3.1 PLAN AND PROCEDURE

Research is a careful search that endeavours to discover new ideas by scientific study, a course of critical investigation. Research is a deliberate effort to collect information, to shift it, to analyze it, to put it together and to evaluate it. Research is a careful inquiry in seeking facts or principle, a diligent investigation to ascertain something. So it is necessary to adopt and evolve a systematic procedure or specific design to collect essential data and this design is known as research design. A research design includes an outline of what a researcher will do from writing hypothesis and its operational implications to the final analysis of data. A research design is a plan that specifies the sources and types of information relevant to research problem, a strategy specifying which approach will be used for gathering and analyzing the data. It also includes the time and budget since most studies are done under these two constraints. Research design facilitates the smooth sailing of various research operations, thereby making research as efficient as possible, yielding maximal information with minimal expenditure of efforts, time and money.

In every research work, different methods are used at different stages. The discussion about the methods to be employed depends upon the nature of the problem selected and kind of data necessary for its solution.

The method and procedure of research study are bound up with its purpose as they provide a framework in which the goals of research are to be achieved, early in the planning stage of research project, investigator studies the merits of various procedures for collecting evidence. After determining which approach yields form and kind of data
necessary to test hypothesis adequately, the investigator examines the available tools and choose the one that is most appropriate for the purpose. The present research investigated the effect of computer assisted instructions on environmental awareness and attitude towards environmental pollution in secondary school students. It may be recalled here that the present study was undertaken with the following objectives :-

3.2 OBJECTIVES OF THE STUDY

3.2.1 Related to Environmental Awareness

1. To study the effect of computer assisted instructions and conventional method of teaching on environmental awareness of secondary school students.

2. To study the effect of computer assisted instructions and conventional method of teaching on environmental awareness of secondary school students with respect to their residential area.

3. To study the effect of computer assisted instructions and conventional method of teaching on environmental awareness of secondary school students with respect to their type of school.

4. To study the effect of computer assisted instructions and conventional method of teaching on environmental awareness of secondary school students with respect to their gender.

3.2.2 Related to Attitude towards Environmental Pollution

5. To study the effect of computer assisted instructions and conventional method of teaching on attitude towards environmental pollution of secondary school students.
6. To study the effect of computer assisted instructions and conventional method of teaching on attitude towards environmental pollution of secondary school students with respect to their residential area.

7. To study the effect of computer assisted instructions and conventional method of teaching on attitude towards environmental pollution of secondary school students with respect to their type of school.

8. To study the effect of computer assisted instructions and conventional method of teaching on attitude towards environmental pollution of secondary school students with respect to their gender.

3.3 HYPOTHESES

3.3.1 Related to Environmental Awareness

1. There exists a significant difference in the effect of computer assisted instructions and conventional method of teaching on environmental awareness in secondary school students.

2. Environmental awareness in secondary school students taught by computer assisted instructions and conventional method of teaching does not differ with respect to their residential area.

3. Environmental awareness in secondary school students taught by computer assisted instructions and conventional method of teaching does not differ with respect to their type of school.

4. Environmental awareness in secondary school students taught by computer assisted instructions and conventional method of teaching does not differ with respect to their gender.
3.3.2 Related to Attitude towards Environmental Pollution

5. There exists a significant difference in the effect of computer assisted instructions and conventional method of teaching on the attitude towards environmental pollution in secondary school students.

6. Attitude towards environmental pollution in secondary school students taught by computer assisted instructions and conventional method of teaching does not differ with respect to their residential area.

7. Attitude towards environmental pollution in secondary school students taught by computer assisted instructions and conventional method of teaching does not differ with respect to their type of school.

8. Attitude towards environmental pollution in secondary school students taught by computer assisted instructions and conventional method of teaching does not differ with respect to their gender.

3.4 METHODOLOGY

The present study tended to assess the effect of computer assisted instructions on environmental awareness and attitude towards environmental pollution. It comes under the domain of experimental research. Two matched groups were used. Control group and Experimental group were matched on the basis of their result of 8th standard.

3.5 SAMPLING

After finalizing the variables of the present study, consideration was given to select the sample as the representative of the entire population. The entire population here refers to all the secondary school students studying in IXth class of P.S.E.B. in Amritsar district.
The sampling method has been considered to be more economical, convenient and suitable for this study. The target of the sampling procedure was to select a representative sample of secondary school students both boys and girls of IXth class studying in government and non government schools affiliated to P.S.E.B and residing in both rural and urban areas.

This involves proportional selection from several strata. In research various methods are utilized for selection and drawing of samples. After a detailed study of all the available methods, stratified random sampling was found most suitable and has been used in this study.

