CHAPTER IV

METODOLOGY

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CHAPTER IV

METHODOLOGY

4.1. Chapter Preview

This chapter deals with the methodology of the study. The methodology is qualitative while data is quantitative. Based on the analysis of theories and experiential models of teaching and learning, an Experiential learning package with lesson transcripts and activities is developed. The purpose of the investigation was to identify the effect of experiential learning on naturalistic intelligence and achievement. The method adopted for the study, the experimental design, procedure and statistical techniques employed for the analysis of data are described under appropriate sections. The chapter includes an introductory paragraph that describes the research problem. The paragraphs that follows should provide an explanation of the methods the investigator will utilize to gather the data necessary to address the problem. Moreover it might also provide justification for selecting the methods for data collection. It is also advice to discuss certain variables that may have an impact on the outcome of the research.

4.2. Introduction

Methodology is the science of proper modes and orders of procedures. The success and acceptability of the endeavour depends to a large extent on the nature and amount of modes and orders of procedures employed therein. Wastage of time, money and effort can be overted and efficiency and dignity of the research can be raised by the use of the proper methodology. Various methods and procedures have
been developed to aid the acquisition of data. According to Best and Kahn (2005) ‘The machinery of methodology occupied a very important position in any kind of research. The vehicle of any kind of research cannot perform its function without it, since it is to be carried out, and outlines the detailed description of the research variable and procedure’.

Selection of a suitable method of educational research is very important for the success of the research effort. The method used must be in harmony with the broad scientific principles and it must lead to valid generalization and plausible conclusions.

The purpose of writing methodology chapter is to demonstrate to the examiner/reader that the investigator know in detail about the proposed topic and how to conduct the proposed study and to know whether the select research method is logical, applicable, valid and reliable.

A well developed and logically planned methodology will provide a great backbone for the entire research thesis, and will allow the investigator to build an extremely strong conclusion section.

4.3. Statement of the Problem

‘Experiential learning as a correlate of Naturalistic Intelligence of secondary school biology students”.

4.4. Hypotheses formulated

The experiential learning package is developed, referring to the principles of active learning through doing/discovery. It is tested for its effectiveness as a new strategy for learning outdoors and also to find out the correlation between it and naturalistic intelligence by formulating the following hypothesis.
Hypothesis I

Secondary level Biology curriculum has high potential for imparting experiential learning.

Hypothesis II

Experiential learning promotes pro-environmental behaviour of secondary students.

Hypothesis III

Experiential learning enhances environmental experience of secondary level biology students.

Hypothesis IV

Experiential learning enhances the achievement in biology of secondary students.

Hypothesis V

Experiential learning is positively related to Naturalistic Intelligence of secondary school biology students.

Hypothesis VI

Strategies enriched with experiential learning can foster naturalistic intelligence of students at secondary level.

4.5. Objectives of the study

1. To find out the potential of secondary biology curriculum for experiential learning

2. To identify the extent of experiential learning at secondary level
3. To find out the difficulties experienced by teachers while incorporating experiential learning strategies in teaching and learning of Biology.

4. To prepare an Experiential learning package in biology at secondary level

5. To find out the effect of experiential learning on achievement in biology at secondary level.

6. To find out the effect of experiential learning on environmental experience of secondary level biology students

7. To find out the effect of experiential learning on pro-environmental behaviour of secondary level biology students.

8. To prepare and standardized an Inventory to assess Naturalistic intelligence among secondary level students

9. To identify the level of Naturalistic intelligence among secondary students using the standardized inventory

10. To find out the relation between Achievement in Biology and naturalistic intelligence of secondary level students

11. To find the interrelationship among Achievement in biology, environmental experience and pro-environmental behaviour of secondary level of biology students.

12. To prepare an action plan for fostering naturalistic intelligence in secondary level students.

4.6. Methods adopted for the study

The purpose of the present investigation is to study the correlation between experiential learning and naturalistic intelligence of secondary level biology students.
To provide valid answers to specific research questions rose in the study, it was decided that Experimental cum Normative survey method should be adopted for the study. Normative survey was selected for collecting data relevant for the study, considering the objectives of the study and the nature of data required for their realization. The methods thus selected were in accordance with accomplishing the objectives which in turn will help in verifying the hypotheses of the study.

The study mainly used qualitative methods – relying on observation, experiential activities, analysis of observation rubrics and reports etc. Observation is used to examine and record situations more closely and to evaluate the impact of interventions. According to Nation (1997) naturalistic observation is a research method that permits the investigator to collect information in a naturally occurring environment. Five separate Observation schedules are prepared by the investigator with the help of the guide. Consolidation/analysis sheets were prepared based on each and every activity listed in the observation schedules, separately. The sample of the observation rubrics and consolidation sheets are given in Appendix XVII.

