CHAPTER IV

METHODOLOGY

4.1 Introduction

Methodology occupies a very prominent place in research work. The success of research depends largely on the suitability of methods, the tools and techniques used for the collection of data. A preplanned and well described method provides the researcher a scientific and feasible plan for solving the problem under investigation.

The present study is intended to test the “Effect of Blended Learning strategy on Achievement and Social and Environmental Attitude of Secondary School Students.” The details regarding the methods of study, tools and techniques employed, samples selected for the study, experimental design and procedure and statistical techniques applied in this study are given below.

4.2 Hypotheses formulated for the study

The hypotheses formulated for the study are as follows:

- Blended Learning strategy is an effective means for enhancing achievement in Biology of secondary school students.

- Blended Learning is effective in improving Environmental Attitude of secondary school students.

- Blended Learning is effective for promoting Social Attitude of secondary school students.
4.3 Objectives of the study

The study has the following specific objectives in view:

➢ To construct and validate an Environmental Attitude Scale for secondary school students.

➢ To construct and validate a Social Attitude Scale for secondary school students.

➢ To identify the Environmental Attitude of secondary school students.

➢ To identify the Social Attitude of secondary school students.

➢ To design a Blended Learning strategy for learning Biology at secondary level.

➢ To find the Achievement in Biology of secondary school students using Blended Learning strategy developed.

➢ To find the effect of Blended learning on achievement in Biology of secondary school students.

➢ To find the effect of Blended learning on Environmental Attitude of secondary school students.

➢ To find the effect of Blended learning on Social Attitude of secondary school students.

➢ To identify the relation between Achievement in Biology through Blended Learning and Environmental Attitude of secondary school students.
➢ To identify the relation between Achievement in Biology through Blended Learning and Social Attitude of secondary school students.

➢ To identify the relation between Environmental Attitude and Social Attitude of secondary school students.

➢ To analyze the ratings of teachers regarding the effectiveness of Blended Learning in Science at secondary level.

➢ To identify the views of students regarding the beneficial and practical aspects of Blended Learning.

### 4.4 Method adopted

The purpose of the present study was to develop a blended learning strategy for learning Biology and to find out its effect on achievement in Biology, environmental attitude and social attitude of secondary school students of Kerala. Hence the investigator adopted experimental cum survey method for the present investigation. The survey method was used to identify the environmental and social attitudes of students as a preliminary step of the study. It was also used to collect the responses of teachers and students regarding the beneficial and practical aspects with respect to feasibility and practicability of the blended learning strategy in science instruction.

The experimental method was used to study the effect of Blended Learning for enhancing achievement in biology of secondary school students as well as in improving their environmental and social attitude.
4.4.1 Experimental Design

Experimental design is the blue-print of the procedure that enables the researcher to test the hypotheses for reaching valid conclusions about the relationship between dependent and independent variables. The basic experimental design adopted in the present investigation was Pre-test Post-test Non-equivalent Group Design. Two groups were taken for the experimental study namely the experimental group and control group.

4.5 Variables selected for the study

Variables are the conditions or characteristics that the explorer manipulates. The independent variables selected for the present study are Blended Learning and Direct Instruction. The dependent variables are Achievement in Biology and Attitudes viz., Environmental Attitude and Social Attitude of secondary school students.

4.6 Sample selected for the study

The population for the present study comprised of secondary school students of Kerala. Here a sample of 450 secondary school students of representative districts in Kerala had been selected for the survey. Stratified random sampling technique was used for selecting the sample giving due representation to gender, locality and type of school. Experimental method was used to determine the effect of Blended learning on the achievement in Biology of secondary school pupils. For the experimental study the researcher selected two groups of 84 students (42 as experimental group and 42 as control group) from among the 450 students identified for the study. The opinion regarding the beneficial and practical aspects of blended learning were collected from the experimental group and 50 teachers selected for the study.
4.7 Tools used for the study

The following tools developed by the researcher were used for collecting data:

1. Lesson Transcripts in Biology based on Blended Learning on the topic ‘Biodiversity and its Conservation’
2. Lesson transcripts based on conventional method (Direct Instruction) on the topic ‘Biodiversity and its Conservation’
3. Achievement Test on the topic ‘Biodiversity and its Conservation’
4. Environmental Attitude Scale
5. Social Attitude Scale
6. Evaluation Schedule for Teachers
7. Questionnaire for Students

4.7.1 Description of Tools

4.7.1.1 Lesson Transcripts based on Blended Learning Strategy

As the preliminary step for preparing blended learning lessons for learning biology the investigator developed a blended learning strategy. The second step was preparing the lessons based on the strategy developed. The details of the development are as given in the following heads:

4.7.1.2 Blended Learning Strategy

Blended learning strategy finds a harmonious balance between face-to-face human interaction and online access to knowledge that encourages students to be active learners. This is achieved through focusing student activity on learning tasks that require the students to follow a series of actions that will lead to effective learning.
A preliminary try out of the strategy was undertaken to understand the effect of the strategy on the intended population.

Procedure

- Preliminary Phase: In the preliminary phase, which starts one week prior to the face-to-face session, students get basic information about blended learning. They have the first opportunity to get to know to their content delivery strategies. By doing so, they already get into contact with various requirements suitable for blended learning.

- Face-to-Face Session: In the face-to-face session, technical and instructional knowledge are transmitted by using different didactical methodologies. Moreover, a project work is initiated which will be finalized during the follow-up phase in blended learning.

- Creating Collaborative/Cooperative Learning Communities: A number of approaches can help engage learners in collaborative learning environments:
  
  a. Clearly Define Roles – Describe the relationship between the different roles in the learning community (including the instructor, subgroups, group leaders/facilitators, and individual learners) and outline their responsibilities and interdependencies.

  b. Create Sub-Groups – Create sub-groupings of learners that have their own limitations for small group learning activities and group project collaboration.

  c. Support Individuality – Provide a way for learners to create personal profiles that contain their collections and salient information to the topic at hand.
- Follow-up Phase: The students continue to work in face to face and collaborative blended learning environments.

- Review Phase: The strategy adopted was reviewed with respect to its objectives and sufficient modifications made through revision after consultation with experts.

After the preliminary try out, a strategy was outlined based on the necessary modifications required for students by taking into consideration the benefits of different delivery modes, methods and media. The outline of the strategy including the composition and sequence of blended learning activities developed for the topic ‘Biodiversity and its Conservation’ are presented below:

**Table 4.1**

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<th>Content</th>
<th>Learning Architecture</th>
<th>Delivery modes</th>
<th>Tasks and Events</th>
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<td>Exploratory</td>
<td>Field visits.</td>
<td>Task 1: Determining the levels of ecological organization through an analysis of the different components of the biosphere.</td>
</tr>
<tr>
<td></td>
<td>Self-paced learning</td>
<td>Web/Computer-Based Learning</td>
<td>E 1: Visit a local area to document the type of organisms living there and record field observations.</td>
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<tr>
<td></td>
<td>Guided Discovery</td>
<td>Instructor-led Classroom</td>
<td>E 2: View the first multimedia lesson on to analyze the various categories of the Biosphere independently.</td>
</tr>
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<td>Classroom</td>
<td>E 3: Identify the Levels of Ecological Organization.</td>
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</tbody>
</table>
### Lesson 2

| Methodology | Task 2-Learning the different types of ecosystem in relation to their relative importance in supporting various life forms.  
E 1: Observe the characteristics of different ecosystems  
E 2: Conduct a case study of a nearby ecosystem  
E 3: Visit natural and artificial ecosystems to compare the nature and characteristics of them and prepare a presentation on it. |
| Self-paced learning | Computer-Based Learning  
Case study  
Web Based Learning |

### Lesson 3

| Methodology | Task 3: Learn the diversity of organisms in relation to the different methods and levels of classification  
E 1: Learn the contributions of scientists in grouping organisms on the basis of various criteria.  
E 2: Role play any animal based on their respective address. |
| Exploratory  
Participatory | Instructor-led Classroom  
Role play |

### Lesson 4

| Methodology | Task 4: Determine the various interactions in the ecosystem  
E 1: Observe features and differences of food relations in an ecosystem.  
E 2: Discuss on ‘food relations between different organisms in an ecosystem.’  
E 3: Observe and identify the nature and relationship of lichen |
| Guided Discovery  
Exploratory | Instructor-led Classroom  
Investigation: Laboratory work |
| Lesson 5 | Exploratory | Task 5: Learn the existence of food web and its relation with the ecosystem  
E 1: View the nature and characteristics of food chains and food webs  
E 2: Construct Food Chains and Food Webs |
|----------|-------------|-------------------------------------------------------------------|
| Guided Discovery | Computer-Based Learning | **Lesson 6**  
Exploratory – Project-Based Learning  
Field visits  
Surveys, Interviews and Project work  
Web/Computer-Based Learning  
Self-paced learning | Task 6: Learn about and understand the shift in perception and awareness of the environment during the last five-six decades.  
E 1: Explore the condition of biodiversity in the past, present and future.  
E 2: Examine the Action Plans prepared by various countries to maintain and conserve biodiversity in their places and prepare one. |
|            | Instructor-led Classroom | **Lesson 7**  
Exploratory | Task 7: Learn the status and trends of biodiversity and develop awareness to others regarding measures to protect biodiversity  
E 2: View the multimedia presentation on Status and Trends of Global Biodiversity and conduct a group discussion on |
|            | Web Based Learning | **Lesson 7**  
Exploratory | Task 7: Learn the status and trends of biodiversity and develop awareness to others regarding measures to protect biodiversity  
E 2: View the multimedia presentation on Status and Trends of Global Biodiversity and conduct a group discussion on |
|            | Group Discussion | **Lesson 7**  
Exploratory | Task 7: Learn the status and trends of biodiversity and develop awareness to others regarding measures to protect biodiversity  
E 2: View the multimedia presentation on Status and Trends of Global Biodiversity and conduct a group discussion on |
### Lesson 8
**Exploratory**
- **Instructor-led Classroom**
- **Web/Computer-Based Learning**
- **Participatory**
- **Campaigns**

**Task 8: Learn about natural resources and types – renewable and non-renewable energy sources**

- **E 1:** Analyze the different ways of utilizing Natural Resources wisely.
- **E 2:** Investigation on the utilization of energy resources

### Lesson 9
**Exploratory**
- **Web/Computer-Based Learning**
- **Participatory**
- **Group discussion**
- **Creative work**

**Task 9: Learn to control depletion of biodiversity**

- **E 1:** Identify the ways by which biodiversity is badly affected.
- **E 2:** ‘Poverty is the worst form of pollution’
- **E 3:** Outline plans for effective water management.