In stratified random sampling, the entire population is divided into smaller homogeneous groups or strata and then the samples are selected randomly within each stratum. While selecting the sample, there are certain principles which are to be very clearly followed. The population which is to be studied, decision about who would constitute the sample, accessibility and availability of sampling units after preparation of source list are some of these. For the present study, a source list consisting of the names of schools of Amritsar district was compiled. Care was taken that list was upto date and no repetition of schools was there. Sample in the present study comprised of 640 secondary school students (boys and girls) studying in IXth class of rural and urban areas of government and non government schools of Amritsar district

3.6 Data Collection

Size of sample is a very important parameter. If the sample is too small, it will not be representative of the population and results cannot be generalized. If the sample becomes too large, study becomes difficult and costly. It was decided to select the sample size as
640 i.e. 640 school students would be respondents -320 belonging to experimental group and 320 belonging to control group. The strata were then chosen as boys-girls and government school students - non government school students and urban school students - rural school students of IXth class of P.S.E.B. Sample distribution is as follows:

**TABLE 3.1 Composition of Sample**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the School</th>
<th>Type of School</th>
<th>Location</th>
<th>Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Govt. Sr. Sec. School for Girls Mall Road, Asr</td>
<td>Govt.</td>
<td>Urban</td>
<td>Girls(F) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>2.</td>
<td>Dashmesh Public School, Asr</td>
<td>Non Govt.</td>
<td>Urban</td>
<td>Girls(F) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>3.</td>
<td>Govt. Sec. School, Ram Bagh, Asr</td>
<td>Govt.</td>
<td>Urban</td>
<td>Boys(M) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>4.</td>
<td>S.S.S.S. School, Asr</td>
<td>Non Govt.</td>
<td>Urban</td>
<td>Boys(M) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>5.</td>
<td>Nav Model School, Verka, Asr</td>
<td>Non Govt.</td>
<td>Rural</td>
<td>Girls(F) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>6.</td>
<td>Govt. Sec. School, Mudhal, Asr</td>
<td>Govt.</td>
<td>Rural</td>
<td>Girls(F) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>7.</td>
<td>Nav Model School, Verka, Asr</td>
<td>Non Govt.</td>
<td>Rural</td>
<td>Boys(M) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
<tr>
<td>8.</td>
<td>Govt. Sr. Sec. School, Jethuwal, Asr</td>
<td>Govt.</td>
<td>Rural</td>
<td>Boys(M) 40 C.G 40 E.G</td>
<td>80</td>
</tr>
</tbody>
</table>

**3.7 SELECTION OF TOOLS**

A research tool plays a major role in any worthwhile research, as it is the sole factor in determining the sound data and in arriving at perfect conditions about the problem or
study in hand. It ultimately helps in providing suitable remedial measures to the researcher. These tools help the researcher to analyse responses on related variables and in careful interpretation. A researcher needs many data gathering tools and devices which may vary in their complexity, design, administration and interpretation. Each tool is appropriate for collection of certain kinds of evidences and information and it is possible that the researcher may examine the available instruments and choose one or more to meet specific research requirements.

3.8 TOOLS USED

To test the framed hypothesis the investigator used the following tools:

- Computer Assisted Instructions on Environmental Awareness for IXth class
- Achievement test on Environmental Awareness-Constructed by the investigator
- Conventional lesson plans on Environmental Awareness for IX class
- Taj Environmental Attitude Scale-Dr. Haseen Taj(2001)

3.9 DESCRIPTION OF TOOLS USED

3.9.1 DEVELOPMENT OF C.A.I. PROGRAMME :

Developing a good computer assisted instructional programme involves a number of techniques and devices to be incorporated and requires several special skills. The programmer must have mastery of the subject matter as well as knowledge of the techniques of programming which he is intending to programme.

3.9.1.1 STEPS IN DEVELOPING THE C.A.I. PROGRAMME

There are three basic steps in developing the programme:-
3.9.1.1 A. Preparation

The Preparation involves the four factors:-

(a) Selection of the topic to be programmed

(b) Planning the content

(c) Defining behavioral objectives and

(d) Constructing a criterion test

3.9.1.1A(a) Selection of the topic to be programmed:-

The choice of the topic is very important and must be related to the choice of the programming style. A number of factors were taken into consideration while selecting the topic:- (i) The field of the study of the investigator is Environment. Topics from this subject area were therefore, thought to be selected.

(ii) The topic Environment involves the study of a number of concepts. Such content matter can be easily put in the form of linear type of CAI programme. The choice of the programming style and the topic are related to each other.

(iii) The investigator is quite familiar with the subject matter because of interest in the subject matter and more over she had a number of discussions on this topic with a number of subject experts.
(iv) The topic is prescribed in the curriculum of science of IXth class of all schools following PSEB syllabus in Amritsar

3.9.1.1A(b) Planning the content:-

The content outline was planned keeping in view the syllabus and the understanding level of the students of IXth class. For this, careful review of the syllabus was made on one hand and thorough study of the text books and other reference material available on the topic on the other hand. After having studied the subject matter thoroughly, the major aspect to be programmed was found. These broader and the general objectives served as the basis for writing the terminal behavior.

The scope of the content includes:-

(i) Understanding Ecosystem  
(ii) Depletion of Resources  
(iii) Waste Generation and Management  
(iv) Environmental Values and Ethics

3.9.1.1A(c) Defining the Behavioral Objectives :-

It is suggested that one should write the objectives in general rather than in behavioral terms as they form the basis for defining the behavioral objectives. Keeping it in view the general statement was written as “Computer Assisted Instructions on Environment for the students of IXth class.”

Unit wise objectives were written as follows:-

1. To study the environment.
2. To study the living things in ecosystem, how the ecosystem works.
3. To study the depletion of environment and resources.
4. To study ways and means to protect our environment, waste generation and management, environmental values and ethics.

These content wise objectives were supplemented with the general objectives of the development of the programme given as follows:

1. A study of the nature of programmed learning.
2. Development of linear programme on the given topic environment.
3. Preparing the criterion test based on the content matter included in the computer assisted instructions of the programme.
4. Try out of the programme.
5. Evaluation and improvement of the programme.

