III METHODOLOGY

3.1. INTRODUCTION

Research methodology gives an outline of specific operational steps involved in the present study. Details of the research design, design of instructional packages, construction and validation of tool, distribution of the sample and the methods adapted in treating the samples with different environmental education instructional materials and data gathering procedures are described in this chapter.

3.2. RESEARCH DESIGN

Research design appropriate for the problem under investigation was planned and executed. Instructional materials for three strategies were prepared. Since knowledge and attitude are complementary to each other, separate tools to evaluate these aspects were constructed.

Pilot study was planned at three stages. The first one was to be done by the researcher herself in order to have first-hand experience in executing the programme and make relevant changes in the instructional materials wherever necessary. Pre-test was administered and the scores were used to validate the tools.

The second pilot study was carried on by experienced practising teachers and inputs were obtained. Necessary changes were made in the instructional materials to ensure feasibility of the treatments.

After selecting suitable (convenient) sample based on independent variables, treatment was carried out during the second term of academic year as per the plan of the school, thus eliminating any disturbance to the regular functioning of the schools. Learning took place during science periods of class time table and was carried on by the respective science teachers, thus preventing any distraction during treatment.
In each school, only one instructional material was employed and hence there was no transfer of experience from pupils taught using one strategy to those taught using another strategy.

A total of eight periods of forty minutes duration each was the planned duration of treatment. However, as attempts to control learning time are likely to create artificial conditions that are in opposition to the principles of good teaching (Sharma, 2003), teachers were given freedom regarding duration of treatment.

3.3. ENVIRONMENTAL EDUCATION CONCEPTS UNDER STUDY

In schools, environmental education was included in the curriculum both as interdisciplinary subject and multidisciplinary subject and hence concepts drawn from both the sources namely, science textbook and environmental education book of standard eight of state board syllabus for Tamil Nadu were taken up for the study. Broad areas of the content and the concepts of environmental education considered for the present study were:

Noosphere included waste management - ways to minimise waste, solid waste disposal - land fill method, composting and burning of combustible waste, role of micro organisms in waste disposal, role of earthworm in decomposition - vermiculture, sewage management, treatment of sewage, septic tank and environmental biotech. Impact of population growth on ecosystems, human settlements and land distribution, stress due to population growth on social facilities and civic services, increase in consumption, encroachment on monuments, changing life styles with increased use of plastics and detergents.

Biosphere included balance in nature, ecosystem, interaction between living and nonliving components, structure and function of ecosystems, energy flow through ecosystems-food chain, food web and food pyramid. Vegetation types, phyto - geography, vegetation and animals in relation to climatic zones of the earth, arctic zone, north temperate zone, tropical zone, south temperate zone, vegetation of sea shore, mangrove vegetation or halophytes and their adaptations.
Pollution included air pollution - causes, effects and possible solutions, green house effect, depletion of ozone layer and acid rain. Water pollution - causes, effects and methods of prevention - eutrophication and toxicity caused by DDT. Soil pollution, causes, effects and methods of prevention, biological magnification and its implications.

Natural Resources included water - fresh water sources, rain water harvesting, composition of water, different types and forms of water, hydrological cycle, sources of water-rain water, well water, sea water, importance of ground water table and certain factors that affect ground water table. Renewable and non-renewable sources of energy, availability and potential in the Indian context, renewable sources-solar, wind, tidal, biomass and hydro-energy including bio-wastes, non-renewable sources-coal, petroleum and its products, nuclear energy and natural gas.

3.4. MEANS AND MODES OF ENVIRONMENTAL EDUCATION

The most preferred and advocated mode of environmental education is outdoor experiences in the form of field trips, nature trails, culture trails, visit to zoos, museums, botanical gardens, science parks etc., or participation in clean green projects, campaigns, field work, environmental quality monitoring etc. Due to paucity of time, financial implication, limitations of these programmes and restrictions imposed by the educational authorities who are hesitant to send pupils outside school campus the researcher had to limit the study on those strategies which can be carried out inside the school campus.

Projects, speeches by experts, exhibitions, e-learning, audio-visuals, screening of films, self learning, library usage, multimedia, activity etc., are some of the methods employed in schools. The following criteria were taken into consideration in deciding the strategies to be employed in the present investigation:

- the strategy should be suitable for usage in the existing classrooms.
- the technical support required must be available in the school campus,
- it must be suitable to learn all the environmental education concepts prescribed for standard eight,
- it must be suitable for the age group and
- each strategy must be distinctly different from the other in their format and approach.