### Lesson 10
**Self-paced learning**
- **Web/Computer-Based Learning**

**Task 10: Analyze and Discuss the importance of in-situ conservation**

- **E 1:** Analyze the conservation strategies to protect wildlife
- **E 2:** Identify methods of in-situ conservation,

### Lesson 11
**Exploratory**
- **Instructor-led Classroom**
- **Computer-Based Learning**

**Task 11: Analyze and discuss the importance of ex-situ conservation.**

- **E 1:** Discuss the importance of conservation.
- **E 2:** View the multimedia presentation on ex-situ
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<td>Lesson 12&lt;br&gt;Guided Discovery</td>
<td>Web/Computer-Based Learning&lt;br&gt;Instructor-led Classroom</td>
<td>Task 12: Learn our most successful conservation ventures in the recent times.</td>
<td>E 1: Observe the multimedia presentation on conservation projects. E 2: Analyze the role of conservation projects in eco-development.</td>
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<tr>
<td>Lesson 13&lt;br&gt;Exploratory</td>
<td>Instructor-led Classroom&lt;br&gt;Computer-Based Learning</td>
<td>Task 13: Learn to experience the rich variety of native species that help to define our nation.</td>
<td>E 1: Learn about Red Data Book and Red List prepared by IUCN.</td>
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<td>Lesson 14&lt;br&gt;Exploratory</td>
<td>Web/Computer-Based Learning&lt;br&gt;Group discussion</td>
<td>Task 14: Establishing the relevance of ecological hotspots.</td>
<td>E 1: Identify the features of ecological hotspots. E 2: Conduct a discussion on “Why is India considered as one of the richest countries in the world in terms of biodiversity?”</td>
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<td>Lesson 15&lt;br&gt;Exploratory</td>
<td>Computer-Based Learning&lt;br&gt;Supervised Study</td>
<td>Task 15: Learn the role of environmental organizations</td>
<td>E 1: Identify the role of environmental organizations. E 2: Enumerate the services of environmental organizations.</td>
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| Lesson 16 | Exploratory Participatory | Task 16: Acquaint with Environmental Acts and Laws  
E 1: Identify the significance of environmental legislation  
E 2: Identify our role in environmental legislation |
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| Lesson 17 | Exploratory Participatory | Task 17: Probing into the concept of Sustainable Development  
E 1: Discuss various aspects of the developmental issues.  
E 2: Detailed examination of the concept of sustainable development |
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<td>Instructor-led Classroom</td>
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</table>

| Lesson 18 | Exploratory              | Task 18: Admitting the need of green living for a sustainable existence.  
E 1: Prepare ways of living in a sustainable manner.  
E 2: Developing eco-friendly lifestyles |
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The details of the Blended Learning Lesson Transcripts are given below. The CD containing the multimedia presentations are attached in the back cover of the thesis.
LEsson Transcripts
Based on
Blended Learning

Topic: biodiversity and its conservation

Prepared by: Tara S. NaIr
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(Assistant Professor,
NSS Training College,
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Supervised by: Dr. Bindu R.L.
Associate Professor,
Department of Education,
University of Kerala,
Thiruvananthapuram.
# INDEX OF LESSONS

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<td>Classification of Organisms</td>
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<td>Lesson VI</td>
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<td>Lesson VIII</td>
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<td>Lesson IX</td>
<td>Threats to Biodiversity- causes and effects</td>
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<td>Lesson X</td>
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<td>Lesson XI</td>
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<td>Lesson XVII</td>
<td>Conservation vs. Development</td>
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<td>Lesson XVIII</td>
<td>Sustainable and Green Living</td>
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</table>
Methodology 100

**Face to Face Learning**

![Images of face to face learning activities]

**Online Learning**

![Images of online learning activities]
Exploratory Learning

Self paced Learning

Participatory Learning
Broad Objectives

- Weaving strategies to integrate face to face and online activities in the learning process.
- Facilitate meaningful learning within a climate of positive, enthusiastic learning contexts.
- Support students to establish effective communication and establishing social bonds.
- Develop abilities to project one’s self and establish personal purposeful relationship with the environment as well as society.

Specific Objectives

The specific outcomes of this blended learning strategy in terms of cognitive, affective and conative experiences are the following:

(i) to recognize the role of ecosystem for the stable existence of Biosphere;
(ii) to identify the help rendered by food Web in strengthening each ecosystem;
(iii) to analyze the disturbances caused in the equilibrium of ecosystem as the complexity of food web decreases;
(iv) to differentiate the different types of Biodiversity;
(v) to define Biodiversity and estimate the present condition of biodiversity at the local, national and global levels;
(vi) to find reasons for the actual causes of Biodiversity depletion;
(vii) to establish the need and importance of Biodiversity conservation;
(viii) to suggest measures to solve problems affecting Biodiversity;
(ix) to evolve plans for comprehensive schedule of action to conserve Biodiversity;
(x) to evaluate the possibilities of linking Biodiversity with development;
(xi) to substantiate the importance of Sustainable Development;
(xii) to realize that all organisms on earth have equal rights and importance to live in this environment;
(xiii) to develop concern to all organisms and to protect them;
(xiv) to develop communication skill, democratic outlook, scientific bent of mind, creative and meta-cognitive abilities, attitudes, social skills and values.

**Major Concepts**

1) Biosphere is the interactive collection of all the earth’s ecosystem- i.e. all life on earth and all the non-living elements that interact with life.

2) Biodiversity is the bio -richness of the earth which includes different kinds of plants, animals and micro-organisms which provides the basis for ecosystems and the services they provide, upon which all people fundamentally depend.

3) Nature keeps the ecosystem in balance; any change can cause a ripple effect through the entire community.

4) Local declines in biodiversity are even more dramatic than global declines, and the beneficial effects of many organisms on local processes are lost long before the species become globally extinct.
5) Unprecedented changes are taking place in the ecosystems of the world, including species losses through local extinctions, species additions through biological invasions, and wholesale changes in ecosystems that follow transformation of wild lands into managed ecosystems. These changes have a number of important effects on ecosystem processes.

6) Through sympathetic management of their own land, local authorities can make a significant contribution to local biodiversity targets as well as a landscape approach to conservation.

7) If large populations of species become extinct over a short period of time, whether from natural phenomena, rapid evolution or human intervention, biodiversity shows decline.

8) The condition of biodiversity at the local, national and global levels are in great concern. Although a number of uncertainties remain, the importance of ecosystem services to human welfare requires that we adopt the prudent strategy of preserving biodiversity in order to safeguard ecosystem processes vital to society.

9) Overexploitation has resulted in the loss of biodiversity in a variety of ways. The lack of biodiversity can result in failures in eco-systems and in agricultural progress that supports the food systems of humans. This is why awareness of biodiversity is so important.

10) Changes in the identity and abundance of species in an ecosystem can be as important as changes in biodiversity in influencing ecosystem processes.
11) Human impacts on global biodiversity have been dramatic, resulting in unprecedented losses in global biodiversity at all levels, from genes and species to entire ecosystems;

12) Biodiversity and global climate change are interlinked in terms of world efforts to reduce the potential for loss of glaciers, rising sea levels and radical shifts in weather patterns

13) The global distribution of biodiversity -- its geography –and extensive ecological hotspots are interesting in its own right, and relevant to conservation.

14) In the modern era, due to human actions, species and ecosystems are threatened with destruction to an extent rarely seen in earth history.

15) Conservation of biodiversity (both in-situ and ex-situ) helps to replenish the great loss to biodiversity.

16) Linking conservation of biodiversity with development has resulted in the idea of sustainable development.

17) Environmental sustainability should be embedded in every human activity through environmentally responsible designs and also an extended responsibility programmes (energy efficient enhancements, reducing paper wastage and cutting carbon emissions).

18) Sustainable living is a lifestyle that attempts to reduce an individual's or society's use of the Earth's natural resources and personal resources.
Lesson Plan 1 Levels of Ecological Organization

Grade Level: 8th Grade - High School  Subject: Life Science

Sub-Subject: Ecology  Length/Duration: 4-5hrs

Major Concept: Biosphere is the largest unit of life on the earth’s surface.

Blended learning strategy:

- **Objectives**-Cognitive, Affective & Psychomotor
  
  The pupil
  
  (i) observes natural and virtual habitats
  
  (ii) recognizes the levels of ecological organization;
  
  (iii) draws and labels different levels of ecological organization
  
  (iv) identifies the need and importance of each organism in the biosphere
  
  (v) establishes Biosphere as the largest unit of life on the earth’s surface;
  
  (vi) evaluates the role of biosphere in maintaining life.