Defining Behavioral Objectives:

For attaining specific learning outcomes the following objectives were set forth:-

1. The pupils will be able to identify the types of ecosystem.
2. The pupils will be able to differentiate between forest and desert ecosystems.
3. The pupils will be able to describe the adaptations of desert ecosystem.
4. The pupils will be able to explain Nekton and Benthos.
5. The pupils will be able to discriminate between autotrophs and heterotrophs.
6. The pupils will be able to outline the term carnivores.
7. The pupils will be able to distinguish the examples of carnivores and herbivores.
8. The pupils will be able to identify the decomposers.
9. The pupils will be able to describe food web.
10. The pupils will be able to explain various environmental cycles as water, carbon, nitrogen.
11. The pupils will be able to explain the importance of trees and how they can help in making environment free of pollution.

12. The pupils will be able to describe destruction of ecosystem.

13. The pupils will be able to explain pollution.

14. The pupils will be able to explain silviculture.

15. The pupils will be able to expand C.N.G.

16. The pupils will be able to differentiate between crop rotation and mixed cropping.

17. The pupils will be able to enlist and identify renewable and non renewable sources of energy.

18. The pupils will be able to explain various types of non conventional sources of energy as solar energy, geothermal energy and wind energy.

19. The pupils will be able to identify oil as non renewable source of energy.

20. The pupils will be able to describe urbanization and industrialization as cause of deterioration of environment, cause of floods.

21. The pupils will be able to explain organic farming and biogas.

22. The pupils will be able to name the most important gas for green house effect.

23. The pupils will be able to define water harvesting.

24. The pupils will be able to explain vermicomposting.

25. The pupils will be able to explain mixed cropping.

3.9.1.1A(d) . Construction of Achievement Test on Environmental Awareness:--

After writing objectives in behavioral terms and developing instructional sequence of the unit to be taught. It is very essential to construct an achievement test. The purpose of the achievement test is to evaluate the effectiveness of CAI and to check the
competency attained by the students at the end of the instructional period in term of objectives to be achieved. Every item measures one specific objective on the programme.

In the present investigation the achievement test includes objective type items and all the items were systematically derived from the objectives set forth. Achievement test also helped in writing the frames of the programme in such a way that its items were systematically distributed over the programme.

Each and every step of the programme had the same importance. Achievement test has the following characteristics.

1. It checks the competency attained through the subject matter of the programme.
2. It ensures whether the objectives of programmed instruction are attained or not.
3. It would help the instruction in improving upon the frames of the programme.
4. It is representative of all frames of the programme.

3.9.1.1A-d(i) Standardization of an Achievement Test on Environmental Awareness

Standardization of the Achievement Test removes the element of subjectivity and makes the achievement test highly structured. Following steps were followed to standardize the achievement test on environmental awareness.

1. **Formulation of objectives**: Specific objectives were clearly stated by the investigator in behavioral terms.

2. **Review of already available tests**: An indepth review of the already available tests in the field of environment was done.
3. **Intensive study of the subject matter**: The investigator thoroughly studied the syllabus and content material of IXth Class Environmental Education to obtain clarity of the concepts.

4. **Preparation of blue print**: Blue print is an outline of the achievement test in terms of objectives and content.

**Table 3.2 showing blueprint**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Objective Unit</th>
<th>Knowledge (Recall)</th>
<th>Understanding (Comprehension)</th>
<th>Application</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Understanding Ecosystem</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1(3)</td>
<td>7</td>
</tr>
<tr>
<td>II</td>
<td>Depletion of Resources</td>
<td>1(2)</td>
<td>1(2)</td>
<td>1(2)</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>Waste Generation and Management</td>
<td>1 (2)</td>
<td>1(2)</td>
<td>1(2)</td>
<td>6</td>
</tr>
<tr>
<td>IV</td>
<td>Environmental Values and Ethics</td>
<td>1 (2)</td>
<td>1(2)</td>
<td>1(2)</td>
<td>6</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>25(25)</td>
</tr>
</tbody>
</table>

Note: Figures within brackets indicate the no. of questions and figures outside the brackets indicate marks

5. **Preparation of question bank**: A question bank of 100 questions was prepared from 4 units named Understanding Ecosystem, Depletion of Resources, Waste generation and management, Environmental values and ethics.

6. **Scrutinization**: Questions were then scrutinized by subject experts and language experts. After the suggestions of experts 50 items were taken.
7. **Try out on a Small Sample**: 50 questions were then tried out on a small group of 8 students of IXth Class. On the basis of the feedback of students, the questions which posed confusion or were time consuming or had difficult language was removed. 40 questions were retained after try out on a small group.

8. **Final try out on a sample of 100 students**: The selected 40 questions were then tried out on a sample of 100 students. On the basis of difficulty level and discriminative value, 25 questions were selected for the final format of the achievement test.