Taking into consideration of these criteria the researcher selected activity strategy, instructor controlled multimedia strategy, visual strategy and conventional strategy. The educational implications of the above strategies chosen for the present investigation are given in the ensuing paragraphs.

3.4.1 Activity Package

Studies on cognitive development reveal that student participation is the key to the success in learning. Through active participation, learning becomes internalised and becomes a part of learner’s cognitive structure. It also becomes meaningful and permanent. Piaget’s theory of cognitive development and Bruner’s theory of concept formation support this belief. Learner-centred activities such as learning-by-doing, field study, experimentation, group discussion, games, role playing, project work, problem solving and inquiry approach are some of the active learning techniques which bring about maximum learner participation.

According to pragmatism, learning always occurs as a result of movement in activity. The teacher has to capitalise upon the activities of children to direct the teaching - process. Rabindranath Tagore advocated that the child must express himself with his whole body. The education of the body should have contact with air, water, earth and light. Through the employment of the whole body, thought and emotions must be accompanied. Mahathma Gandhi wanted to keep the student engaged in many activities, throwing them from one excitement to another, which will provide to each pupil hectic activity and scope for showing creative genius and organising capacity. His aim was to grow aesthetic, moral and artistic potentialities that are Gandhian principles of “Learning by doing”

Activity strategy has all the features of participatory learning, wherein, the process of learning happens both physically and mentally. The pupils collect the data, organise them in tables and graphs and present it in the class, leading to meaningful discussions. They engage in field work within the
school campus. Issue based learning and case studies develop cause-effect relationships and ability to solve environmental problems. Enacting a drama develops a feeling of empathy for the characters they play and find solutions to the problems posed. Performing experiments and analysing the results develops a scientific inquiry and attitude among pupils.

Activities relevant to environmental education concepts were taken from activity guides prepared by Centre for environmental Education, Ahmedabad. Some of them were devised by the investigator and also by other school teachers.

Activities relevant to the environmental education concepts selected for the present study and suitable for the level of the pupils were planned. Some of the activities were drawn from activity manuals produced and published by Centre for Environmental Education, Ahmedabad. Most of them were designed by the researcher and a few by practising school teachers. The activities comprise of surveys, games, experiments, completing the stories, issue based discussions, a drama and a puppet show. A copy of the activity manual is placed in Appendix No IV in the form of a booklet.

3.4.2 Instructor Controlled Multimedia Package

In this age of technology multimedia is a very popular medium. It means integration of sound, still images, animation, video and text along with computing technology. Thus the incorporation of visual and audio into teaching makes the teaching learning process more interesting. The use of this technology in education is cost effective and would have greater impact on learners than other media. There is rich evidence to support positive impact of multimedia packages on learners.

Computer has entered all educational sectors. To face and survive in a rapidly changing society, teachers must have basic skill and capacity to use this modern technique. Course relevant multimedia packages must be available to the teachers to organise easier, better and quicker learning. Hence the researcher chose instructor controlled multimedia as one of the strategies for the present study.
This strategy employed power point along with audio tag recorded by the researcher. The content material was first organised into a comprehensive sequence of concepts. Then those concepts were explained using clear and easily flowing sentences, simple and relevant vocabulary accompanied by voice modulation suitable to the concepts and the age group.

Photographs and video clippings were obtained from google, environmental education text books and the library of multimedia developer.

Some photographs were obtained from Environmental Education text books and internet. Video clippings were obtained from internet and from the archives of the multimedia producer. Compact disc with the multimedia is presented in Appendix No V.

3.4.3 Visual Aids Package

There is a very simple saying, but very meaningful, “I hear and I forget, I see and I remember”. One picture is equal to hundreds of words. Though visual medium is traditional, it is regarded as the most powerful of all the senses through which we see, perceive and visualise everything. But it should be clear, lively and meaningful.

The investigator made models, charts, flash cards and graphs. The help of school drawing master was sought for drawing pictures. Posters were obtained from Centre for Environment Education, Ahmedabad.