- **Methods**- a. *Exploratory*- involves direct observation of the environment through field visits and observations
b. Guided Discovery – Teacher presents the topic and puts some questions for discussion and motivates pupil to do some investigatory activities. Teacher gives necessary instructions wherever necessary.

c. Self-paced learning- Each pupil engages in self learning utilizing the multimedia presentation.

- Media: Synchronous - Instructor-led Classrooms, Field visits

Asynchronous- Surveys, Web/Computer-Based Learning

### Strategy Outline:

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<thead>
<tr>
<th>Tasks and Events</th>
<th>Outcomes</th>
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<tr>
<td><strong>Task 1.1</strong> - Determining the levels of ecological organization through an analysis of the different components of the biosphere.</td>
<td>Data recording and project journals keeping</td>
</tr>
</tbody>
</table>
| **Event 1.1.1**: Field Research (3 hrs)  
Instructions for field visit  
Visit a local area to document the type of organisms living there. (Students should record the types of organisms inhabiting the area based on the type of organism, its living conditions, collective nature, etc.) Describe the conditions as you see it there; the biotic and abiotic aspects of the place and their relationships among themselves. Also let the students observe the natural surroundings outside the school campus in order to find out different organisms in the immediate surroundings. | Observes natural surroundings and identifies different organisms |
| **Proforma for Field work**  
Use the format below as a general guideline for your field analysis. The points provided in the guidelines can be used to fill in the answers to the various issues for each area:  
1. Aims and objectives: To identify and document: | |
- the Biotic and abiotic components in that environment
- how they are useful to the organisms inhabiting there
- how organisms are related to each other
- examples of habitats
2. **Methodology**: Observation of habitats
3. **Results and conclusions**:

<table>
<thead>
<tr>
<th>Follow-up Discussion: How are organisms distributed in the environment?</th>
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<tbody>
<tr>
<td><strong>Event 1.1.2 Self-paced learning (1 hr)</strong></td>
</tr>
<tr>
<td>View the first multimedia lesson to analyze the various categories of the Biosphere independently.</td>
</tr>
<tr>
<td>i. Organism</td>
</tr>
<tr>
<td>ii. Population</td>
</tr>
<tr>
<td>iii. Community</td>
</tr>
<tr>
<td>iv. Ecosystem</td>
</tr>
<tr>
<td>v. Biome</td>
</tr>
<tr>
<td>vi. Biosphere</td>
</tr>
<tr>
<td>Categorize the various components of the Biosphere.</td>
</tr>
<tr>
<td>Find out the meaning of each and relation of these components with one another.</td>
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<tr>
<th><strong>Event 1.1.3. Guided Discovery - 1 hr.</strong></th>
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<tbody>
<tr>
<td>1. Draw the levels of Ecological organization.</td>
</tr>
<tr>
<td>2. Identify the role of each organism in the biosphere.</td>
</tr>
<tr>
<td>3. Find out how biosphere helps in maintaining and supporting various life forms.</td>
</tr>
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</table>

<table>
<thead>
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<th>Preparations:</th>
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<tr>
<td>Prepares field notes</td>
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<tr>
<td>Infers about the distribution of organisms in the environment</td>
</tr>
<tr>
<td>Classifies the various components of the Biosphere; interprets terms; and establishes Biosphere as the largest unit of life on the earth’s surface</td>
</tr>
<tr>
<td>Analyses the role of biosphere in maintaining life in the biosphere.</td>
</tr>
</tbody>
</table>

**Reflection:**

1. What is Biosphere?
2. What are the components of the Biosphere?
3. Identify and list three biotic and abiotic factors each in a wetland community.
4. Why is biosphere so much important?
Lesson 2 - Ecosystem- types and functions

Grade Level: 8th Grade - High School
Subject: Life Science
Sub-Subject: Ecology
Length/Duration: 3 hrs

Major concept: Ecosystems have a stable role in the existence of biosphere.

Blended learning strategy:

- **Objectives** - Cognitive, Affective & Psychomotor
  The pupil
  (i) recognizes the components of ecosystem;
  (ii) identifies the characteristics of different ecosystems
  (iii) analyses the role of ecosystem in the stable existence of the Biosphere;
  (iv) evaluates the services rendered by each ecosystem.

- **Methods** - a. Exploratory - Case Study to prepare an environmental profile of that area; Field visit to ecosystems
  b. Self-paced learning – Independent practice to find out the characteristics of different ecosystems in the environment..
• **Media** - *Synchronous* - Instructor-led Classrooms

*Asynchronous* - Case study, Web/Computer-Based Learning

**Strategy Outline:**

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<th>Tasks and Events</th>
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<tr>
<td><strong>Task 2.1</strong> - Learning the different types of ecosystem in relation to their relative importance in supporting various life forms.</td>
<td>Observes features of ecosystem; classifies them based on the characteristics; relates with natural effects</td>
</tr>
<tr>
<td><strong>Event 2.1.1: Independent practice: Self-paced learning</strong> (1 hr)</td>
<td></td>
</tr>
<tr>
<td>View the second multimedia lesson and observe the characteristics of different ecosystems. Classify them and note their characteristics. Discuss how an environmental phenomenon like hurricane can affect components in an ecosystem.</td>
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<tr>
<td><strong>Event 2.1.2: Case Study</strong> (2hrs)</td>
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</tr>
<tr>
<td>Conduct a case study of a nearby ecosystem like wetland, grassland, sacred grove or hill-slope to prepare an environmental profile of that area in order to have an appreciation of the ecosystem’s goods and services, which include its various assets. In assessing the ecosystem’s values, it is not enough to look at its structure and functions but at who uses it and how the resources reach the users. Place the profile in your individual portfolio.</td>
<td>Observes a particular ecosystem; collects and records details of its assets and services</td>
</tr>
<tr>
<td><strong>Event 2.1.3 Field visit</strong> (2 hrs)</td>
<td></td>
</tr>
<tr>
<td>Visit natural and artificial ecosystems. Compare the nature and characteristics of them and prepare a presentation on it. Document the nature of various ecosystems in your area in order to have a deeper appreciation of its value to mankind. Adopt ways to preserve any one of them in their real condition.</td>
<td>Observes natural and artificial ecosystems; compares their nature and characteristics; appreciates its values</td>
</tr>
</tbody>
</table>
Reflection:

1. As human populations increase what might happen to the earth?
2. What are the services rendered by an ecosystem?
3. Explain how pesticides sprayed on the water in a wetland ecosystem could affect a different ecosystem.

Lesson 3- Classification of Organisms

Grade Level: 8th Grade - High School
Subject: Life Science
Sub-Subject: Ecology
Length/Duration: 1

Major Concept: As science became a part of human life, the classification of living organisms underwent a thorough modification led to a more systematic and scientific approach to classification.

Blended learning strategy:

- Objectives-Cognitive, Affective & Psychomotor

  The pupil

  (i) recognizes the contributions of scientists in classifying organisms

  (ii) classifies organisms based on specific criteria

  (iii) identifies different levels of classification

  (iv) observes organisms around

  (v) differentiates organisms based on features

  (vi) participates in role-play
(vii) realizes the role of organisms in nature.

- **Methods**- *Guided Discovery*- teacher guides student to classify organisms based on characteristics and to discuss on the need of a family.

*Participatory*- engages in role-playing organisms based on their classification

- **Media**- *Synchronous* - Role play

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task-3.1</strong> Learn the diversity of organisms in relation to the different methods and levels of classification</td>
<td>Co-construction of knowledge, development of organization, higher-order thinking and reflective skills.</td>
</tr>
<tr>
<td><strong>Event 3.1.3: Face –to-face session – Role play (1 hr)</strong></td>
<td></td>
</tr>
<tr>
<td>1) Learn the contributions of scientists in grouping organisms on the basis of various criteria.</td>
<td></td>
</tr>
<tr>
<td>2) Observe pictures of various organisms and categorize them based on differences and similarities.</td>
<td></td>
</tr>
<tr>
<td>3) Identify various levels of classification of organisms around.</td>
<td></td>
</tr>
<tr>
<td>4) Enquire into the details of Binomial Nomenclature.</td>
<td>Observes different organisms, classifies them based on similarities and dissimilarities; identifies the levels of classification</td>
</tr>
<tr>
<td>5) Probe into the basic question “Do organisms on this earth need a family and how it is possible?” To find answers teacher exhibits a chart showing the levels of classification and gives pictures of animals and asks to classify them by observing the chart. Teacher consolidates the findings. Then teacher gives clue cards to groups and asks to find out the family, class, order, phylum and kingdom of animals like cat and dog.</td>
<td></td>
</tr>
<tr>
<td>6) Asks students to <strong>role play</strong> any animal of their choice based</td>
<td>Actively participates in</td>
</tr>
</tbody>
</table>
Reflection:
1. What is Binomial Nomenclature?
2. Identify the different levels of classification of tiger.

Lesson 4- Food relations in the Ecosystem

Grade Level: 8th Grade - High School
Subject: Life Science
Sub-Subject: Ecology
Length/Duration: 45mnts

Major Concept: Different types of relations called interactions exist among organisms of various types, which are either beneficial or harmful to organisms.

Blended learning strategy:

- Objectives-Cognitive, Affective & Psychomotor

  The pupil

  (i) recognizes the different food relations in the ecosystem;

  (ii) identifies mutual relationships among the organisms in the ecosystem;

  (iii) observes different interactions in nature;

  (iv) classifies the types of food relations among organisms;

  (v) categorizes positive and negative interactions

  (vi) draws and labels relationships
(vii) defines different interactions
(viii) evaluates their role in interdependence of organisms

- **Methods-** *Guided Discovery*- teacher encourages pupil for discussion and successive finding of concepts.