9. **Conduct Item Analysis**: Preparation of item Grid. A flowchart showing the entry of each student on each question was plotted. It is known as Item Grid.

   a) **Finding out the Difficulty level**: Each Item was thoroughly scanned to find out the difficulty level. Items with values between 0.23 to 0.89 were selected. The difficulty value of each of the 40 items was computed by the formula

   \[ \text{Difficulty Value of the item} = \frac{\text{No. of students responding correctly to the item}}{\text{Total No. of Students}} \]

   **Table3.3 showing Difficulty Level of the items**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Solved by No. of Students Correctly</th>
<th>Difficulty Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79</td>
<td>0.79*</td>
</tr>
<tr>
<td>2</td>
<td>96</td>
<td>0.96</td>
</tr>
<tr>
<td>3</td>
<td>91</td>
<td>0.91</td>
</tr>
<tr>
<td>4</td>
<td>89</td>
<td>0.89*</td>
</tr>
<tr>
<td>5</td>
<td>89</td>
<td>0.89*</td>
</tr>
<tr>
<td>6</td>
<td>86</td>
<td>0.86*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>7</td>
<td>92</td>
<td>0.92</td>
</tr>
<tr>
<td>8</td>
<td>92</td>
<td>0.92</td>
</tr>
<tr>
<td>9</td>
<td>81</td>
<td>0.81*</td>
</tr>
<tr>
<td>10</td>
<td>92</td>
<td>0.92</td>
</tr>
<tr>
<td>11</td>
<td>93</td>
<td>0.93</td>
</tr>
<tr>
<td>12</td>
<td>88</td>
<td>0.88*</td>
</tr>
<tr>
<td>13</td>
<td>89</td>
<td>0.89*</td>
</tr>
<tr>
<td>14</td>
<td>85</td>
<td>0.85*</td>
</tr>
<tr>
<td>15</td>
<td>95</td>
<td>0.95</td>
</tr>
<tr>
<td>16</td>
<td>86</td>
<td>0.86*</td>
</tr>
<tr>
<td>17</td>
<td>84</td>
<td>0.84*</td>
</tr>
<tr>
<td>18</td>
<td>95</td>
<td>0.95</td>
</tr>
<tr>
<td>19</td>
<td>82</td>
<td>0.82*</td>
</tr>
<tr>
<td>20</td>
<td>89</td>
<td>0.89*</td>
</tr>
<tr>
<td>21</td>
<td>95</td>
<td>0.95</td>
</tr>
<tr>
<td>22</td>
<td>89</td>
<td>0.89*</td>
</tr>
<tr>
<td>23</td>
<td>93</td>
<td>0.93</td>
</tr>
<tr>
<td>24</td>
<td>68</td>
<td>0.68*</td>
</tr>
<tr>
<td>25</td>
<td>89</td>
<td>0.89*</td>
</tr>
<tr>
<td>26</td>
<td>72</td>
<td>0.72*</td>
</tr>
<tr>
<td>27</td>
<td>75</td>
<td>0.75*</td>
</tr>
<tr>
<td>28</td>
<td>20</td>
<td>0.20</td>
</tr>
<tr>
<td>29</td>
<td>97</td>
<td>0.97</td>
</tr>
</tbody>
</table>
Discriminative Value: Answer sheets of students were arranged in descending order. Upper 27% of Total N (100) at the higher end and 27% of total N (100) at the lower end was taken. Middle bulk of 46% was left. The extreme ends provide high discriminatory powers. Items with values between 0.23 to 0.89 were selected. The discriminative value was calculated by the formula

\[
\text{Disc. Val.} = \frac{\text{Correct responses of higher group (RH)} - \text{Correct responses of lower group (RL)}}{27}
\]

Table 3.4 Discriminative Value

<table>
<thead>
<tr>
<th>Item No.</th>
<th>No. of Correct Responses</th>
<th>Discrimination Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RH</td>
<td>RL</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>8</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>23</td>
<td>18</td>
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<tr>
<td>11</td>
<td>23</td>
<td>18</td>
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<tr>
<td>12</td>
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<td>13</td>
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</tr>
<tr>
<td>14</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>16</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
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<td>18</td>
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<tr>
<td>19</td>
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<td>2</td>
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<tr>
<td>20</td>
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<td>24</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>24</td>
<td>25</td>
<td>2</td>
</tr>
</tbody>
</table>
The test has the universe of content as it includes statements from all the selected dimensions of environmental awareness namely Understanding Ecosystem, Depletion of Resources, Waste Generation and Management & Environmental Values & Ethics. Due weightage was given to all the dimensions while selecting items. The scale contains 25 statements which represent the universe of content. Hence, it has content-validity. It has also construct validity as items were selected having the ‘t’ values equal to or more than
1.75 (Edward et.al. 1975). The test was given to experts in the field of education and they agreed that the items in the test were relevant to the objective of the study. Hence it has face validity. The validity of the whole test was found to be 0.85 by finding correlation of obtained scores with Environmental Awareness test by Dr. Praveen Kumar Jha. The present study employed split half method to determine the co-efficient of internal consistency. The reliability was found to be 0.78 by the use of Spearman brown prophecy formula.

**Table 3.5 showing unitwise allocation of items in the final form of the test**

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Name of the Unit</th>
<th>No. of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Understanding Ecosystem</td>
<td>7</td>
</tr>
<tr>
<td>2.</td>
<td>Depletion of resources</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Waste generation and management</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>Environmental Values and Ethics</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

Scoring Key For Environmental Awareness Achievement Test

**Part I**
- 1. Terrestrial
- 2. Forest
- 3. Desert
- 4. Neptoon
- 5. Autotrophs
- 6. Carnivores
- 7. Herbivores

**Part II**
- 8. Decomposer
- 9. Foodweb
- 10. Water
- 11. Carbon dioxide
- 12. Destruction
- 13. Pollution
- 14. Silviculture

**Part III**
- 15. False
- 16. Crop rotation
- 17. Renewable
- 18. False
- 19. Non renewable
- 20. True

**Part IV**
- 21. True
- 22. Carbon dioxide
- 23. True
- 24. Vermicomposting
- 25. FWPCA

Categorisation based on scores

High-15-25, Moderate-10-15, Low-Below 10

**3.9.1.1B Programme Writing :-**
Programme writing is the major task of the process of development. It requires a thorough knowledge of programme rule. A programme is responsible for drafting groups of frames which cover the subject matter contained in the behavioral terms.