The researcher prepared charts, models and flash cards and took the help of an art teacher to draw pictures. Posters were purchased from the Centre for Environment Education, Ahmedabad. Due care was taken to use visual aids wherever necessary. Charts on the causes and effects of various types of pollution were prepared to help the children understand difficult concepts.

3.5. DESIGN OF INSTRUCTIONAL MATERIALS

A brief account of the materials used in the above mentioned strategies, topic-wise, is furnished below.
Content area – Noosphere

Topic: Waste Management

i) Activity strategy

- A survey form about type of waste generated at home and the method of disposal at present and a different form to collect information about waste materials 50 years ago were used. This had to be followed by comparison and discussion on eco-friendly methods of disposal of waste material;

- A procedure for vermicomposting was given. This was meant to develop the skill of vermicomposting.

ii) Multimedia strategy

- Pictures accompanied by suitable explanation were employed to learn about the structure and processes involved in gobar gas plant, septic tank, vermitech, incinerator and sewage treatment plant;

- Video clippings were used to convey the importance of segregation of waste; to explain the harmful effects of polluting river water with domestic sewage and industrial effluents and to elaborate on air pollution caused by burning garbage in open.

iii) Visual aids strategy

Charts on harmful effects of sewage and posters on garbage eclipsing the earth were used. Posters entitled ‘Save earth’, ‘How to break the vicious cycle of garbage’, ‘Segregation of waste and the process of composting left-over food’ were used to explain the eco-friendly methods of disposal.

Topic - Population - Global Challenge

i) Activity strategy

- Charts on population explosion were prepared by students, in groups, and the effects were discussed;

- A survey form was used to collect data about the usage of plastics in commercial places and this had to be followed by a discussion on the possible methods of reducing, reusing and recycling waste materials;
• Quantity of domestic usage of detergents was found by undertaking data collection and their harmful effects were discussed during the discussion session that followed;
• A survey was used to find the present land usage pattern and the changes that have come over the past 50 years, in the home range of the students;
• Consequences of over-exploitation of resources and health hazards caused by changing lifestyles were reinforced by a case study about a place called Sonara;
• Sustainable development methodologies were discussed using a case study on industrial revolution versus protection of sanctuaries.

ii) Multimedia strategy
• Graphs and tables were used learning the concept of population explosion; Video clippings - on garbage-filled open drains, sewage canals blocked with plastic and leading to flooding in cities - were shown to depict the effects of changing lifestyles.

iii) Visual Aids strategy
Posters titled ‘City highlights’ and ‘A Green future’ were used to explain changing lifestyles and sustainable growth respectively.

Content area - Biosphere

Topic-Balance of Nature

i) Activity strategy
• Students acted as various components of nature and formed food chains in different ecosystems to learn the constituents of ecosystems;
• The concept of food web is understood by forming a food web themselves and enacting the effects of external forces acting on ecosystem by removing various components;
• Display of food pyramid with students as actors.

ii) Multimedia strategy
• Pictures depicting various food chains, food webs and food pyramids were used to explain the concepts;
• A video clipping on Nilgiri hills was also used to show what an ecosystem is.

iii) Visual Aids strategy
Colourful charts with pictures of food chain, food web, food pyramid and aquatic biodiversity were used to help the students visualise the complex and delicate interrelationships in the ecosystems.

Topic-Vegetation Types

i) Activity strategy
• The game “where is my home?” was played in the participatory learning of climatic zones of the earth and the flora and fauna inhabiting it;
• The experiment “Too salty for me” was conducted to know that plants living in fresh water are not adapted to live in brackish water.

ii) Multimedia strategy
• Each climatic zone was shown on the world map accompanied by a description of the climatic conditions and picture of plants and animals inhabiting it;
• Halophytic adaptations were described using pictures of Rhizophora with respiratory roots and viviparous germination.

iii) Visual Aids strategy
Charts showing various climatic zones of the world and Rhizophora with respiratory roots and vivipary were used.