The methods and techniques used for collecting data are given below:

- To find out the potential of secondary level biology curriculum for Experiential learning:
  - Content Analysis of the secondary level biology curriculum

- To develop the Experiential learning package
  1. Thorough analysis of the theories and principles related to Experiential learning and Naturalistic Intelligence.
  2. Survey method to identify:
(i) The extent of usage of experiential learning in secondary level biology teaching

(ii) The difficulties faced by teachers while incorporating experiential learning strategies in teaching biology lessons.

➢ To study the effect of experiential learning on achievement, pro-environmental behaviour, environmental experience and Naturalistic Intelligence.

Experimental method for determining the effectiveness of experiential learning strategies in teaching select topics through one group pre-test, post test design.

➢ To develop the Naturalistic Intelligence Inventory

Through analysis of the theories related to intelligence and multiple intelligences and consultation with experts including Howard Gardner.

➢ To evaluate the performance skills of students

Observation schedule for evaluation of skill based performance of students during select experiential learning activities (Field based activities, ICT based lessons, Agriculture)

4.7. **Tools and Techniques used for the study**

A good number of tools were found necessary for the collection of data required to test the hypotheses. The details regarding all these tools and techniques employed for the study are presented as given below:

- Content Analysis of the secondary level biology syllabus
• Experiential learning package with lesson transcripts based on the select experiential learning activities prepared by the investigator

• Achievement test in biology

• A standardized scale to identify Pro environmental behaviour of secondary level students

• A standardized inventory for Environmental experiences

• Naturalistic Intelligence Inventory prepared and standardized by the investigator

• Naturalistic intelligence checklist prepared and validated by the investigator

• Questionnaire to measure the extent of experiential activities in secondary schools

• Questionnaire to measure the difficulties experienced by teachers while incorporating experiential learning strategies

• Observation schedule for evaluation of skill based performance of students during select experiential learning activities. (Field based activities, ICT based lessons, Agriculture)

Description of Tools

4.7.1. Content Analysis

In order to identify the extent of experiential learning strategies in the secondary level biology curriculum, it had become a necessary to locate the experiential learning potential areas in the curriculum. Topics which have direct relation to the experiential learning were identified.
The investigator conducted this content analysis with the help of the supervising teacher, curriculum experts, secondary level biology teachers and other experts in the field of education. At first topics having direct relation to experiential learning were identified. The other biology topics that have relation to the major topics were also analyzed. The content areas and other related details were analyzed and consolidated.

### 4.7.2 Questionnaire to measure the extent of experiential activities secondary schools

The tool was used to measure the extent of usage of experiential activities in secondary schools while teaching biology. The questionnaire was prepared by the investigator, discussing with guide, secondary level biology teachers and experts. Based on their opinions, a draft form of questionnaire with 25 items was prepared. After validation by experts, 20 items of Experiential learning activities in biology were prepared, each area with sub items related to the main areas.

The main areas included under the questionnaire are the following:

- Conducting of awareness programmes in the society.
- Taking census of trees and plants in the immediate environment
- Arranging field visits and trips to places of scenic beauty and bio diversity
- Cultivating crops and agriculture (at least one crop)
- Simulations and role playing
- ICT based activities/preparation of power points, preparation seminars by net browsing
- Skill in identifying nature of soil, soil types, land preparation techniques for different crops etc
- Planting and maintaining gardens at school and home
- Knowledge in Waste management
- Activities related to conservation of natural resources
- Survey of Natural resources in the campus, near the campus and in the community
- Reduction in consumption of petrol/diesel (reduce oil shortage, reduce pollution)
- Learn the process of producing natural manures and bio fertilizers and bio pesticides
- Management of food products & preservation
- Conducting outdoor campaigns and nature camps
- Conducting laboratory experiments to facilitate theoretical knowledge
- Preparation of Nature calendar
- Collecting, organizing and exhibiting natural items
- Project preparations on select topics (group & individual)
- Plastic free zone (activities related to recent issues)

A sample of the tool is given in Appendix XII

4.7.3 **Questionnaire to measure the difficulties experienced by teachers while incorporating experiential learning strategies**

A questionnaire was prepared by the investigator with the help of the guide to collect data from secondary teachers regarding the difficulties experienced by
them while incorporating experiential learning strategies the investigator collects about 48 statements related to difficulties and send to experts for validation. Based on their comments and suggestions, some items are modified while some rejected. Finally a questionnaire with 25 items was prepared by the investigator. A sample of the tool is given in Appendix XIII.