  *Exploratory*- Investigation on symbiosis

- **Media-** *Synchronous*- Instructor-led Classrooms & Hands-on Labs
  *Asynchronous*- Web/Computer-Based Learning

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task: 4.1</strong> Determine the various interactions in the ecosystem</td>
<td>Development of presentation skills, and ability to synthesize knowledge in a creative way</td>
</tr>
<tr>
<td><strong>Event 4.1.1: Self-paced learning</strong> View the lesson on Food relations in the Ecosystem and identify the features and differences of each of them.</td>
<td><strong>Event 4.1.2: Guided Practice: In-class activity</strong> (1 hr) Students are divided to form groups of 5 each in order to have a discussion on ‘food relations between different organisms in an ecosystem.’</td>
</tr>
<tr>
<td></td>
<td>Identifies positive and negative interactions existing among organisms; differentiates them according to their nature; interprets them and cites examples.</td>
</tr>
<tr>
<td>1. Analyze the nature of different types of relations existing among organisms of various types.</td>
<td></td>
</tr>
<tr>
<td>2. Find out the positive and negative interactions in the environment, viz; mutualism, commensalism, predation, parasitism and competition.</td>
<td></td>
</tr>
</tbody>
</table>
Ask group leaders to present their findings.

**Event 4.1.2 Investigation: Laboratory work**

Take a bit if lichen found on a tree bark or a rock and tease it apart with straight pins. Prepare a wet mount slide of the pieces. Observe it under the microscope. Describe the appearance of the two kinds of organisms that make up the lichen. What kind of symbiosis exists between them? Prepare a short note with suitable diagram.

**Reflection:**

1. Mention the types of interactions in the environment.
2. Differentiate negative and positive interactions.
3. Explain the relationship between shark and remora.

---

**Lesson 5 - Food Web and Balance in Ecosystem**

Grade Level: 8th Grade - High School  
Sub-Subject: Ecology  
Subject: Life Science  
Length/Duration: 1 hr

**Major concept:** In an ecosystem there are many different food chains and many of these are cross-linked to form a food web. Ultimately all plants and animals in an ecosystem are part of this complex food web.

**Blended learning strategy:**

- **Objectives** - Cognitive, Affective & Psychomotor

  The pupil

  (i) observes different ecosystems in nature;

  (ii) identifies various trophic levels;

  (iii) constructs Food Chain and Food Web;

  (iv) reasons out why the complexity of food web varies
(v) evaluates the services rendered by food Web in strengthening each ecosystem.

- **Methods** - *Exploratory*—analyze nature complexity of food web

  *Guided Discovery*—observe and discuss characteristics of food chains and food web.

- **Media** - *Synchronous*—Instructor-led Classrooms

  *Asynchronous*—Computer-Based Learning

**Strategy Outline:**

<table>
<thead>
<tr>
<th>Task 5.1- Learn the existence of food web and its relation with the ecosystem</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event 5.1.1- Self-paced learning</td>
<td>Identifies nature and characteristics of food chains and food web</td>
</tr>
<tr>
<td>View the multimedia lesson on Food Chain and Food Web and note the nature and characteristics of food chains and food webs.</td>
<td></td>
</tr>
<tr>
<td>Event 5.1.2- In-class activity</td>
<td>Constructs food chains and food webs; identifies different trophic levels; establishes their relationship with each other; predicts consequences of effects in food chains; suggests role of each organism in the ecosystem.</td>
</tr>
<tr>
<td>a. Prepare maximum number of Food Chains by observing organisms in your surroundings and record them.</td>
<td></td>
</tr>
<tr>
<td>b. Establish mutual links between food chains on the basis of your findings and expand them.</td>
<td></td>
</tr>
<tr>
<td>c. Notice the complexity of the relationships and construct a Food Web.</td>
<td></td>
</tr>
<tr>
<td>d. Find out what happens when one of the organisms is removed from the food chain.</td>
<td></td>
</tr>
<tr>
<td>e. Discuss in detail how it affects the balance of the ecosystem.</td>
<td></td>
</tr>
<tr>
<td>f. Arrange the organisms of an ecosystem into different trophic levels.</td>
<td></td>
</tr>
<tr>
<td>g. Examine whether an organism occurs in more than one trophic level.</td>
<td></td>
</tr>
<tr>
<td>h. Find out other examples.</td>
<td></td>
</tr>
</tbody>
</table>
i. Mention the role of decomposers and their position in the trophic level.

j. Prepare diagrammatic sketches if possible using graphic tools and display in your portfolio or group folder.

**Reflection:**

1. As complexity of food web decreases how will it affect the ecosystem?

2. State the significance of trophic levels.

3. What is the significance of decomposers?

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**Lesson 6 - Exploring Biodiversity at Local level- past, present and future conditions**

Grade Level: 8th Grade - High School          Subject: Life Science

Sub-Subject: Ecology              Length/Duration: 1 week project

**Major Concept:** Biodiversity is the variation of life forms in a given ecosystem which includes all the living organisms found there.

**Blended learning strategy:**

- **Objectives**-Cognitive, Affective & Psychomotor
  
  The pupil
  
  (i) recognizes the different types of biodiversity;

  (ii) compares the condition of biodiversity in the past and present;

  (iii) identifies the importance of biodiversity

  (iv) reasons out why India is considered to be one of the mega biodiversity centers of the world;

  (v) analyzes the nature of biodiversity around;
(vi) develops problem solving skills
(vii) appreciates the beauty of nature.

- **Methods** - *Exploratory* – Project-based learning, where the pupil actively engages in the planning and execution of a project based on the condition of biodiversity in the locality.

- **Media** - *Synchronous* - Field visits
  *Asynchronous* - Surveys, Interviews and project work

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 6.1</strong></td>
<td>Experiences learning by doing</td>
</tr>
<tr>
<td>Learn about and understand the shift in perception and awareness of the environment during the last five-six decades.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 6.1.1: Survey &amp; Group Discussion</strong></td>
<td></td>
</tr>
<tr>
<td>Survey and analyze the condition of biodiversity in the past, present and future in your locality to gather data and discusses in class the actual condition of biodiversity now.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 6.1.2: Project Based Learning</strong></td>
<td>Develops process skills related to planning and</td>
</tr>
<tr>
<td>a. Make an informal interview with at least five persons above the age of 60. Ask about their perception of the environment in the early 60’s and compare it to their perception today. Do they remember any important events related to the environment 30-50 years ago? Why do they think the events were important?</td>
<td></td>
</tr>
<tr>
<td>b. Write an individual paper (maximum 500 words) on your findings. Place the document in your individual portfolio.</td>
<td></td>
</tr>
<tr>
<td>c. Compare and discuss your findings with your group in the</td>
<td></td>
</tr>
</tbody>
</table>
classroom. Select a moderator and prepare a common paper on your findings. (Maximum 1000 words). Place document in group folder.

**Event 6.1.2- Self-paced learning**

View the multimedia presentation on Biodiversity and find out the various benefits of it.

Examine the Action Plans prepared by various countries to maintain and conserve biodiversity in their places. Go through the recommendations proposed by the respective authorities. Prepare an **Action Plan** to lessen the loss of biodiversity in your locality and submit to relevant authorities with public participation.

**Reflection:**

1. Define biodiversity.

2. What are the valuable services provided by biodiversity?

3. Find out how your community disposes of its wastes and how much disposal costs.

4. Do the disposal costs reflect stresses placed on the environment’s food webs or only the monetary cost of disposal?

5. Identify areas recognized as World Heritage Sites by organizations and prepare notes.
Lesson 7 - Status and Trends of Global Diversity

Grade Level: 8th Grade - High School
Sub-Subject: Ecology

Subject: Life Science
Length/Duration: 3 hrs

Major Concept: Biodiversity is under serious threat as a result of human activities; the main dangers worldwide are of population growth and resource consumption, climate change and global warming, habitat conversion and urbanization, invasive alien species, over-exploitation of natural resources and environmental degradation.

Blended learning strategy:

- Objectives-Cognitive, Affective & Psychomotor

  The pupil

  (i) recognizes the features of biodiversity at the global level;

  (ii) identifies the global condition of natural resources;

  (iii) compares the state of biodiversity at local, national and global levels;

  (iv) estimates the rate of species loss annually;
(v) analyses the nature of threats to global biodiversity
(vi) predicts consequences of the disappearance of organisms from the earth;
(vii) develops concern over the condition of our earth facing several threats.

- **Methods** - *Exploratory* - Search for relevant information regarding the various threats posed to global biodiversity and discuss in groups

- **Media** - *Synchronous* - Instructor-led Classrooms

*Asynchronous* - Web/Computer-Based Learning

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and Events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 7.1</strong> To learn the status and trends of biodiversity and to develop awareness to others regarding measures to protect biodiversity</td>
<td></td>
</tr>
<tr>
<td><strong>Event 7.1.1</strong> Self-paced learning (1 hour)</td>
<td>evaluates the MEA on ecosystems</td>
</tr>
<tr>
<td><strong>Event 7.1.2</strong> (2 hours)</td>
<td></td>
</tr>
<tr>
<td>a. View the multimedia presentation on Status and Trends of Global Biodiversity.</td>
<td>Identifies threats to global biodiversity,</td>
</tr>
<tr>
<td>b. Search for relevant information regarding the various threats posed to global biodiversity and discuss in your</td>
<td></td>
</tr>
</tbody>
</table>
group: “The present three most urgent global environment issues”. Select a moderator. Write a group essay, maximum 1000 words.

c. Based on your essay, prepare a 20 minutes lecture using power point with the same title for an audience of the Ecoclub, or similar.

d. Find out the importance of International Convention on Biological Diversity (CBD).