Content Area-Pollution:

Topic: Air, Water and Soil Pollution

i) Activity strategy
• A drama was enacted by the students to elicit the effects of air, water, soil and noise pollution and the need to take immediate action;
• A shadow puppet show discussing the causes and remedies for different types of pollution was performed by the students;
An experiment was performed to demonstrate the algal bloom in water bodies, caused by runoff of fertilisers and mixing of sewage loaded with organic matter;

A platform to analyse the various facets environmental issues and arrive at conclusions was created, by presenting a case study titled “Choose between factory and pure water”.

ii) Multimedia strategy

Sources of air pollution like industries and thermal power plants were detailed with pictures. Air pollution and global warming were portrayed using pictures like-melting glaciers of Mount Kilimanjaro and Mantanna of United States (taken in 1938 & 1981), declining Arctic ice cover, healthy corals versus bleached corals, disappearing ponds of Alaska and change in rainfall leading to seasonal and unexpected floods;

Thinning and hole formation in Ozone layer around the earth were articulated with photographs;

Pictures on the effects of acid rain were used;

Solutions to counter air pollution were discussed using pictures of Electro-static precipitation, water towers and alternate sources of energy like energy from waves;

Sources and impact of water pollution were shown in the following photographs-spraying of pesticides, symptoms of pesticide poisoning and arsenic poisoning;

The process of Eutrophication and death of water bodies was taught with a video clipping.

iii) Visual Aids strategy

Charts showing sequences leading to acid rain aided in explaining the phenomenon;

The thickness of Ozone blanket around the earth was shown in a chart, to explain the protective role and importance of this layer. The various levels of thinning and formation of hole due to Chlorofluorocarbons were also depicted;
• The causes and effects of air pollution and water pollution were charted to aid in summing up the discussion;
• The process of Bioaccumulation of pesticides and the effects of Bio-magnification at various tropic levels were shown in a pictorial format;
• The topic was concluded using a poster aid titled, “Act now to make a difference for our environment”

Content area - Natural Resources

Topic – Water

i) Activity strategy
   - An demonstration was conducted to visualize the proportion of different forms of water available on earth;
   - Students conducted an experiment to understand the process of water cycle and its capacity to yield fresh water continuously.

ii) Multimedia strategy
   - Pie diagrams depicting different forms of water was used to highlight the limited availability of fresh water;
   - The phenomenon of water cycle was explained with pictures;
   - Groundwater exploitation and its diversion for non-agricultural purposes by the farmers were discussed using pictures;
   - The procedure of rain water harvesting was explained in a video clipping.

iii) Visual Aids strategy
   - Charts were used to help in visualising water cycle and a model was used for rain water harvesting.

Topic-Energy

i) Activity strategy
   - A group activity was done to find the impact of various energy choices available in our day-to-day life;
   - A model of solar cooker was constructed and tested by the students;
- To learn about the complexities faced in the choice of energy sources, an issue-based discussion was carried out using a half story titled ‘Choosing between Dam and Livelihood’.

ii) Multimedia strategy
- Pictures on tapping solar energy, nuclear power generation and sources of nuclear energy were used for explaining the available sources of energy;
- Video clippings of power generation in wind mills, potential of hydropower in electricity production and use of fossil fuels as energy source were employed.

iii) Visual Aids strategy
- Charts on wind, solar and hydro power generation were used to explain the different types of energy available for use;
- Posters urging to use green modes of transportation were used to highlight an energy-saving and eco-friendly lifestyle.

3.6. DEVELOPMENT OF THE TOOLS

Tools to measure the effects of above mentioned strategies were constructed based on the expected learning outcomes stated as follows:

At the end of application of the above strategies each pupil

- Improves awareness about environmental concerns.
- Develops understanding of ecological principles.
- Develops concern for environmental problems.
- Commits him/herself for environmental protection.
- Demands action to promote conservation of natural resources

Learning outcomes expected in environmental education were under two domains namely cognitive and affective. Hence the investigator prepared an achievement test, designed to measure cognitive domain and an attitude scale meant for testing affective domain.
3.6.1 ACHIEVEMENT TEST

Achievement test containing 100 items with a variety of test items namely, multiple choice (55), fill in the blanks (10), match the following (10), and true or false (25) was prepared giving due consideration for all the content areas.

The total of 100 items prepared in both Tamil and English were scrutinized by a panel of experts in education, namely two senior school teachers, two Head Masters, and three Professors in the Colleges of Education in terms of appropriateness, concepts, teaching learning outcomes, clarity, specificity, brevity, objectivity and refinement of the items. The items on which queries were raised, clarifications were sought and modifications suggested by the experts were executed.