4.7.4. Preparation of Experiential learning packages

The selection of the learning environment is an important and active part of the teaching/learning process. Constructivist and active learning requires the kind of flexible learning environment created, where teacher provisions teaching-learning process with tools that prompt students to organize and create knowledge. How we design and arrange instruction has a great deal to do not only with what is learned but also with how the learner used what is learned. The relationship between information and environment can change depending on the instructional goal.

Pupils can construct meaning from simplified experiences involving actions and consequences. Thus the instruction/learning process involves the selection, arrangement and delivery of information in an appropriate environment and how the learner interacts with that information. The role of the teacher is primarily to facilitate this by organizing and directing experiences which are matched with pupils’ attainments and abilities. A combination of theoretical and empirical methods was used for collecting relevant data for the study.

The potential of experiential learning strategies in the secondary biology curriculum is analyzed by content analysis and the areas/contents are identified. The difficulties experienced by the secondary level teachers in incorporating experiential
strategies are also analyzed and the learning package is prepared considering the content as well as the difficulties experienced by secondary level teachers.

The main Experiential learning strategies selected were Agriculture, Field based Activities, which includes field visits, field trips and field awareness programmes, and ICT based activities. The first two categories are directly related to outdoor education whereas the investigator selected the third one ICT based activity because of the availability of the rich experiences through internet. It helps our learners to access information documents from various selected websites and learning activities that are shared with other students within the classroom. PowerPoint presentations on biological topics, will allow the class to move into the area of computer simulations.

Thus the Experiential learning package consists of different experiential learning lesson transcripts. Mainly three experiential learning strategies are selected:

- Agriculture
- Field based Activities( field visits, field trips & field awareness programmes)
- ICT based activities
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EXPERIENTIAL LEARNING PACKAGE
(Lesson Transcripts on Agriculture, Field based Activities
& ICT based Activities).

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Preparation of Experiential learning packages
The potential of experiential learning strategies in the secondary biology curriculum is analyzed by content analysis and the areas/contents are identified. The difficulties experienced by the secondary level teachers in incorporating experiential strategies are also analyzed and the learning package is prepared considering the content as well as the difficulties experienced by secondary level teachers. The main Experiential learning strategies selected were Agriculture, Field based Activities, which includes field visits, field trips and field awareness programmes, and ICT based activities. The first two categories are directly related to outdoor education whereas the investigator selected the third one ICT based activity because of the availability of the rich experiences through internet. It helps our learners to access information documents from various selected websites and learning activities that are shared with other students within the classroom. PowerPoint presentations on biological topics, will allow the class to move into the area of computer simulations. Thus the Experiential learning package consists of different experiential learning lesson transcripts.

![Diagram of Experiential Learning Strategies]

**Fig 4.1** List of Experiential Strategies
Lesson Transcript for Experiential Learning (Agriculture)
Number of Students : N = 60

Preliminary Information / Previous Knowledge of Learners:

Students know that all living organisms require food. They also know that plants can make their food themselves (autotrophs). They may know that the energy from food is utilized by organisms for carrying out their various body functions, such as digestion, respiration, and excretion. They may know that in order to provide food for a large population - regular production, proper management and distribution of food is necessary. They also know that crops are of different types like cereals, vegetables, and fruits, and also some of the methods of preserving food materials at home.

Specific Learning Objectives:

Students will be able to develop the following objectives:

- Knowledge of the following aspects
  - Cropping patterns – Rabi and Kharif
• Basic patterns of crop production
• Preparation of soil/land for cultivation (tilling & ploughing)
• Traditional and modern agricultural implements
• About manures and fertilizers (nodules of leguminous plants)
• Irrigation practices
• Animal husbandry
• Food preservation techniques

✓ Understanding of the following concepts:
• In order to provide food to our growing population, we need to adopt certain agricultural practices
• Ability to discriminate Rabi crops from Kharif crops
• Identifies the new practices in agriculture
• Differentiates the preparation of land for different crops
• Discriminates manures from fertilizers
• Compares natural fertilizers with organic ones

✓ Application
• Apply the new irrigation practices in cultivation
• Apply the gained experience in making gardens at home
• Analyses the importance of biological manures and pesticides
• Apply biological pest control measures in cultivation

✓ Specific Skills like:
• Skills related to the fundamentals of agriculture like preparation of land for cultivation, sowing and winnowing, threshing, harvesting, selecting of healthy seeds for sowing etc.
• Skill in observing facts related to agriculture
• Cognitive skills like recalling and recognizing information’s related to cultivation and cropping, attains ability to compare and differentiate between natural and organic fertilizers and pesticides, applying the gained knowledge in the cultivation or planting of new crops, interpreting and analyzing the learned methods of cultivation, cropping and harvesting etc.