<table>
<thead>
<tr>
<th>Reflection:</th>
<th>Analyses several global environmental issues; evaluates the significance of CBD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How is biodiversity badly affected by human influences?</td>
<td></td>
</tr>
<tr>
<td>2. Explain the status of global biodiversity.</td>
<td></td>
</tr>
<tr>
<td>3. Why is it said that “We must act before it is too late”?</td>
<td></td>
</tr>
</tbody>
</table>

**Lesson 8 - Natural resources - Renewable and Non-renewable**

Grade Level: 8th Grade - High School

Sub-Subject: Ecology

Subject: Life Science

Length/Duration: 3 hrs

**Major Concept:** Natural resources are the resources for the use of humans that are found naturally in the environment without any interaction of human beings.

**Blended learning strategy:**

- **Objectives**-Cognitive, Affective & Psychomotor

  The pupil

  i. recognizes the different types of natural resources

  ii. classifies natural resources into renewable and non-renewable

  iii. suggests uses of natural resources wisely

  iv. adopts means of utilizing and managing resources

- **Methods**- *Exploratory*—directed for self-learning concepts and to explore on the utilization of energy in the locality.
Methodology 123

- **Media** - *Synchronous* - Instructor-led Classrooms, Campaigns
  
  *Asynchronous* - Web/Computer-Based Learning

**Strategy Outline:**

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 8.1</strong> - Learn about natural resources and types – renewable and non-renewable energy sources</td>
<td><strong>Identifies different types of natural resources, and the ways in which they are utilized; establishes their importance</strong></td>
</tr>
<tr>
<td><strong>Event 8.1.1</strong> Self-paced learning</td>
<td></td>
</tr>
<tr>
<td>a. View the multimedia lesson on Natural Resources and analyze the different ways of utilizing them wisely. Find out why renewable resources are an important aspect of sustainability.</td>
<td></td>
</tr>
<tr>
<td>b. Complete the following table:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Natural Resources</th>
<th>Man-made Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Hydroelectric power</td>
</tr>
<tr>
<td>Petroleum</td>
<td>Gasoline</td>
</tr>
<tr>
<td>Farmland</td>
<td>Potato chips</td>
</tr>
<tr>
<td></td>
<td>Medicines</td>
</tr>
</tbody>
</table>

**Event 8.1.2** - Investigation

Conduct an investigation on the utilization of energy resources in your locality and make aware the people about the proper utilization of energy using appropriate aids.

**Reflection:**

1. List the important sources of renewable and non-renewable energy sources.
2. Why should energy be conserved?

3. Explain the 4 R’s of conservation.

---

**Lesson 9 - Threats to Biodiversity - causes and effects**

Grade Level: 8th Grade - High School  
Subject: Life Science  
Sub-Subject: Ecology  
Length/Duration: 2 hrs

**Major Concept:** Rich biodiversity of India is under severe threat owing to habitat destruction, degradation, fragmentation and over-exploitation of resources.

**Blended learning strategy:**

- **Objectives** - Cognitive, Affective & Psychomotor
  
  The pupil
  
  (i) recognizes the different threats to biodiversity;
  
  (ii) compares present state of biodiversity loss with that of the past;
  
  (iii) identifies the importance of biodiversity;
  
  (iv) analyses the threats to biodiversity;
  
  (v) suggests ways to avoid biodiversity depletion.

- **Methods** - **Exploratory** – observes the factors causing biodiversity loss and investigates surroundings
Participatory – participates in group discussion

- **Media** - *Synchronous* - Instructor-led Classroom, Group Discussion

  *Asynchronous* - Web/Computer-Based Learning

**Strategy Outline:**

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 9.1</strong> Learn to control depletion of biodiversity (1 hr)</td>
<td></td>
</tr>
<tr>
<td><strong>Event 9.1.1</strong> (1 hour)</td>
<td></td>
</tr>
<tr>
<td>View the multimedia presentation on Threats to Biodiversity and identify the ways by which biodiversity is badly affected. Participate in environmental quiz in the website <a href="http://www.keepbanderabeautiful.org/bsbslid1.html">http://www.keepbanderabeautiful.org/bsbslid1.html</a></td>
<td></td>
</tr>
<tr>
<td><strong>Event 9.1.2</strong> (2 hrs)</td>
<td></td>
</tr>
<tr>
<td>1. <strong>Group discussion:</strong> Take part in a typical 1980’s discussion: Topic: ‘Poverty is the worst form of pollution’, <em>Indira Gandhi</em>, Prime Minister of India’ (1966-77 and 1980-84) This exercise is used to practice collaboration and gather arguments that you can use for later essays. Look for information in the Internet. Make reference to your sources. <em>Keep your input short, in “postcard” style!</em></td>
<td>Develop skills in peer collaboration and techniques for using thinking and reasoning in a creative way</td>
</tr>
<tr>
<td>2. <strong>Investigation:</strong> Find out what happens to waste water in your area. What effects would untreated water have if discharged into a lake or river? Outline plans for effective water management.</td>
<td>Suggests measures for effectively managing polluted water</td>
</tr>
</tbody>
</table>

**Reflection:**

1. What can we do save biodiversity from destruction?
3. How can the application of fertilizer and pesticides to a farm field affect drinking water?
4. Explain how pollution indicates that ecosystems are out of balance.
Lesson 10 - In-situ conservation-Types

Grade Level: 8th Grade - High School                      Subject: Life Science
Sub-Subject: Ecology                                         Length/Duration: 1 hr

Major concept: In-situ conservation, the conservation of species in their natural habitats, is considered the most appropriate way of conserving biodiversity.

Blended learning strategy:

- **Objectives**-Cognitive, Affective & Psychomotor
  
  The pupil
  
  (i) recognizes the methods of conserving organisms
  
  (ii) explains the methods of in-situ conservation
  
  (iii) reasons out why protected areas form a central element of any national strategy to conserve biodiversity.
  
  (iv) admits Biodiversity as a beautiful and wonderful aspect of nature;

- **Methods**- *Self-paced learning* involving student paced learning
• **Media- Synchronous** - Instructor-led Classrooms

  *Asynchronous* - Web/Computer-Based Learning

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**Strategy Outline:**

<table>
<thead>
<tr>
<th>Tasks and Events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 10.1</strong> Analyze and Discuss the importance of conservation.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 10.1.2 Self-paced learning</strong></td>
<td></td>
</tr>
<tr>
<td>a. View the <strong>multimedia presentation</strong> on in-situ conservation and categorize the methods of conservation. Note the types of zonation in biosphere reserves, their functions and ecological significance.</td>
<td>Identifies the nature of conservation strategies</td>
</tr>
<tr>
<td>b. Read the documents published by WWF-India and CPR Environmental Education Centre, Chennai on Wild Life Conservation.</td>
<td>Classifies the methods of in-situ conservation,</td>
</tr>
<tr>
<td><strong>Event 10.1.1 Group Discussion</strong></td>
<td></td>
</tr>
<tr>
<td>Observe the <strong>video</strong> on Wild life Sanctuaries and analyze the conservation strategies adopted in our country in general and our state in particular to protect wildlife. Discuss the types of zonation in Biosphere reserves and the need of it. Collect articles related to conservation and discuss their relevance. Paste pictures of them in your portfolio.</td>
<td>Gathers information of wild life conservation</td>
</tr>
</tbody>
</table>

**Reflection:**
1. What are the different ways of in-situ conservation?

2. Why are sacred groves considered as the backbone of village economy?

Lesson 11 - Ex-situ conservation-Types

Grade Level: 8th Grade - High School  
Subject: Life Science

Sub-Subject: Ecology  
Length/Duration: 1 hr

Major concept: Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats and draws on a diverse body of techniques and facilities.

Blended learning strategy:

- **Objectives**-Cognitive, Affective & Psychomotor

  The pupil

  (i) recognizes the potentials of natural habitats;

  (ii) explains the methods of ex-situ conservation;

  (iii) identifies areas of ex-situ conservation;

  (iv) admits Biodiversity as a beautiful and wonderful aspect of nature;
(v) conducts debate on the topic *Do we have the right to destroy life forms or do we have a duty to protect them?*

- **Methods**: *Exploratory* – explores wild life sanctuaries
- **Media**: *Synchronous* - Instructor-led Classrooms  
  *Asynchronous* - Web/Computer-Based Learning

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 11.1</strong> Analyze and discuss the importance of ex-situ conservation.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 11.1.1</strong> Observe the video on Silent Valley National Park and analyze the conservation strategies adopted in our country in general and our state in particular to protect wildlife.</td>
<td>analyze the ex-situ conservation strategies</td>
</tr>
<tr>
<td><strong>Event 11.1.2</strong> View the multimedia presentation on ex-situ conservation and note the features of conservation. List the purposes of ex-situ conservation. List the contributions of TBGRI. Prepare a list of Botanical Garden and Zoos in India.</td>
<td>differentiates ex-situ and insitu conservation</td>
</tr>
</tbody>
</table>

### Reflection:

1. Differentiate in-situ and ex-situ conservation.
2. How are organisms conserved ex-situ?
3. Gene banks have been recognized as of extreme importance. Why?
Lesson 12 - Conservation Projects

Grade Level: 8th Grade - High School
Subject: Life Science

Sub-Subject: Ecology
Length/Duration: 1 hr

Major Concept: Conservation is an ethic of resource use, allocation, and protection. Its primary focus is upon maintaining the health of the natural world: its, fisheries, habitats, and biological diversity. Secondary focus is on materials conservation and energy conservation, which are seen as important to protect the natural world.