Pilot study was conducted by the investigator herself in order to ascertain the validity of the tool. The tools and the answer sheets were given to twenty five students who were not given any treatment on environmental education in that particular academic year. The investigator informed the students that it was only an experiment and the outcomes would be kept confidential. 45 minutes time was given to them to read the questions thoroughly and give answers in the answer sheets provided to them. The answer sheets were collected and evaluated, allotting one mark to each correct response.

Item analysis was done in order to ensure the validity and the reliability of the test items. Item analysis is a method of examining the responses (answers) of the students to individual test items (questions). This is done to assess the quality of those items and the test as a whole. It is a valuable tool to improve the items or omit the items which are easier or tougher to the respondents. By eliminating such items the test is conducted with moderate level of difficulty and with valid items. Item analysis uses difficulty index to find the extent of difficulty of each item. This index is nothing but the average of percentage of students who have not answered the particular items in the upper twenty seven and the lower twenty seven percent. So, higher the index
value, higher the difficulty level. Similarly lower the index value, lower the difficulty level. In order to set the test with moderate difficulty for the targeted sample, items with moderate difficulty were selected i.e. the items which have difficulty index ranging between twenty five percent and seventy five percent were selected. The items selected were given asterisk mark in the last column of the table. Thus, twenty four items from part A, four items from part B, and twenty two items from part D were selected for the achievement test containing fifty items in total.

Validity of the item was checked by means of discrimination index. This is obtained by subtracting the portion of the students who answered correctly in the lower twenty seven percent, from the portion of the students who answered the item correctly in the upper twenty seven percent. Thus the validity will show that higher the discrimination index, higher the validity and a copy of item analysis for achievement test is placed in APPENDIX NO I.

Care was taken to choose an equal number of questions from four major areas of environmental education syllabus (Noosphere - 12, Biosphere - 13, Pollution - 13, Natural resources - 12). This ensured content validity.

A copy of the achievement test questions along with the answer sheet is placed in APPENDIX NO II.

3.6.2 ATTITUDE SCALE

The researcher collected forty statements which were relevant to the positive attitude towards environment. Each of the statement expressed definite favourableness or unfavourableness to a particular point of view and number of favourable and unfavourable statements was approximately equal. Thus Likert - type attitude scale was constructed. Then answer sheet for the tool was prepared in which, three alternative responses namely, strongly agree, agree and disagree were provided.

The total of 40 items prepared in both Tamil and English were scrutinized by a panel of same experts who scrutinized achievement test in terms of appropriateness, clarity, specificity, brevity, objectivity and refinement of the items. Modifications suggested by the experts were executed.
Pilot study was carried out in order to ascertain the validity and reliability of attitude scale. The scale and the answer sheets were supplied to the students after they completed the achievement test. The investigator explained to them to read each statement carefully, decide whether they strongly agree, agree or disagree with the statement and tick the same against the relevant column in the answer sheet. Thirty minutes was given to the pupils to complete the answers. At the end of the stipulated time, the answer sheets were collected and scored as per the following procedure. The statements were of two types, namely, positive statements and negative statements. For positive statements, three marks were allotted if they chose to strongly agree, two marks for agree and one for disagree. For negative statements, one mark was allotted if they strongly agree, two for agree and three marks for disagree.

Three measures of reliability were given. The scale consisted of forty items which measure the attitude towards environment. Twenty five respondents were selected for reliability analysis. The scale items were divided into two parts (forms), each part containing twenty items selected randomly. The correlation between two forms was found to be 0.4820, indicating that the items between the two forms correlate moderately. Spearman Brown and Guttman split-half reliabilities were used to find the reliability coefficients of the scale by dividing the scale items into two halves into some random manner. The correlation between the two forms was used to find the Spearman Brown reliability and the variances of sum scale and forms were used to find Guttman reliability. Cronbach’s coefficient uses variances for the individual items (here 40) and the variance for the sum of all the items. If there was no true score but only error in the items then the variance of the sum would be the same as the sum of variance of the individual items. Therefore, coefficient alpha would be equal to zero. If all items were perfectly reliable and measure the same thing (true score), then coefficient alpha was equal to 1. Reliability analysis for attitude scale and reliability coefficients are given in tables 3.1 and 3.2.
In all, the reliability of the three statistics namely Spearman – Brown, Guttman and Cronbach’s alpha showed that the reliability of the scale constructed for attitude assessment was between 0.5 and 0.7, which made the constructed scale fairly reliable. However some items were eliminated for final study because the students found the scale too lengthy. Hence item correlations were found out and items which had correlations above 0.75 with total score of the scale were taken for final study. Thus twenty items were finally selected and the items are given in APPENDIX III along with answer sheet.