✓ Creative Reflection:
• Experimenting with new crops
• Collecting and planting new herbs and ornamental plants at school campus and at home
• Conscientizing public towards planting trees/plants for the betterment of human beings.
• Creating awareness among learners/public towards the need for cultivating vegetables /fruits
• Expresses curiosity towards land filling and farmer’s suicides

✓ Positive Attitude:
• Positive attitude towards cultivating plants and crops for human betterment
• Shows attitudes towards finding out new and improved modes of cultivation
• Develops attitude towards biological fertilizers and pest control measures.

✓ Interest:
• Develops interest in cultivation/agricultural activities
• Shows interest in adopting new modes of vegetative propagation among plants
• Shows interest in creating herbal/ornamental gardens at school campus and at home
• Develops interest in collecting varieties of vegetables /herbs

✓ Appreciation:
• Develops appreciation towards the diversity in nature
• Appreciates the beauty /variety in nature
• Began to appreciate the labour done by farmers /agriculturalists

✓ Meta cognition:
• Develops future plans towards environmental protection
• Writes articles in journals related to environmental issues
• Designs projects related to protection of natural resources
• Writes articles /papers related to farming and cultivation

❖ Learning Environment:

Proper orientation in cultivation and related aspects are gained from classrooms. Smart rooms are used to impart the needed knowledge supplemented by PowerPoint presentations and slides. Practical knowledge (experience) is gained through the outdoor activities (fields allotted) in the campus. Students are divided into 5 groups and cultivating fields are allotted to each group.

Experiential Lesson Plan (Agriculture)

The Lesson Plan showing the learning activities and learning outcomes on the experiential strategy agriculture is shown in Table 4.1.
Table 4.1

Experiential Lesson Plan (Agriculture)

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners are made familiar with the importance of regular crop production, proper</td>
<td>Recognizes (K)</td>
</tr>
<tr>
<td>management and proper distribution of food materials.</td>
<td>Identifies (U)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupils gains knowledge in the different cropping patterns – Rabi &amp; Kharif. They</td>
<td>Distinguishes (U)</td>
</tr>
<tr>
<td>also understand that the patterns are based on climatic changes.</td>
<td>Identifies (U)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>They gain information related to agricultural practices in general</td>
<td>Recognizes (K)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Learners gain specific information related to preparation of soil. They prepare soil</td>
<td>Differentiates (U)</td>
</tr>
<tr>
<td>for different crops (list of crops given below).</td>
<td>Compares (U)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Learning Activities

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners observe the use of different agricultural implements in the field. They also make use of some implements for their cultivation</td>
<td>Observes(S)</td>
</tr>
<tr>
<td></td>
<td>Locates(U)</td>
</tr>
<tr>
<td>Learners are taught the mechanism of selection of good seeds for sowing</td>
<td>Identifies (U)</td>
</tr>
<tr>
<td>Students are asked to transplant the seedlings from the nursery to field beds.</td>
<td>Identifies (U)</td>
</tr>
<tr>
<td>Learners are made familiar with the significance of adding manures to crops. The importance of biological manures is also discussed. Now they are asked to add the needed manures and fertilizers to the crops. They also applied biological pest control measures for pests in brinjal.</td>
<td>Observes (U) Examine (U), Identifies (U)</td>
</tr>
<tr>
<td>Students notice that some plants are weaker in nature, due to the lack of nutrients in the soil. Continuous growing of crops makes the soil poorer in nutrients. They gain knowledge in manuring.</td>
<td>Observes (S), locates (S), interprets (A) Analyzes (A) Identifies (U)</td>
</tr>
<tr>
<td>Learners noticed that some microorganisms increase the soil fertility. They observe the root nodules of leguminous plants also learn about crop rotation.</td>
<td>Observes(S), locates (S), notices the spot(S), Identifies(U) reasons (A)</td>
</tr>
<tr>
<td>Learners are asked to prepare compost pits and convert the collected plant wastes and vegetable wastes to manure</td>
<td>Locates(S), collects(S), identifies(U)</td>
</tr>
<tr>
<td>Students are asked to remove weeds manually</td>
<td>Locates(s), recognizes(K)</td>
</tr>
<tr>
<td>Learners are asked to collect the mature products</td>
<td>Observes(S), recognizes(K)</td>
</tr>
<tr>
<td>Learners are made familiar with the techniques of storage and usage of the harvested products</td>
<td>Identifies(U), analyzes(A) Observes(S)</td>
</tr>
</tbody>
</table>