Blended learning strategy:

- Objectives-Cognitive, Affective & Psychomotor

  The pupil

  (i) recognizes various conservation projects

  (ii) identifies the objectives of Project Tiger, Project Elephant, etc.

  (iii) compares the strategies adopted to conserve projects for different organisms

  (iv) cites examples of other projects in Our country to conserve organisms

  (v) suggests the need for developing indigenous breeds
(vi) appreciates the values of conservation projects

- **Methods** - *Guided Discovery* - teacher leads student discovery of various conservation projects and their importance.

- **Media** - *Synchronous* - Instructor-led Classrooms

  *Asynchronous* - Surveys, Web/Computer-Based Learning

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task-12.1</strong> Learn our most successful conservation ventures in the recent times.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 12.1.1 Guided Discovery</strong></td>
<td></td>
</tr>
<tr>
<td>Observe the multimedia presentation on conservation projects.</td>
<td></td>
</tr>
<tr>
<td>a. Discuss the strategies adopted for conserving organisms.</td>
<td>Compares the features of different conservation projects for organisms</td>
</tr>
<tr>
<td>b. Note the activities done through each strategies and the relevance of them.</td>
<td></td>
</tr>
<tr>
<td>c. Prepare a list of the objectives of each project.</td>
<td>Evolves plans for eco-development</td>
</tr>
<tr>
<td>d. Mention the states where these projects are launched.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 12.2: Group Discussion</strong></td>
<td></td>
</tr>
<tr>
<td>Analyze the role of conservation projects in eco-development.</td>
<td></td>
</tr>
<tr>
<td>Discuss it in class and evolve a strategy to protect animals that need immediate conservation scientifically.</td>
<td></td>
</tr>
</tbody>
</table>

### Reflection:

1. What are conservation projects?

2. What is Project Tiger?
3. State the objectives of Project Elephant.

4. What are the programmes for conserving cattle?

5. Where is Indo-Swiss livestock project?

6. How are conservation projects helpful for eco-development?

Lesson 13 - Red Data Book and IUCN Red List of Threatened Species

Grade Level: 8th Grade - High School
Subject: Life Science
Sub-Subject: Ecology
Length/Duration: 1 hr

Major Concept: Red Data Books are widely recognized as the most comprehensive, apolitical evaluation of the conservation status of plant and animal species as well as measures of the success or failure of various conservation initiatives.

Blended learning strategy:

- **Objectives** - Cognitive, Affective & Psychomotor
  
  The pupil
  
  (i) recognizes the use of Red Data Books
  
  (ii) identifies the IUCN Red List Categories and criteria to classify species
  
  (iii) enumerates cause of extinction
  
  (iv) suggests measures to protect species from extinction

- **Methods** - Exploratory – explores the importance of red data book

- **Media** - Synchronous - Instructor-led Classrooms

  Asynchronous - Web/Computer-Based Learning
Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 13.1</strong> Learn to experience the rich variety of native species that help to define our nation.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 13.1</strong> View the multimedia presentation on Red Data Book. Observe Red List prepared by IUCN. Cite examples of organisms facing threats.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 13.2</strong> Analyze the following table and list the names of organisms classified under each category.</td>
<td></td>
</tr>
</tbody>
</table>
Collect pictures and other relevant details regarding endangered and threatened species and lace in your portfolio.

Reflection:

Many people value elephant tusks as decorative objects in their homes. How would this affect the elephant population in our country?

Lesson 14 - Ecological Hotspots

Grade Level: 8th Grade - High School
Subject: Life Science
Sub-Subject: Ecology
Length/Duration: 1

Major Concept: An ecological hotspot is a bio-geographic region that is both a significant reservoir of biodiversity and is threatened with destruction.

Blended learning strategy:

- Objectives-Cognitive, Affective & Psychomotor
  The pupil
(i) recognizes the relevance of ecological hotspots
(ii) identifies the importance of Western Ghats
(iii) reasons out why Silent valley is included in World Heritage list
(iv) establishes Silent valley as an ecological hotspot
(iv) reasons out why is India considered as one of the richest countries in the world in terms of biodiversity.

- **Methods**: Exploratory – views websites to search information
- **Media**: Synchronous - Instructor-led Classroom- group discussion
  - Asynchronous-, Web/Computer-Based Learning

### Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 14.1</strong> Establishing the relevance of ecological hotspots.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 14.1.1</strong></td>
<td></td>
</tr>
<tr>
<td>View the multimedia presentation on Ecological hotspots and observe the features of them. Find out the criteria for qualifying as an ecological hotspot.</td>
<td>Identifies the features of ecological hotspots</td>
</tr>
<tr>
<td><strong>Event 14.1.2</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Browse</strong> the following website: <a href="http://www.biodiversityofindia.org/index.php?title=Biodiversity_hotspots_in_India">http://www.biodiversityofindia.org/index.php?title=Biodiversity_hotspots_in_India</a> and note the features of ecological hotspots.</td>
<td>establishes the importance of ecological hotspots</td>
</tr>
<tr>
<td><strong>Event 14.1.3 Group discussion</strong></td>
<td></td>
</tr>
<tr>
<td>Read the document on biodiversity. Conduct a <strong>discussion</strong> on “Why is India considered as one of the richest countries in the world in terms of biodiversity?” Condense the report in your portfolio.</td>
<td></td>
</tr>
<tr>
<td><strong>Task 14.2</strong> Learn about World Heritage List</td>
<td>develops</td>
</tr>
</tbody>
</table>
Event 13.2.1 Self-paced learning
Browse the site:
http://www.biodiversityofindia.org/index.php?title=Biodiversity_hotspots_in_India
Find out the reasons for declaring Silent Valley in the World Heritage List.

Event 13.2.2 Debate
Debate on the topic ‘Do we have the right to destroy life forms or do we have a duty to protect them?’

Reflection:

1. List the features of ecological hotspots.

2. What are the issues in biodiversity that needs immediate attention in our country?

Lesson 15 - Organizations and Institutions engaged in Conservation activities
Grade Level: 8th Grade - High School Subject: Life Science
Sub-Subject: Ecology Length/Duration: 1

Major Concept: An environmental organization is an organization that seeks to protect, analyze or monitor the environment against misuse or degradation or lobby for these goals.

Blended learning strategy:

- Objectives-Cognitive, Affective & Psychomotor
The pupil

i. recognizes several organizations involved in environmental activities,

ii. identifies the mission and goals of WWF, WPSI, CPE, NGC, etc.

iii. establishes the role of environmental organizations

iv. appreciates the service rendered by environmental organizations

• **Methods** - *Exploratory* – explores role of environmental organizations

• **Media** - *Synchronous* – Supervised Study

  *Asynchronous* - Web/Computer-Based Learning

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**Strategy Outline:**

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 15.1 Learn the role of environmental organizations</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Event 15.1.1 Self paced learning</strong></td>
<td></td>
</tr>
<tr>
<td>a. View the presentation on Environmental Organizations functioning all over the world and prepare a short description on their role in nature conservation.</td>
<td>Identifies the role of environmental organizations</td>
</tr>
<tr>
<td>b. View the CDs developed by WWF on various environmental days like world wetland day, world Environment day, world water day, etc.</td>
<td>Realizes the services of environmental organizations</td>
</tr>
<tr>
<td><strong>Event 15.1.2 Supervised Study</strong></td>
<td></td>
</tr>
</tbody>
</table>
a. Read the newsletters published by WWF-India and find out the major role of that organization.
b. Discuss the important services offered by them in educating students.
c. Refer the magazine ‘KERALA CALLING’ and identify the worth of God’s own country.
d. Go through different environment related magazines and make a list of them with their role in environmental education.

**Event 15.1.3 Individual work**

a. Collect details of institutions involved in the development and co-ordination of biodiversity conservation in your country and highlight the services in your state.
b. Prepare articles on issues related to the environment.

**Reflection:**
Evaluate the services rendered by environmental organizations.

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**Lesson 16 - Environmental Legislation**

Grade Level: 8th Grade - High School

Subject: Life Science

Sub-Subject: Ecology

Length/Duration: 1 hr

**Major Concept:** Environmental legislation protects India's rich biodiversity and monitors decisions and actions relating to use of biological resources/related knowledge wisely and judiciously.

**Blended learning strategy:**

- **Objectives** - Cognitive, Affective & Psychomotor
The pupil

(i) recognises the environmental Acts and Laws

(ii) explains the objectives of Wildlife Protection Act (1972), Forest Conservation Act (1980), EPA (1986);

(iii) extrapolates the applications of environmental laws in daily life,

(iv) develops awareness on abiding to natural rules of Nature.

- **Methods** - *Exploratory* - find out the laws and regulations adopted all over the world to conserve biodiversity
  
  *Participatory* - Participates in Open Forum

- **Media** - *Synchronous* - Instructor-led Classrooms

  *Asynchronous* - Web/Computer-Based Learning

**Strategy Outline:**

<table>
<thead>
<tr>
<th>Tasks and events</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 16.1 Acquaint with Environmental Acts and Laws enforcing rules and regulations for the conservation of biodiversity.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Event 16.1 Self-paced learning</strong> Observe the multimedia presentation on Environmental Legislation and find out the laws and regulations adopted all over the world to conserve biodiversity. Find out the relevance of them in environmental protection.</td>
<td>infers the significance of environmental legislation</td>
</tr>
</tbody>
</table>
**Event 16.2: Creative Forum**

Arrange an open forum to acquaint with environmental laws. Create awareness on Laws and Rules regarding environment to others.