3.7. FEASIBILITY STUDY OF THE PACKAGES

Pilot study I was conducted by the researcher herself for the English version of all the three packages. Additions, deletions and modifications were done where ever necessary and the Tamil version of the packages were prepared.

Pilot study II was carried out for Tamil versions of the packages by the practising teachers. At both the stages suggestions of the teachers were sought and relevant changes were made in the packages making them fit for classroom usage.

**TABLE 3.1**

RELIABILITY ANALYSIS FOR ATTITUDE SCALE

<table>
<thead>
<tr>
<th>Statistics for</th>
<th>Mean</th>
<th>Variance</th>
<th>No. of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1</td>
<td>45.36</td>
<td>4.0581</td>
<td>20</td>
</tr>
<tr>
<td>Part 2</td>
<td>42.76</td>
<td>5.5997</td>
<td>20</td>
</tr>
<tr>
<td>Scale</td>
<td>88.12</td>
<td>8.7193</td>
<td>40</td>
</tr>
</tbody>
</table>

**TABLE 3.2**

RELIABILITY COEFFICIENTS

<table>
<thead>
<tr>
<th>No.of Cases</th>
<th>25</th>
<th>No. of items</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 items in part 1</td>
<td></td>
<td>20 items in part 2</td>
<td></td>
</tr>
<tr>
<td>Correlation between forms</td>
<td>0.4820</td>
<td>Equal-length Spearman-Brown</td>
<td>0.6507</td>
</tr>
<tr>
<td>Guttman Split-half</td>
<td>0.6405</td>
<td>Unequal-length Spearman-Brown</td>
<td>0.6507</td>
</tr>
<tr>
<td>Alpha of part 1</td>
<td>0.4931</td>
<td>Alpha for part 2</td>
<td>0.7083</td>
</tr>
</tbody>
</table>
3.8. SAMPLE SELECTION

The attribute variables chosen for the present study were:
- Type of school (Government and Private)
- Locality Urban and Rural)
- Gender (Boys and Girls)
- Medium of instruction (Tamil and English)

The treatment variables chosen for the present study were:
- Conventional strategy
- Activity strategy
- Instructor controlled multimedia strategy
- Visual aids strategy

Simple random sampling technique was followed in selecting the sample. First the schools in Coimbatore educational district were listed and segregated based on variables considered for the study. Under one category, all the schools were assigned numbers which were put on slips of paper and lottery was drawn.

The final sample consisted of students from the following schools:

a. Padmavathiammal High School, Kalapatti
b. Kadri Mills Higher Secondary School, Ondipudur
c. Government Higher Secondary School, Chinniampalayam
d. P.S.G Sarvajana Higher Secondary School, Peelamedu
e. Corporation Higher Secondary School, Siddhapudur
f. Corporation Higher Secondary School for Girls, R.S.Puram West
g. Corporation Higher Secondary School for Boys, R.S.Puram West
h. Corporation Higher Secondary School for Girls, Ranganathapuram

Due permission was obtained from the educational authorities and the head masters. Some schools had many sections of a particular category and so again lottery method was used in selecting a particular section. For conventional strategy samples were selected from all the eight schools keeping in mind the attribute variables. Thus six hundred and twenty seven pupils were selected with due consideration for the variables mentioned.

The final sample in terms of independent variables involved in the present investigation is given in table: 3.3
### TABLE 3.3

**DISTRIBUTION OF THE SAMPLE**

<table>
<thead>
<tr>
<th>Attribute Variables</th>
<th>Variables in instructional material</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional</td>
<td>Activity</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Type of School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>80</td>
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</tr>
<tr>
<td>Private</td>
<td>40</td>
<td>33.3</td>
</tr>
<tr>
<td>Locality</td>
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<td></td>
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<td>Urban</td>
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<td>75</td>
</tr>
<tr>
<td>Rural</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>65</td>
<td>54.1</td>
</tr>
<tr>
<td>Girls</td>
<td>55</td>
<td>45.9</td>
</tr>
<tr>
<td>Medium of instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tamil</td>
<td>65</td>
<td>54.2</td>
</tr>
<tr>
<td>English</td>
<td>55</td>
<td>45.8</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