(i) Writing of Frames:

Each behavioral objective is now carefully broken into frames. These frames constitute the whole body of the programme. A frame can be said to be unit of presentation of instructional sequence. Before the actual writing of the frames, the programmer carefully orders the behavioral objectives and when he is about it, he starts breaking of the subjects matter and complete the task keeping always off view the set of programming principle.

Each frame is provided with its correct response so that the student find that his answer is correct. He obtains confirmation but if it is incorrect, he received correction. It is essential and distinguishing characteristics of programmed instruction it is essential and distinguishing characteristics of programmed instruction that correct response is always written along with the frames.

(ii) Designing of frames:

For writing frames the following two operation are helpful:

1. Priming
2. Prompting

1. Priming: Priming is used to help the appearance of a desired behavioral. According to Susam Markle, “the priming is useful only in introductory frames and if the programmer uses more and more of it in teaching frames. The learner may give correct response without understanding the frames.
2. **Prompting:-** Prompting is supplementary stimulus, a bit of assistance a cure a reminder and a previous association of phrase that help the learner to give the desired response. A prompt guides a learner to give the correct response without ever controlling his behavior. It prevents the learner from making unnecessary errors.

(iv) **Sequencing of frames:-**

After designing of the frames, the discussion should lead is to described some systematic approaches to design all sequencing. There are three common approaches in designing of frame sequencing.

1) **Matrix Approach**

2) **Ruleg Approach**

3) **Egrul Approach**

1) **Matrix Approach:-** This is an old education device for making sure that everything is covered. In programming the concept can be placed on one axis and the behavior to be brought through the frames on the other axis. This gives a fairly clear picture of the structure of as well as behavior covered through the programme.

2) **Ruleg Approach:-** Element in this approach Ru’s rule (hence the RU) or the principles or generalization or definition or any general statement and the egs or examples (from eg) in the broad principles are introduced first and than examples are given to illustrate these principles. Ruleg system is an attempt to formalize the production of frames and their sequencing according to some systematic rule.
3) **Egrul Approach** :- This approach prefers to start from examples and the students can work from previous experience. This approach may be called inductive in form. This structure of a frame, consist of the following three parts:-

1- **Stimulus**: The information is presented

2- **Response**: The learner construct or select a response .

3- **Feedback**: The knowledge of result is given in form of a report to the leaner on the status of response that he was made.

**(v)EDITING**

After completing the first draft the programme, then programme was edited.

The main objectives of the editing of the programme are:-

1. To improve the logical sequence of the frame.

2. To sharpen and to smoothen the programme.

3. To improve the technical accuracy.

   The programme was given to the language expert. Subject expert also made certain modification concerning the subject matter.

   The copy of hand written programme was now ready for data collection and further modification on the basis of try-out.

**3.9.1.1(C) EVALUATION**

Evaluation of the programme is the final stage in the development of a programme.

Evaluation of the programme in this sense refers to testing of the programme material.

Testing of a programme is kind of trial situation for the frames and sequence brought out by the programme.
There are three types of testing:-

1. Individual testing
2. Small Group testing
3. Field testing

**1. Individual Testing or Try out on Individual:-**

Individual testing is characterized by the fact that. It is usually carried out informally with individual learner, one at a time. The purpose of the individual testing is to check for the first version of the programme product which is essentially still any guess about the material to be taught.

In the present investigation the programme in its initial from was given to an individual, a student of IXth class of Amritsar. Each frame was read by the learner and he was asked to make a response. The student was provided immediate feedback after he made response to each frame. The student face difficulties at a number of frames. These frames were improved afterwards.

**2. Small Testing or Try out on small Group:-**

After making necessary modification in the frames on the basis of individual try out, the programme is triad out on small group of 5 to 10 average students. Here programme determines whether the programme succeeds in bringing desirable game in learning.

In the present investigation the modified programme in CAI form was selected form school. Proper instructions for doing programme were given. The reactions
of the student before and after completing the programme were given. After the completion of the programme, the students were given the criterion test.

On the basis of the data of five students, the following modification were made in the programme.

1. The change in the language, grammar and sentence formation were made in these frame.
2. Errors are relatively greater on the frames number 9,10,13,17,24,28,31,37,59,66,
3. Difficult frame were simplified.
4. 8 frames were removed and new 8 inserted in place of them.
5. Sequence continuity was maintained.

3. Field Testing or Try Out on large Group:-

After having made the above changes in the programmed materials the whole programmed material was written and got cyclostyled. In this way whole programme is consisted of 75 frames.

In this present investigation the large programme was tried on 100 students of IXth class. The students were given direction and similar procedure was adopted as in the case of small group. At the end of the instructional period criterion test was given to the students and the reactions of the students were recorded.
4. Evaluation of the programme

In this chapter an evaluation of the programme has been done. The data obtained on a large group (N=100) has been subjected to analysis by finding error rate, programme density and sequence progression. This validity hypothesis have also been tested.