*K – knowledge, U – understanding, A – application, S – skill.*

Crops selected for cultivation:  brinjal, chillies, snake guard, plantain & tapioca
Fig 4.2 Phases of Experimental Learning

Phase I Preparatory Phase (what do you know?)
The select group of students is made prepare for the activity, by eliciting their previous knowledge related to farming and cultivation. Then the teacher/facilitator makes connections between prior knowledge and experiences with what is going to present. Find out what learners ideas are on the topic. Then introduce the content of the new experiential lesson.

60 students were selected for the Experiential learning on agriculture. The students are divided into 5 groups and duties are allotted to groups. Each group is taught the basics of cultivation. The investigator took special attention in directing the group of students to observe and record the relevant details of cultivation. Doubts of students were clarified by the accompanying staff whenever necessary. Students were provided with log books to record their observation and activities. The time taken to harvest each crop and the pattern of growth processes are also note down by the learners.

**Phase II  Procedure Action Phase (what is happening?)**

Here the real experiential learning occurs. Learners perform or do the activity with the help of the facilitator/teacher. The important aspect is that the Experiential activity may be an individual or group experience, involving doing action. 60 secondary level students are taken to the campus field for conducting agriculture. They are informed that they are going to learn the concepts of cultivation through farming of select crops. They are asked to observe, perform and understand the concepts as per the objectives. A plan of action is then prepared. Students are divided into 5 groups, each group having 12 students each. Each group is assigned to work under the supervision of a teacher/facilitator. Each group is assigned a particular crop to cultivate on. Each member of the group has to work independently
with the group without losing group consciousness. The overall monitoring is done by the investigator.

**Phase III  Sharing phase (What happened?)**

Here the learners share their reactions and observations. Participants can explain, or write the report of the activity based on their experiences. They can discuss their feelings generated from the experience.

**Phase IV  Processing Stage (What’s Important?)**

Here the learner discuss and analyze and look at the gained experience at a cognitive level. With the help of the teacher, they internalize the themes and concepts gained though the experience.

**Phase V  Generalization /Reflection Phase (so what?)**

Here the learners connect the gained experience with the real world situations. They internalize the importance of plants to humans and develops positive attitude towards cultivating plants and also understands the importance of preserving our valuable flora for the future generations.

**Phase VI  Application Stage (Now What?)**

Here learners try to apply the gained experience to new situation. They began to keep vegetable/ornamental garden at homes also.

**Phase VII  Assessment Phase (How much experience achieved?)**

Here the investigator assesses the performance of students in cultivation using evaluation techniques. Two types of evaluation measures are employed:

- Achievement test to test cognitive skills
• Observation/Skill assessment schedules to record and analyze the farming skills.

By monitoring the activities of students, the investigator and staff members analyze the student’s skills in land preparation, planting, manuring, weeding, methods of pest control, harvesting, preservation of seeds etc. Also their skills in observation, communication, and daily recording of observations are observed. The final reports are also discussed.

Discussion

Agriculture is one of the suitable ways to develop values in children. Children reared in the environment and culture of cultivation is good learners, considerate to others, careful, interested in work, cooperative and emotionally stable. Sustainable farming: a farming closer to a natural ecosystem, using optimum land without losing soil fertility and optimum natural resources, minimizing the usage of chemical fertilizers and pesticides, use of crop rotation methods, multiple farming, green manuring etc can bring about sustainable food production. So, in order to provide adequate food to all in future in a sustainable and ecologically sound manner, it would become essential to popularize agriculture among our learners.
FIELD BASED ACTIVITIES
(Objectives)
Main Units:

Conservation of plants and animals, pollution of air and water, some natural phenomena, diversity in living organisms, natural resources, why do we fall ill, our environment, how do organisms reproduce, managing our resources, management of natural resources, human eye & colourful world.

Sub Units:

Deforestation and causes, consequences & Reforestation, Conservation of forest and wildlife & biosphere reserves, Flora & fauna, Endemic species & Endangered species, Wild life sanctuaries & national parks, Significance of Red Data Book, Natural phenomenon (cyclones earth quakes, floods, tsunami etc), Different types of pollution, causes and effects with reference to specific case studies, Classification of living organisms, Hierarchy in classifications & nomenclature, Natural resources, Biogeochemical cycles, Green house effect, Sustainable development, Health and hygiene.