### 3.9 EMPLOYMENT OF INSTRUCTIONAL STRATEGIES

The investigator approached the science teachers of the selected groups of pupils and sought their willingness to participate in the study. They were instructed to teach as per the strategy allotted by the researcher. Therefore, the teachers did not have the choice of their own in selecting a particular strategy. The investigator gave the instructional materials. Model classes were taken by the researcher if necessary and clarifications were given. One week time was given to them to go through the materials supplied and prepare themselves for applying the strategy in their classrooms. Then classroom trails were experimented to ensure that the teachers had a thorough understanding of the usage of the specific materials supplied to them. The teachers were informed that the investigator is aiming to find out the effect of a particular method of teaching only and assured that it was only an experiment and the outcomes would be kept confidential.

Prior to commencement of different strategies selected, the investigator herself administered pre-test using achievement test and attitude scale and hence ensured the elimination of teacher influence.
3.9.1 Activity strategy

In activity strategy, activities had to be planned well ahead. The survey sheets relating to plastics, land usage, solid wastes and sewage were supplied to the students on the previous day, so that they could come to the class with completed survey sheets. Need for earth worms, other materials used for vermi composting and the location of the pit were all discussed in the class and their supply was ensured at the time of learning the lesson.

Experiments titled Too Salty for Me, Algal Bloom, Little Drops of Water, Water Cycle and Solar Cookers were discussed with groups of pupils who volunteered to perform the experiments and they were given instructions and help to perform the experiments for the entire class.

Drama ‘Let Us Lock the Organs’ and ‘Is It True’ required talented pupils and proper training. Students were given chance to choose their roles and were given the necessary support to enact the drama. All the materials were prepared by the students themselves.

The five case studies and energy choice activity required preparation of charts. Those pupils who volunteered to do them were supplied with the content and pictures. Pupils who were willing to present them were given a chance to present the cases to the entire class. The teachers guided the discussions and gave clarifications wherever necessary.

The activity on the components of the ecosystem, required each student to take up a role. As the teacher read out the components, the students came forward to take up the roles, wrote the same on a piece of paper and fixed them on their chest. This activity was done either in the class or in the school play ground. ‘Web Of Life’, ‘A Pyramid In The Eco System’ and ‘Prey-Predator’ games were played in the school play ground and were followed by discussion sessions.

Photographs of some of these activities are presented in the ensuing plates No: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10 and 3.11.
3.9.2 Multimedia Strategy

The science teacher brought the pupils to the computer lab where the LCD was kept ready. As she/he taught the lesson the technician helped in the operation of the projector so that the teacher continued the session without interruption.

3.9.3 Visual Aids Strategy

Teachers had a thorough knowledge of the visuals, carried relevant aids to the classes and kept them closed. At the appropriate time they displayed the aids and explained the concepts to the students. Photographs of some of the visual aids are presented in plates No: 3.12, 3.13, 3.14, 3.15, 1.16 and 3.17.
3.9.4 Conventional Strategy

For conventional strategy the concerned science teachers were asked to employ their usual method of teaching.

3.10. ADMINISTERING POST – TEST

After completion of the teaching about environment employing specific strategies, which lasted for eight periods, the next day achievement test and the scale to assess attitude were administered for the post – test by the investigator. The answer sheets were collected, evaluated and the final scores were obtained. Due care was taken that there was a gap of thirty days between pre – test and post – test.

3.11. METHOD OF ANALYSIS

Chapter number IV dealt with analysis and interpretations. Paired ‘t’ – test was employed to find out if there was significant difference between the initial and final scores in achievement scores and attitude scores. Using ‘t’ – test, initial scores were analysed to find out if significant differences existed between groups based on attribute variables. Using ANOVA, initial scores were analysed to find out significant differences existed between groups based on treatment variables. ANOCOVA was employed on the final scores to remove the covariate effect of initial scores, to compare the final scores based on independent variables and to find out if there is interaction between treatment and attribute variables. Adjusted means of final scores were subjected to Scheffe’s – F test to find out pairs of groups which had significant differences.