**Reflection:**

1. How far is environmental legislation applicable to citizens alike?
2. Hunting of wild life animals is strictly prohibited under which act?

---

**Lesson 17 - Conservation vs. Development**

Grade Level: 8th Grade - High School  
Sub-Subject: Ecology  
Subject: Life Science  
Length/Duration:

**Major Concept:** Sustainable development is the ‘development that meets the needs of the present without compromising the ability of future generations to meet their needs’ (Brundtland Report).

**Blended learning strategy:**

- **Objectives**-Cognitive, Affective & Psychomotor

  The pupil
(i) recognizes the relationship between conservation of biodiversity and development;

(ii) compares the impacts of new technologies over the old ones;

(iii) discriminates negative impacts of development

(iv) Debates on issues concerned with development

(v) analyses the risks surrounding development projects;

(vi) defines sustainable development.

- **Methods- Participatory**- Role plays situations prevalent in the society.

- **Media- Synchronous** - Instructor-led Classrooms

  **Asynchronous**- Web/Computer-Based Lear

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**Strategy Outline:**

<table>
<thead>
<tr>
<th>Tasks and events</th>
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</thead>
<tbody>
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</tr>
</tbody>
</table>
Task 17.1: Probing into the concept of Sustainable Development.

Event 17.1.1 Role Play (45 mnts)

a. The subject of this lesson is a video on the present appearance of our cities and towns. After watching the video and discussing various aspects of the developmental issues, the students role-play members of four teams: the city dwellers, flora, fauna and the environmentalists.
b. Using extensive online resources linked to the lesson, students research the issues and evaluate the sources. The students will understand the concept of "sustainable development", interpret a current issue from multiple perspectives, learn to advocate for a point of view, and learn to resolve an issue through a conflict resolution scenario.

Event 17.1.2 Independent practice (1 hr)

View the video on the concept of sustainable development.

a. Find out the type of development seen in your residential area and comment on the impacts due to improper developmental practices adopted there.
b. Plan an activity to remind the authorities on the issues of unsustainable development.

Reflection:

1. Define the concept sustainable development.
2. What is the preferable mode to be adopted in development?

Lesson 18 - Sustainable and Green Living
Major Concept: Sustainable living is a lifestyle that attempts to reduce an individual's or society's use of the Earth's natural resources and personal resources.

Blended learning strategy:

- **Objectives** - Cognitive, Affective & Psychomotor
  
  The pupil

  (i) recognizes the need for sustainable living

  (ii) identifies ways of green living

  (iii) suggests means for sustainable living practices

  (iv) predicts consequences of unsustainable living styles.

- **Methods** - Self-paced learning

- **Media** - Synchronous - Instructor-led Classrooms

  Asynchronous - Web/Computer-Based Learning

Strategy Outline:

<table>
<thead>
<tr>
<th>Tasks and events</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 18.1</strong></td>
<td></td>
</tr>
<tr>
<td>Admitting the need of green living for a sustainable existence.</td>
<td></td>
</tr>
<tr>
<td><strong>Event 18.1.1 Self paced learning</strong></td>
<td></td>
</tr>
<tr>
<td>Observe the conditions and rules of Green Living prepared by WWF-India website http // wwf.org and prepare ways of living in a sustainable manner. Find out why is it important to develop ways of sustainable living.</td>
<td>Suggests ways of sustainable living</td>
</tr>
<tr>
<td><strong>Event 18.1.2 Self paced learning</strong></td>
<td></td>
</tr>
<tr>
<td>View the multimedia presentation on sustainable living and</td>
<td>Develops eco-friendly</td>
</tr>
</tbody>
</table>
note down the conditions for green living. lifestyles.

Application of learning strategy:

Prepare useful and eco-friendly products that could be utilized for various purposes using cheap materials available at home.

Reflection:

1. Suggest novel measures for green living.
2. Mention some possible measures to consider development in tune with nature’s way.
3. How is it possible to estimate nature’s services to support biodiversity?

The philosophy of Environmental Education asserts that man is an integral and separable component of the ecosystem. Within this system, his culture, values, scientific
and technical knowledge and his associations and arrangements are the elements through which he interacts with the biotic and abiotic environment. It needs to be clearly understood by all the human beings that we cohabit with all other living organisms. For this, an understanding of the use of the available resources and also the impact of his activities on the ecosystem is necessary. Such an understanding could be most possible through an education system, which clearly explains our inter-relationships and interdependence with the environment, functioning of different ecosystems and the need for its conservation. This major responsibility is to a great extent attained through the development and implementation of a Blended Learning Strategy which combines teaching strategies and delivery media convenient to learner needs.

Blended Learning is an approach to course design that meaningfully brings together the best of both face-to-face & online learning. It is not intended to supplant either of these individual approaches, rather to build from each to create a new, more effective learning experience for students. At its heart, great blended learning course design will seek to leverage that which is best done in-person (debates; group presentations; reflexive response/thought) in combination with that which is best done online (provision of content; deeper, reflective discourse; document management & organization). Blended Learning is the application of this mix toward an instructional effort. Through blended learning, face-to-face activities are used to create social presence among students and then online activities can be used to sustain it and use it to support self pacing.

4.7.1.4 Lesson Transcripts based on Direct Instruction
The same units were selected and lesson transcripts were prepared according to Direct Instruction method. The direct instruction method provides the opportunity for students to receive information from the teacher through lecture, demonstration or presentations by providing students the opportunity to receive information directly about a subject and begin to cognitively apply that information to previous learning. Twenty lesson transcripts were prepared by the investigator. Each lesson was instructed within a span of 45 minutes. The sample lesson transcript based on Direct Instruction is attached in Appendix VIII.

4.7.1.5 Achievement Test

Any test that measures the attainments or accomplishments of an individual after a period of training or learning is called an Achievement Test. (Downie,1961) The investigator prepared an achievement test based on the topic “Biodiversity and its conservation” for assessing the theoretical achievement of secondary school students belonging to standard VIII. This test containing 50 items was used as both pre-test and post-test. The question paper is attached in Appendix VII. A scoring key was prepared for the items prepared. Students were directed to mark their answers in the separate answer sheet provided. The response sheets were scored according to the scoring key.

Validity and Reliability of the Achievement test

The test was developed very carefully following the principles of Achievement test construction. The content validity was established based on the judgment of teachers and teacher educators at secondary level. Construct validity concerned not only with the test itself but also with the theory seeks to explain or to account for the results which are obtained when the test is used. In the present achievement test, the content was organized
in a logical order. Adequate representation was given to sub-concepts. The empirical validity of the test was calculated by correlating the scores obtained in the scholastic achievement test with marks obtained in another class test. The correlation coefficient obtained was 0.78. The obtained value shows that the test has good empirical validity. The reliability of the achievement test was established using the split half method. The obtained score is 0.75 showing that the test has high reliability.

4.7.1.6  Development of Environmental Attitude Scale

The Environmental Attitude Scale prepared for the present study is intended to provide an objective measure of the environmental attitude of secondary school students in Kerala. A Likert-type scale was developed following the conventional procedure laid down by Edwards (1957). The scale contains 88 items selected from core areas of environmental concern which the investigator considers to be highly sufficient to produce a valuable measure of the attitude of an individual towards the environment.

Preparation and Validation of Environmental Attitude Scale

As a preliminary step to the preparation of draft scale, a list of 100 statements (favorable and unfavorable statements almost equal in number) was prepared and was given to experts for suggestions. As per the suggestions received an edited scale consisting of 88 items were selected from the draft scale in which positive statements and negative statements were included.

The components identified in the scale and its description is given below:

1. Regard for Life and Environment- Human beings should essentially have a good regard to various life –forms on earth as well as to the environment on which we interact our majority of the time.
2. Environmental issues- Many of the environmental problems being experienced are a result of human contributions, such as excessive waste, industry pollution and overpopulation. Meanwhile, the Earth's resources become scarcer, creating an impending problem for the planet's inhabitants.

3. Equitable and judicious use of Resources- A new economic order at the local, national and global levels must be based on the ability of individuals to distribute benefits of natural resources by sharing them more equally among the communities and countries such as our own.

4. Conservation of Nature and Natural Resources- Each and every natural resource should be conserved either in natural or artificial settings in order to preserve our natural wealth, biodiversity as well as our life itself. Its primary focus is upon maintaining the health of the natural world: its forests, fisheries, habitats, and biological diversity. Bringing back an ethic for nature conservation describes an individual’s will to conserve nature and natural resources.

5. Ecological Responsibility- We as consumers should recognize the impact of our decisions on the physical environment and possible conflict between the desire to own things and the destruction of the environment. Whether only the government is responsible and what the role of citizens in sanitation and protecting the environment is a crucial issue. A readiness to accept one's obligations arising from inequitable usage of ecological space as measured in ecological footprint analysis can perhaps be considered a virtue.

6. Sustainable Development and Eco-friendly Life style-
Sustainable development is a development that meets the needs of the present generation without compromising the ability of the future generation to meet their needs. A person having favorable agreement with this multi dimensional concept will show a positive attitude towards the environment as well as follow an eco-friendly lifestyle.

The components were given due weightage. The draft scale was administered on a small group of secondary school students. On the basis of the feedback from the pilot testing, changes in the language and structure of the statements were made and an estimate of the time required to complete the marking of the responses was obtained. The responses obtained along a five-point scale were scored as follows. For the positive statements scores 5,4,3,2,1 were given for marking responses viz., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA), Strongly Disagree (SD) respectively. Reverse scoring procedure was adopted for the negative statements. The attitude towards environment of secondary school students is the scores obtained for all the statements in the scale.

