selected the objective Application. Forty questions were included in this test. The details are shown in the table 4.1 and 4.2.

**Table.4.1**

Weightage given to the Objectives in the Environmental Theory Awareness Test

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>objectives</th>
<th>marks</th>
<th>Percentages.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
<td>19</td>
<td>47.5%</td>
</tr>
<tr>
<td>2</td>
<td>Understanding</td>
<td>21</td>
<td>52.5%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table.4.2**

Weightage given to the Objectives in the Environmental Application Awareness Test

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Objective</th>
<th>marks</th>
<th>Percentages.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Application</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

**Weightage to the Content**

A content analysis provides a summary of the intentions of the curriculum expressed in content terms. In this step the Investigator analyzed the content thoroughly and found out which content to be covered in the environmental Theory Awareness test and its significance sections.
The three topics from basic science of standard VIII, Environmental Pollution, Earth for Future and Relationships in the Earth formed the content domain. Items that measured the same learning outcome (Gronlund, 1993) or deal with the same content (Thorndike et al., 1991) are usually grouped together. The three topics were divided into six units and adequate weightage were given to each unit. Since the Environmental Application Awareness Test items are the conversion of the same Knowledge and Understanding questions of the Environmental Theory Awareness Test, the weightage given to the content for the two tests are same. The details are shown in table 4.3

Table 4.3

Weightage to the content given in the Environmental Theory and Application Awareness Tests

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Content</th>
<th>No of Questions</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environment</td>
<td>13</td>
<td>13</td>
<td>32.5</td>
</tr>
<tr>
<td>2</td>
<td>Ecological relationships</td>
<td>6</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Water Pollution</td>
<td>7</td>
<td>7</td>
<td>17.5</td>
</tr>
<tr>
<td>4</td>
<td>Land Pollution</td>
<td>5</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>5</td>
<td>Air pollution</td>
<td>7</td>
<td>7</td>
<td>17.5</td>
</tr>
<tr>
<td>6</td>
<td>Sound and radiation Pollution</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>40</strong></td>
<td><strong>40</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Weightage to the Difficulty Level

Based on the difficulty level, the items were in the test were classified into easy, average, and difficult. Proper weightage was given to each difficulty level. As per the try out results of Environmental Theory Awareness Test and Application awareness test were made same by selecting only the items coming in between 0.4 and 0.6 difficulty index. Therefore the weightages given to the Difficulty level of two tests were also same. The details of difficulty level of Environmental theory and application awareness tests were shown in table 4.4.

Table: 4.4

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Difficulty level</th>
<th>No. of Questions</th>
<th>Percentages of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easy</td>
<td>12</td>
<td>30%</td>
</tr>
<tr>
<td>2</td>
<td>Average</td>
<td>17</td>
<td>42.5%</td>
</tr>
<tr>
<td>3</td>
<td>Difficulty</td>
<td>11</td>
<td>27.5%</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>40</td>
<td>100%</td>
</tr>
</tbody>
</table>

Blue print of the Environmental Theory and Application Awareness tests

A test blue print or table of specifications ensures that the teacher will not overlook details considered essential to a good test. More specifically, it ensures that a test will simply whether learning has taken place across the range of (1). Content areas covered in class and reading and (2). Cognitive process
considered important. The blue print of the two awareness tests were shown in the table 4.5 and 4.6. The final Question Papers and Scoring key were included in the appendices VII-XII.

Table 4.5

Blue Print of the Environmental Theory Awareness Test

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Knowledge</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy</td>
<td>Average</td>
</tr>
<tr>
<td>Level of Question</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our environment</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Food relationship in the environment</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Water pollution</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Land pollution</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Air pollution</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Sound Pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 4.6

Blue Print of the Environmental Application Awareness Test

<table>
<thead>
<tr>
<th>Objective</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy</td>
</tr>
<tr>
<td>Our environment</td>
<td>3</td>
</tr>
<tr>
<td>Food relationship in the environment</td>
<td>5</td>
</tr>
<tr>
<td>Water pollution</td>
<td></td>
</tr>
<tr>
<td>Land pollution</td>
<td>1</td>
</tr>
<tr>
<td>Air pollution</td>
<td></td>
</tr>
<tr>
<td>Sound Pollution</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
</tbody>
</table>

4.7 Environmental Ethics Scale

In the present study, the Investigator used another standardized tool – the Environmental Ethics Scale standardized by Haseen Taj (2005). It includes 45 items in the form of statements. Each one is followed by three responses, viz – I agree absolutely, I slightly agree, and I don’t agree. The subject is asked to indicate his or her response to the different statements. Out of 45 statements, 8 are
positive statement and 37 are negative statements. For positive statements a score of three (3) is given to I agree absolutely response, a score of two (2) for slightly agree response and a score of one for don’t agree response. For negative statements, the scoring is reversed. A subject can get a maximum score of 135. There is 30 to 45 minutes were taken for completing the questionnaire. The Reliability of the test was 0.88. Table 4.7 shows the total number of positive and negative items with serial numbers of Environmental Ethics Scale. Investigator converts the English version of the Environmental Ethics Scale to Malayalam without losing the meaning of the statements and applied. The Environmental Ethics Scale was given in the Appendix XIII.

<table>
<thead>
<tr>
<th>Type</th>
<th>Serial number of items</th>
<th>Total No. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>9,16,19,21,22,23,24,42</td>
<td>8</td>
</tr>
<tr>
<td>Negative</td>
<td>1,2,3,4,5,6,7,8,10,11,12,13,14,15,17,8,20,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,43,44,45</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

**4.8 Procedure Adopted**

The experimental study was conducted to ascertain the effectiveness of the EMBIS and PAOA in creating Environmental Awareness among the secondary school pupils of Kerala. The data collection was carried out in the following phases.
1. Pre-test conducted

2. Learning by the experimental and control groups

3. Post test conducted.

**Pre-Test Conducted**

The Investigator in the present study made use of one experimental group and one control group. Before starting the experiment, the Investigator administrated the intelligence test, environmental awareness tests and the environmental ethics scale for the two groups. The scores collected were subjected to statistical analysis.

**Learning by the Experimental and Control Groups**

The present study conducted aimed to experiment the effectiveness of EMBIS and PAOA on creating the environmental awareness among the secondary school pupil. The procedure adopted for the study was as follows. The Investigator prepared and standardized the two environmental awareness tests and the same was used as both pre-test and post test to measure the performance of students before and after the experiment. The experimental group was taught through EMBIS with LCD projector with sound in a semi dark room. Each EMBIS material consists of twenty minutes duration. The control group was taught through PAOA. The two groups were given equal attention during the course of the experiments.
**Post Test Conducted.**

Immediately after the completion of the teaching, the Investigator once again administered the same awareness tests to the two groups. Prior information regarding the date on which the awareness tests will be administered was given. The tests were administered in same days with adjacent periods. The score obtained were then analyzed by using statistical techniques and the comparison of the two groups was done to ascertain the effectiveness of EMBIS and PAOA on creating Environmental Awareness among the Secondary School Pupils of Kerala.

### 4.9 Statistical Techniques Used

To study the effectiveness of EMBIS and PAOA on creating the environmental awareness among the secondary school pupil, the Investigator compared the means of the post tests scores of the students in experimental and control groups. In order to find out whether there was any significant difference between the means of the post test scores of the students in the two groups, the pre tests scores and post test scores of students in experimental and control groups were subjected to the following statistical techniques.

1. Mean
2. Standard Deviation
3. Critical Ratio