Analysis of data:

Analysis of the data has been attempted to find the following elements:-

1. Error rate
2. Programme Density
3. Sequence Progression.
4. Validity hypothesis
5. Criterion test basis

Error rate:-

Error means an incorrect response made by a student on a frame. Error rate is the probability of making a wrong response. It is defined as

\[
\text{Error rate} = \frac{\text{Number of error made by all students}}{\text{Number of response} \times \text{Number of students}} \times 100
\]

\[
\text{Error rate} = \frac{\text{Ne}}{\text{Nr. NS}} \times 100
\]

Tallies of errors of all the 100 students of ixth class on each frame. It is clear from table no.3.9.1 that the error are relatively greater on frames 9,10,13,17,24,28,31,37,59,66. There is no error on 30 frames. The error rate of all the 75 frames have been found. The
programme was divided into 7 equal tapes and 8 half tape. Each 7 tape contain 10 frame and last 8 tape contain 5 frame. Error rate of individuals frames, individual tapes and the programme as a single tape have been worked out. Table no3.9.2 shows these error rates. Region description of error rate over the programme as a single tape is given below:-

It is clear from table that frames 9, 10, 13, 17, 24, 28, 31, 37, 59, 66, 68 have large number of errors. This shows either some sort of ambiguity or greater complexity of these frames. From the frame 9 it seems that the students were faced with difficulty of making its response.

In the case of frame 13, 17, 31, 59, 66, the possible reason for giving wrong response can be sort of confusion between the response. There are 30 frames on which the students made no error and 28 frames have one error each, 6 frames have two errors 5 frames have three errors, 4 frames have 4 errors, 2 frames have 5 errors. These frames are relatively simple.

The error rate of all the 75 frames have been calculated (using the formula given in this chapter) taking small independent tapes on one hand the entire programme as one single continuous (Cumulative) tape on the other. The error rate are given in the table no.3.9.2.

**Programme Density:**

It is calculated by finding the number of different responses required of the student in a section of the programme and dividing by the total number of responses on that section. Here we make tallies of the programmed responses and not the student responses. There are two types of programme density.

1. Independent Density
2. Cumulative Density
1. Independent Density

The density of a single tape forming a section of the programme is known as independent density. Therefore, on each tape taken as an independent (section). The number of different responses required of a student is divided by the total number of responses on that independent tape (section).

\[
\text{Independent Density} = \frac{N_d}{N_t}
\]

Where \(N_d\) is the number of different responses on a single type and \(N_t\) is the total number of responses required on a single type.

2. Cumulative densities

It is the density of the whole programme considered as a single tape. If all the tapes are combined to form a large single tape, the density calculated over this large tape will be the cumulative density of the programme as a whole. Table no.3.9. 3 shows the independent mid cumulative density.

Region wise description of cumulative density has been given below:-

(a) Frames (1-10):

In this region, there is slow decrease on cumulative programme density.

(b) Frames (11 to 20) -
In this region, there is constancy on cumulative programme density.

(c) Frames (21-30) -

In this region, there is increase & decrease of cumulative programme density.

(d) Frames (31 to 40) -

In this region, increase & decrease both in first phase & then decrease.

(e) Frames (51 to 60) -

In this region, both increase & decrease is there.

(f) Frames (61 to 70) -

In this region, there is increase in cumulative programme density.

(g) Frames (71 to 75) –

In this region, there is increase in cumulative programme density.

Sequence Progression

A study of sequence has been made by entering the errors made by each student on each frame on flow chart.

Figure no. 1 shows the flow chart of errors made by students of Xth class on each of the 75 frames. The error marks (X) represents the error made by student on a frame. The number of errors on each frame by 100 students are entered on the top row and on the right end column are entered the number of errors made by each student on all the 75 frames. Table no3.9.4 and 3.9.5 reproduce the information given in the figure 1.

It is evident from the flow chart that the frames 9, 10, 13, 17, 24, 28, 35, 37, 59, 68, 69 have greater frequency of errors. It is clear from the flow chart that the students identification number 19, 22, 36, 47, 50, 67, 79, 88, 91 have made more errors.
Validity Hypothesis

In order to test the sequence we set the following validity hypothesis.

"If 95% of the pupil made correct responses on 95% of the total responses on all the frames of the programme, the sequence is deemed valid".

3.9.2 Preparation of Conventional Lesson Plans

Lesson Plan is actually a plan of action. It is the core, the heart of effective teaching. It entails hard work and is potentially rewarding. A teacher without lesson plans ends his day tired from his efforts to keep proper discipline in the class and feels discouraged with his failures, a teacher with good plans is also tired, but his tiredness is tempered with the joy of satisfaction.

Definitions of Lesson Plan

A lesson plan may be defined as a teaching outline of the important points of a lesson arranged in an order in which they are to be presented. It may include objectives, points to be asked, references to materials, assignments etc.

(Carter V. Good)

A lesson plan is actually a plan of action. It, therefore, includes the working philosophy of the teacher, his knowledge of philosophy, his information about and understanding of his pupils, his comprehension of the objectives of education, his knowledge of the material to be taught, and his ability to utilize effective methods

(Lester B. Stands)

Advantages of Lesson Planning

1. It makes the work regular, well organized, systematic and orderly.

2. It prompts confidence and self-reliance in the teacher.
3. It helps the teacher to proceed with a particular aim in view and thus makes him conscious of interests and attitudes to be developed among students.