The draft tool (Appendix I) was tried out on a sample of 450 Secondary school students giving representations to their gender, type of school and locale of residence. All the response sheets were scored as per the scoring procedure explained earlier. The score given to each item was summated to yield the total score. Finally 370 response sheets were selected for item analysis. Out of the draft tools circulated, 31 were found to be incomplete in some respect or the other and as such excluded from item analysis. Again for facilitating computations, the remaining booklets were reduced to 370 by rejecting other booklets at random. The 370 booklets were arranged in the order of the total scores,
and the highest 27 percent (the top 100) and the lowest 27 percent (the bottom 100) response sheets alone were used as extreme groups for item analysis. The details of the item analysis are given in Appendix II. The items having t-value equal or above 1.96 were selected, as the t-value is a measure of the extent to which a given statement differentiates between the high and low groups. After computing the t-value, 74 items were selected making sure that 37 items are positive and 37 items are negative. The final tool is given in Appendix III.

**TABLE 4.2**  
Component-wise distribution of statements in the Final Environmental Attitude Scale

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Constructs</th>
<th>Statement No.</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. of Statements</td>
</tr>
<tr>
<td>1</td>
<td>Regard for life and environment</td>
<td>1,7,14,19, 21, 29,40,43,49,57,59,65,69</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Environmental issues</td>
<td>2,6,9,15,22,27,28,32,33,37,38,44,51,55,60,63,64,67,70</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>Equitable and judicious use of resources</td>
<td>3,17,24,31,35,39,42,47,48,53,56,61,68,74</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>Conservation of Nature and Natural Resources</td>
<td>4,8,13,20,26,34,36,46,50,54,66,72</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>Ecological responsibility</td>
<td>10,25,30,41,73</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Sustainable Development and eco-friendly life style</td>
<td>5,11,12,16, 18, 23,45,52,58,62,71</td>
<td>11</td>
</tr>
</tbody>
</table>

**Validity and Reliability of the Environmental Attitude Scale**

The Environmental Attitude Scale was prepared following the principles of Attitude Scale construction (Likert, 1952; Thurstone & Chave, 1946; Edwards, 1957).
The face validity of the Attitude Scale was ascertained by showing the prepared scale to experts for their assessment. The external validity of the attitude Scale was established by correlating the scores on another established Environmental Attitude Scale developed by Abraham & Arjunan (2005). The obtained co-efficient of correlation (validity co-efficient) was found to be 0.67 showing that the Attitude Scale is reasonably valid. The reliability of the final Attitude Scale was determined by the \textit{test-retest method}. The reliability coefficient was computed from the test scores of secondary school students. The co-efficient of correlation between the two tests was calculated to be 0.84, indicating that the Attitude Scale developed has high reliability.

\textbf{4.7.1.7 Development of Social Attitude Scale}

The Social Attitude Scale is a device to measure attitude of a person or group with respect to a social object or phenomenon such as a person, race, institution, or trait. A Likert-type Scale consisting of 80 items, selected from core areas of social concern was developed which is highly sufficient to measure the social attitude of a secondary school student. The scale was designed to produce quantifiable data that may be subjected to statistical analysis in order to draw suitable inferences.

\textbf{Preparation and Validation of Social Attitude Scale}

For the preparation of the draft scale, the investigator decided to select five constructs for the scale. They are:

1. Co-operation- Co-operation is the process of working or acting together. It involves things working in harmony, side by side, while in its more complicated forms, it can involve something as complex as the inner workings of a human being or even the social patterns of a nation.
2. Responsibility- Responsibility is the ability to choose our own responses. It is about taking ownership of your own actions and behaviors instead of making excuses and blaming other people and circumstances and also the ability to look inside yourself and be able to discover your own faults, and then make room for improvement. It includes the engagement of each person towards the community where he lives, which can be expressed as an interest towards what’s happening in the community, as well as in the active participation in the solving of some of the local problems.

3. Democratic Living- Dewey (1916) states that “a democracy is more than a form of government; it is primarily mode of associated living, of conjoint communicated experiences. There are three basic moral principles of democratic living. These three moral principles revolve on the ideals of intellect, generativity, and generosity. Intellect refers to subject matter; generativity refers to self as a lifelong learner; generosity refers to social interactions with diverse others.

4. Empathy- Empathy is the capacity to recognize feelings that are being experienced by another sentient or semi-sentient being. Someone may need to have a certain amount of empathy before they are able to feel compassion. Empathy involves the inner experience of sharing in and comprehending the momentary psychological state of another person. It is the ability to understand another person’s circumstances, point of view, thoughts, and feelings. When experiencing empathy, you are able to understand someone else’s internal experiences.
5. Independence- Independence is the ability to complete tasks with little or minimal supervision. If you prefer to be left alone to 'get on with the work and achieve the desired outcome, in your own way, you're likely to be high in Independence. When your preference is for someone else to guide your performance you'll be low in Independence.

The draft scale (Appendix IV) contained 80 statements with adequate representation given to both positive and negative items and the constructs selected. To each statement the respondent has to mark the responses which may reveal the degree of agreement or disagreement towards each statement in a five-point continuum viz, Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SDA). The details of the item analysis are given in Appendix V. The items having t-value equal or above 1.96 were selected after the item analysis, as the t-value is a measure of the extent to which a given statement differentiates between the high and low groups. After computing the t-value, 70 items were selected for the final tool. The final Social Attitude Scale is given in Appendix VI.

**TABLE 4.3**

**Component-wise Distribution of statements in the Final Social Attitude Scale**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Constructs</th>
<th>Statement No.</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. of Statements</td>
</tr>
</tbody>
</table>


Validity and Reliability of the Social Attitude Scale

The Social Attitude Scale was prepared carefully following the principles of Attitude Scale construction (Likert, 1952; Thurstone & Chave, 1946; Edwards, 1957). The face validity of the Attitude Scale was ascertained by showing the prepared scale to experts for their assessment. The external validity of the attitude scale was established by correlating the scores on another established Scale of Social Attitude developed by Zodikoff (1967). The obtained co-efficient of correlation (validity co-efficient) was found to be 0.77 showing that the Attitude Scale is reasonably valid.

The reliability of the final Attitude Scale was determined by the test-retest method. The reliability coefficient was computed from the test scores of secondary school students. The co-efficient of correlation between the two tests was calculated to be 0.85, indicating that the Attitude Scale developed has high reliability.

Administration of the Attitude Scales

The Attitude Scales viz. the Environmental attitude Scale and the Social Attitude Scale were presented as Single use Booklet with instructions for the respondents. There
was no specific time limit for the completion of the scales however one and a half hours is usually found adequate for the completion of the test.

**Scoring of the Attitude Scales**

Both the attitude scales were scored according to the scoring scheme stipulated for each tool.

### 4.7.1.8 Evaluation Schedule for Teachers

An Evaluation Schedule consisting of 14 items were prepared. This schedule was meant to assess the views of teachers regarding the effectiveness of Blended Learning Strategy in realizing select educational outcomes listed under the following dimensions:

1. Cognitive
2. Affective
3. Process skills
4. Environmental
5. Social
6. Interdisciplinary
7. Teacher competency

The respondents were asked to indicate their opinion by putting a tick mark in any of the three columns namely GE (GreatExtent), SE (Some Extent), NA (Not At All), provided under each section (Appendix IX ). The details of the analysis done are given in the analysis section.

### 4.7.1.9 Questionnaire for students

A questionnaire (Appendix X) was prepared to collect the views of students regarding the beneficial and practical of blended learning strategy prepared viz.
a. Organization and Study skills
b. Investigation skills
c. Collaborative Skills
d. Teacher Support
e. Overall satisfaction of blended learning.

4.8 Experimental Procedure adopted

As the prime objective of the study was to find out the effectiveness of blended learning strategy in teaching Biology at secondary level the basic experimental design adopted in the present investigation was Pre-test post-test Non equivalent Group Design. Survey method was used to find out the social and environmental attitude of secondary school students using attitude scales viz., Social Attitude Scale and Environmental Attitude Scale developed and validated by the investigator. 18 lessons based on the Blended Learning Strategy developed on the topic ‘Biodiversity and its Conservation’ identified by the researcher were taught to the experimental group of students at secondary level. It was to find out whether they are suitable for increasing the achievement in Biology of students. An achievement test was administered as both pre-test and post-test to know the levels of achievement of students exposed to Blended Learning Strategy. Environmental Attitude Scale and Social Attitude Scale were also used to find the improvement in Social Attitude and Environmental Attitude of students before and after exposing students to Blended Learning Strategy. Achievement and attitude scores obtained through blended learning and direct instruction were analyzed in order to find out the effect of Blended Learning Strategy for enhancing achievement and improving social and environmental attitudes respectively.
4.9 Statistical Techniques Used

Descriptive analysis of the dependent variables viz., Achievement, Environmental Attitude and Social Attitude were done. The pre-test and post-test scores of pupils in the experimental and control groups were also consolidated for statistical analysis. Since the aim of the study was to test the effect of blended strategy in teaching biology at secondary level, it become necessary to find out whether there was any significant difference between the means of post-test scores of students in the experimental and control groups. For this, pre-test and post-test scores of pupils in the experimental and control groups were subjected to the following statistical techniques:

(i) Test of significance of difference between means was used to study whether there is significant difference between the means of groups (BLG and DIG) under study.

(ii) Analysis of Co-variance (ANCOVA) was applied to compare the effectiveness of Blended Learning with respect to achievement and attitudes.

(iii) Percentage analysis of the views of teachers and students regarding outcomes and beneficial aspects of blended learning.

The details of the analysis of data using ANCOVA and other statistical techniques have been compiled in Chapter 5.

References