Number of Students : 60

Preliminary Information / Previous Knowledge of Learners:

The learners know that a great variety of plants and animals exist on earth and they are essential for the survival of the mankind. They also know that we should save, preserve and recycle our resources. They also heard about different types of pollutions in our earth. They may be knowing about the importance of health and about the communicable diseases spread in the society due to lack of cleanliness of our surroundings. They also know about the need to preserve our natural resources. They know the concept of eco system and its significance.
They also know that forests are hot spots of our rich biosphere reserves and hence we should protect it.

❖ **Specific Learning Objectives:**

Students will be able to develop the following objectives:

✔ Knowledge of the following aspects

- Deforestation, its causes, consequences & conservation of forest and wildlife, aforestation and reforestation.
- Biosphere reserves – Red data book -flora & fauna, endemic species, endangered species
- Recognizes the importance of wild life sanctuaries and national parks
- Natural phenomenon like lightning, earth quakes, floods tsunami etc
- Recognizes the importance of planet Earth
- Different types of pollution, its impact on environment and remedial measures
- Diversity in living organisms and hierarchy in classification
- Ecosystems- types and its significance in sustainable development
- Conservation and preservation of natural resources
- Management of natural resources

✔ Understanding of the following concepts:

- identifies the importance of wild life sanctuary, national parks and biosphere reserves as areas meant for conservation and preservation of forest and wild animals
- Identifies the significance of the following concepts: endemic species, endangered species, reforestation, aforestation, red data book etc
• Identifies the importance of saving, reusing and recycling paper to save trees, energy and water.

• Develops awareness towards taking necessary precautions to protect ourselves from natural calamities/phenomenon.

• Differentiates different types of pollution and its impact on the environment

• Compares the unity in diversity found among living organisms

• Discriminates the different types of components found in ecosystems

✓ Application

• Apply the learned concepts for the betterment of the society

• Apply the gained experience in creating awareness among common people (towards pollution, waste management, using chemical pesticides etc)

• Analyses the importance of ecosystems and biosphere reserves

• Internalize the importance of saving our environment for sustainable development

✓ Specific Skills like:

• Skills related to locate places of bio diversity

• Skills related to conservation and preservation of flora in the immediate surroundings.

• Skill in locating, collecting and categorizing specimens and natural objects

• Skill in exhibiting the collected natural samples

• Skill in observing facts and changes taking place in the environment

• Cognitive skills like recalling and recognizing facts related to environment, ecosystems, management of natural resources, health and hygiene, etc,
attains ability to compare and differentiate between the impact of various types of pollution to human life, applying the gained knowledge in activities related to conservation of natural resources and creating awareness among public, interpreting and analyzing the learned aspects in terms of present condition of mother earth.

✓ Creative Reflection:

• Experimenting with techniques of waste management (bio gas, recycling etc)

• Collecting and planting new herbs and trees at school campus, at home and in the immediate community to create awareness about the importance of trees to environment (reforestation)

• Conscientizing public towards planting trees/plants for the betterment of human beings and in effective waste management techniques (reduce, reuse and recycle)

• Creating awareness among learners/public towards the ill effects of using and burning plastic items.

• Creating awareness among local people towards environmental cleanliness for maintaining disease free population

• Conduction of awareness programmes and poster presentations related to environmental issues

✓ Positive Attitude:

• Positive attitude towards conservation & preservation of mother earth

• Shows attitudes towards finding out areas of pollution in the surroundings and taking measures to rectify it

• Develops attitude towards reforestation and aforestation procedures
• Develops positive attitude towards preserving our existing natural eco systems
• Develops attitude towards developing positive health habits

✓ Interest

• Shows interest in adopting new techniques and concepts in waste management
• Shows interest in creating herbal/ornamental gardens at school campus and at home
• Develops interest in collecting details of biosphere reserves and biodiversity
• Develops interest in the preparation of power point slides related to biodiversity and natural phenomenon
• Develops interest in field visits/surveying the community for finding out the available water sources
• Develops interest in observing and collecting natural specimens
• Develops interest in the preparation of herbarium sheets
• Develops interest in organizing seminars/symposiums related to environment.