4. It renders a saving in time for the students have a better understanding of the subject and develop some desirable attitudes in a specified time, while in the absence of a plan, it might have taken more time for the similar understanding.

5. Lesson plans establish proper connections between different lessons of study. Therefore, they provide continuity in the teaching process.

6. It stimulates the teacher to introduce striking questions and illustrations.

7. It provides greater freedom in teaching, for a teacher who has properly planned his lesson, enters the class with confidence, without any anxiety, ready to attack the problem and prepared to carry it out like a skilled workman.

Steps involved in Lesson Planning

Herbatian Steps

J.F. Herbart has emphasized the following six formal steps:

1. Preparation (Introduction)  
2. Presentation  
3. Association (Comparison)  
4. Generalisation  
5. Application  
6. Recapitulation

1. Preparation

According to J.F. Herbart, the mind of the child must be prepared to receive new knowledge. Nothing is to be given in vacuum. It is just like preparing the land before sowing the seed.
This step should be brief and nothing new to be told to the students. The teacher is to ascertain what the pupils already know relevant to the topic and to provide link between the previous knowledge and new lesson. This step may involve:

(i) Testing of previous knowledge.
(ii) Arousing curiosity by the novelty of experimentation or activity.
(iii) Story telling.
(iv) Use of charts, pictures and models.
(v) Skilful discussion

2. Presentation

Immediately after the first step, the aim of the lesson should be clearly stated. Then follows the second step. Here in this step the actual lesson begins. Pupils get new ideas and knowledge. Both the teachers and students participate. The teacher is supposed to draw out as much as possible, from the students with the help of judicious questions. In a science lesson, heuristic atmosphere must prevail. Demonstrations, activities and other aids should be used to make lessons concrete and meaningful.

3. Association or comparison

The new ideas or knowledge to be learnt should be compared and associated with already known ideas and facts. It is felt that knowledge is not like piling up bricks, it is like a tree that grows. This step is most important when we are establishing principles or generalizing definitions.

4. Generalisation

In most of the science lessons we have to arrive at certain generalizations. Formulae, principles or laws are to be established. As far as possible, the
pupils should draw out the conclusions themselves. Sometimes pupil’s generalizations may be either incomplete or irrelevant, therefore, the teacher should guide them to make corrections.

5. Application

A lesson of science will be incomplete if the rules or formulae are not applied to life situations. It is always the desire of the pupils to make use of the generalizations and to verify whether those really work in new situations. Here, knowledge becomes clear and meaningful.

6. Recapitulation

This is the last step in the process. Here the teacher ascertains whether the pupils have understood and grasped the subject matter or not. It is generally done by one of the following ways:

(i) Asking suitable questions on the topic taught.
(ii) Applying a short objective type test
(iii) Asking the pupils to label the unlabelled sketch

These steps were applied to prepare lesson plans.

3.9.3 TAJ ENVIRONMENTAL ATTITUDE SCALE BY DR. HASEEN TAJ (2001)

TEAS is a multidimensional attitude scale for measuring attitudes of adolescents, youths and adults towards environment and its allied aspects. This scale is a worthwhile tool not only for diagnostic purposes, but also for changing and modifying attitudes of youth/adults through positive programmes such as outdoor visits, games, simulations as
well as socio-drama, street plays and awareness campaigns etc. TEAS was developed with 61 items consisting of six areas. The six areas dealt within the scale are attitude towards:

1. Population explosion
2. Health and hygiene
3. Polluters
4. Wildlife
5. Forests
6. Environmental concerns

Initially 94 items were pooled from varied sources covering the above mentioned six areas. After a thorough discussion with the subject experts in the field (N=25), 22 items were dropped and a few were modified. The selected 72 attitude statements (based on 80 to 100% agreement by experts) were retained for inclusion in the preliminary form of the Taj Environmental Attitude Scale (TEAS) for try out.

**Scoring**

Each item alternative is assigned a weightage ranging from 4 (Strongly Agree) to 1 (Strongly Disagree) for favourable items. In case of unfavourable items the scoring is reversed i.e. from 1 (Strongly Agree) to 4 (Strongly Disagree). The attitude score of an individual is the sum total of item scores on all the six areas. The range of scores is from 61 to 244 with the higher score indicating the more favourable attitude towards environment and vice versa.
Validity

Taj Environmental Attitude Scale (TEAS) possessed high content validity because the items at first stage for try out of the scale were selected on the unanimous agreement (80 to 100%) of experts in the field regarding its content adequacy. The TEAS also appears to have the item validity. The methods of item selection after computing the t value for each item based on 27% upper and 27% lower scores support this supposition. In addition, the differences in the mean scores of adolescents, youth and adults, rural-urban, male-female, high-low SES and occupational status (service, bussinesss and professionals) were computed. The differences observed also support the adequacy of scale validity.

The concurrent validity of the scale was determined by administering a parallel scale developed by the researcher with the same number of items worded differently retaining the theme. The scale seems to possess the cross validity, since the sample used for establishing the reliability of the scale was other than the one used for try out of the scale. The index of reliability computed for the scale also reflects the intrinsic validity. Hence, the scale is said to be a valid tool for assessing the environmental attitude.