✓ Appreciation:

• Develops appreciation towards the diversity in nature
• Appreciates the beauty/variety in nature
• Began to appreciate the work done by famous environmentalists like Bahuguna.
Meta cognition:

• Designs projects related to environmental conservation
• Writes articles in journals related to environment
• Organize camps/workshops related to conservation of water and water resources

Learning Environment (field activities)

Here the selected field based activities are categorized under three headings:

Field based Activities which includes,

• Field visits
• Field trips
• Field awareness programmes

60 select students are given the details of these activities, its significance and observation procedures by the facilitator/staff members before the conduction of the programme. The learning environment includes field areas/community resources, surveying community resources, field trips to places of bio diversity, resource centres at the society /campus, nearby tribal society/local community for conducting awareness programmes etc.
LESSON TRANSCRIPT

FOR

FIELD VISITS
(LESSON PLAN & PHASES)
Experiential Lesson Plan (Field based activities)

A. Field Visits

The Lesson Plan showing the learning activities and learning outcomes on the experiential strategy field visits is shown in Table 4.2.

Table 4.2
Experiential Lesson Plan (Field visits)

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>Learning Outcomes</th>
</tr>
</thead>
</table>
| Learners are made familiar with the significance of concepts related to environment:  
  - World environmental day  
  - World forest day  
  - Bio-diversity day  
  - Effective waste management  
  - Pollution | Recalls (K)  
Recognises (K) |
| On June 5th, the world environmental day, the select students visited the school campus /nearby fields and planted a number of fruit trees and saplings. They also clean the environment in the nearby tribal community. | Distinguishes(U)  
Locates (S)  
Identifies (U) |
| On World forestry day, the select group of students takes a census of trees and plants in the broad campus, and prepared a documented list including the common and botanical names. They are asked to bring saplings for planting in the campus. They also fixed boards on trees. | Recognizes (K)  
Identifies (U)  
Notices the relevant details (U)  
Locates the spot(S)  
Collects saplings and plants(S) |
<p>| In Bio-diversity day, select students visit the campus and nearby areas of biodiversity and prepared a Habitat album. | Differentiates (U), identifies the |</p>
<table>
<thead>
<tr>
<th>Activity</th>
<th>Knowledge (K), Understanding (U), Skill (S), Application(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey on bio-diversity was also done</td>
<td>flora(U), observes the details(S), locate species(S), recognises the areas(K), compares the different vegetation(U), defines(U)</td>
</tr>
<tr>
<td>Visit to bio-gas plant established in the school campus.</td>
<td>Observes(S), identifies(U), Notices the details(S), infers(A), analyzes (A), Locates(U), reasons out(A)</td>
</tr>
<tr>
<td>Learners acquire information regarding the effective use of kitchen wastes and cow dung in the production of both energy and manure.</td>
<td></td>
</tr>
<tr>
<td>Survey of eco-systems was done by the learners. Pond ecosystem in the campus as well as in the society.</td>
<td>Identifies (U), notices the details (S), compares the different types(U), differentiates the components (U), defines(U)</td>
</tr>
</tbody>
</table>
A. Field Visits: Details of the conducted programme

- On 5\textsuperscript{th} June, on World Environmental day, the students visited the fields and school campus and planted a number of trees, under the guidance of Principal and teachers. The saplings include Gooseberry, Mahagony and Cassia species. An awareness programme for the community was also organised to convey the message to protect and conserve the importance of existing stock of flora. They are also told about endangered species, and a PowerPoint presentation is also made by the students based on endangered flora and fauna. An environmental clean drive was also done by learners by cleaning the nearby tribal locality.

- On March 21\textsuperscript{st}, World Forestry Day, the select group of students took the census of trees in the broad campus, and prepared a list of the same.

- Students are asking to bring various ornamental and medicinal plants and they planted these plants and saplings of fruit bearing trees like Mango, Cherry, Saporta and planted them. They planted the medicinal plants and prepared a herbal garden. Moreover they search the common names and botanical names of the trees and shrubs in the campus with the help of teachers and fixed boards with botanical names for the trees in the campus. Students also make use of reference books and internet for discovering the economic importance of medicinal as well as other plants they listed from the campus,

- In bio-diversity day, select students visited the campus and nearby places and prepared a Habitat Album. A bio-diversity survey of the nearby areas was also done by the learners.
• Visit to Bio-gas plant: A one day field visit to bio-gas plant in the campus is organized for students. It gives the students a clear picture of waste management using kitchen wastes and cow dung.

• Survey of Eco-systems: nearby eco-systems are surveyed (conservation of water bodies) and made a visit to the small pond eco-system situated in the campus itself. Also visited the Chaathancode forest reserve to observe the peculiarities of forest ecosystems, under the supervision of teachers.