Reliability

Reliability of the scale was estimated by two methods (a) Split half (odd-even and 1st half and 2nd half) (b) Test-retest reliability co-efficient with a time gap of one month on a sample of 150. The reliability for test-retest method was 0.60 and index of reliability is 0.77. Reliability for Split half-odd-even method was 0.51 and index of reliability was 0.82. Reliability for 1st half-2nd half was 0.49 and index of reliability was 0.81.
**ACTUAL CONDUCT OF THE TESTS**

In the present study the sample of 640 students was taken for studying the effect of computer assisted instructions on environmental awareness and attitude towards environmental pollution in secondary school students of Amritsar. For the present study, computer assisted instructions, conventional lesson plans, self-prepared achievement test on environmental awareness and Taj Environmental Attitude scale by Dr. Haseen Taj were used. After selecting the sample it was planned to administer the tests to the students, permission of the heads of schools was sought and timings were fixed for the administration of the test. A rapport was established with the students by talking to them on the importance of environmental awareness and study of attitude towards environmental pollution. Thus they were told the purpose of psychological test to be administered. They were requested to cooperate fully in the conduction of test and respond sincerely, truthfully and honestly. Two groups were selected experimental and control, groups were matched on the basis of their 8th standard results. Experimental group was taught through CAI and control group was taught through conventional method. The tests were administered as pre tests and post tests.

As it was necessary to reduce anxiety, before starting the test, the students were assured that their responses would in no way affect their assessment and the information would be kept confidential. Before the start of the test instructions were given to the students as were mentioned in the manuals of the tests. They were provided with the booklets. They were motivated to fill the booklets and there was no time limit to fill these booklets. But the students actually took 20-25 minutes for each test. Raw scores were calculated and tabulated from these response sheets.
STATISTICAL TREATMENT

Raw scores have no value unless they are all subjected to statistical treatment. In the present study:

i. Mean

ii. Standard Deviation

iii. Standard error of the difference between means

iv. Value of ‘t’

v. ANOVA

Formulae used:

1. **Mean**

\[ M = \frac{\sum X}{N} \]

[ Garret, H.E. (1981), Pg. 27 formula:1]

Where \( M \) is the mean of the series

\( \sum X \) is the sum of all scores in the series

\( N \) is the total number of measure in the series

2. **Standard Deviation**

\[ \sigma = \sqrt{\frac{\sum x^2}{N}} \]

[Garrett, H.E. (1981), Pg. 50 formula:12]

Where \( \sigma \) is the standard deviation

\( x \) is the deviation from actual mean i.e. \( x = X - M \)

Where \( x \) is the raw score

\( M \) is the actual mean
\( \Sigma x^2 \) is the sum of the square of deviations taken from the actual mean.

N is the total number of measure in the series

3. **Standard error of difference between means**

\[
\sigma_D = \sqrt{\frac{(\sigma_1)^2 + (\sigma_2)^2}{N_1 N_2}}
\]

[Garrett, H.E.(1981), Pg. 214 formula : 56(b)]

\( \sigma_D \) is standard error of difference between two uncorrelated means

i.e., M_1 and M_2

\( \sigma_1 \) is the standard deviation of the first group.

N_1 is the number of individuals in the first group.

\( \sigma_2 \) is the standard deviation of second group.

N_2 is the total number of individual in the second group.

4. **t-test**

\[
t = \frac{D}{\sigma_D}
\]

Where t is t-value of critical ratio

D is difference between means, M_1 and M_2

\( \sigma_D \) is the standard error of difference between two uncorrelated means.

**ANALYSIS OF VARIANCE TECHNIQUE**

In order to test the hypothesis to determine whether the difference in the means of scores for Sec. School students could be explained in terms of chance fluctuations the techniques of analysis of variance was applied in this educational research to analyse the results. "The value of analysis of variance in testing hypotheses is most strikingly
demonstrated in those educational problems in which the significance of difference among several means is desired.

It may appear that analysis of variance and t-tests are simply two different ways of doing exactly the same job: testing for a mean difference in some respect, it is true. However, there are situations where analysis over t-tests.

Specifically, t-tests have limited application because they are designed for situations where there are only two treatments to compare.

Once we have analysed the total variability into two basic components (between treatments and within treatments variability), we simply compare them. The comparison is made by comparing and statics called f-ratio. For the independent measures, single factor analysis of variance, the f-ratio is computed by dividing the between treatments variance by the within the treat variance.

\[ F = \frac{\text{Variance between treatment}}{\text{Variance within treatment}} \]

F furnishes a comprehensive or over all list of the significance of the differences among means. A significant f does not tell us which means differ significantly, but that at least one is reliability different from some others. If f is not significant, there is no reason for further testing, as none of the mean differences will be significant. But if f is significant, we may proceed to test the separate differences by the t-test.

Assumptions for analysis of variance
1. For analysis of variance, there is the requirement that the sample be randomly selected from the population. This assumption was met as the samples were drawn randomly from all the four denominational schools.

2. The second assumption is that population distribution for each treatment condition should be normal. This assumption was met as ordinarily the researchers are not overly concerned with the assumption of normality, especially when large samples are used. In the present study as the researcher has used a very large sample's therefore, second assumption of normality is automatically fulfilled.

3. Third assumption of homogeneity of variance is an important one and it can be tested either by HarHey's test or by BarHett's test for homogeneity of variance. In the present study, however, the researcher found that the scores on different tests clustered together, therefore, she did not feel the necessity of testing this assumption. Thus, above discussions suggest that the distributions of scores of different variables closely proximated the normal distribution and also assumption of homogeneity is also satisfied.

SPSS was used to make the calculations.