Phases of Experiential Learning:

Phase I Preparatory Phase (what do you know?)

The select group of students is made prepare for the activity, by eliciting their previous knowledge related to concepts like pollution, bio-diversity, eco-systems, waste management etc. Then the teacher/facilitator makes connections between prior knowledge and experiences with what is going to present. Find out what learners ideas are on the topic. Then introduce the content of the new experiential lesson. The select group of 60 students is again grouped into 5 groups, each group composing of 12 students.

Phase II Procedure Action Phase (what happened?)

Here the real experiential learning occurs. Learners perform or do the activity with the help of the facilitator/teacher. The important aspect is that the Experiential activity may be an individual or group experience, involving doing action. 60 secondary level students are taken to the campus field for conducting field visits. They are informed that they are going to learn the significance of observing important days related to environment such as World environmental day, Forest day, bio-diversity day, Earth day, etc. They are asked to observe, perform and understand the
concepts from the available resources in the campus field, as per the objectives. A plan of action is then prepared. Students are divided into 5 groups, each group having 12 students each. Each group is assigned to work under the supervision of a teacher/facilitator. Each group is assigned a particular field activity to carry on. Each member of the group has to work independently with the group without losing group consciousness. The overall monitoring is done by the investigator.

**Phase III  Sharing phase (What happened?)**

Here the learners share the reactions and observations. Participants can explain, or write the report of the activity based on their experiences. They can discuss their feelings generated from the experience.

**Phase IV  Processing Stage (What’s Important?)**

Here the learner discuss and analyze and look at the gained experience at a cognitive level. With the help of the teacher, they internalize the themes and concepts gained though the experience.

**Phase V  Generalization /Reflection Phase (so what?)**

Here the learners connect the gained experience with the real world situations. They internalize the importance of plants to humans and develops positive attitude towards conserving and cultivating plants and also understands the importance of preserving our valuable flora for the future generations.

**Phase VI  Application Stage (Now What?)**

Here learners try to apply the gained experience to new situation. They started planting saplings and herbs in the campus as well as in their homes. They shows interest in reading articles related to environmental issues from newspapers started
noting down such aspects from television. They also write articles/prepare power points based on endangered species, biodiversity etc.

**Phase VII  Assessment Phase (How much experience achieved?)**

Here the investigator assesses the performance of students in field based activities using evaluation techniques. Two types of evaluation measures are employed:

- Achievement test to test cognitive skills
- Observation/Skill assessment schedules to record and analyze the field skills. By monitoring the activities of students, the investigator and staff members analyze the student’s skills in selection and collection of saplings/herbs for planting, methods of planting, identifying the flora, writing the reports, role in discussions etc. Also their skills in observation, communication, daily recording of observations are evaluated. The final reports are also discussed.

**Discussion**

We can foster nature awareness in our learners through field visits programmes. Children who favour environmental consciousness prefer learning through direct exploration of nature. All the learners have the ability to engage their various intelligences in different ways and under varying circumstances. What matters is that how we expose our future generation of learners to opportunities that will allow them to develop their intelligences. Field visits can contribute a lot in nurturing this aspect.
LESSON TRANSCRIPT

FOR

FIELD TRIPS
(LESSON PLAN & PHASES)
B. Field trips

Field based learning provides an ideal environment for constructivist learning that promotes deep scientific understanding in conserving nature and bio diversity. A field study consists of three main steps

- Pre-trip preparations
- A field-based trip that includes hands on experience and
- Post –trip assignments

A pre-trip preparation provides essential background knowledge regarding the visiting place, its bio diversity, the things to observe etc. The field trip provides the learner an opportunity to observe and it promotes independent exploration as well as group values. The post trip assignments help the integration and application of key concepts learned. Thus field trips facilitate increased understanding of bio diversity and conservation biology through encouraging students to become active participants in their own education. Learning is further enhanced through interdisciplinary perspectives incorporating principles of biology, ecology, environmental science, geography, economics and other disciplines.
Table 4.3

Experiential Lesson plan for Field Trips

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners are made familiar with the objectives and significance of field trips. The</td>
<td>Recalls (k)</td>
</tr>
<tr>
<td>select group of students is taken to visit places of biodiversity and different</td>
<td>Recognizes the facts(k)</td>
</tr>
<tr>
<td>types of ecosystems. They are asked to observe and note down the aspects related to</td>
<td></td>
</tr>
<tr>
<td>the following concepts:</td>
<td></td>
</tr>
<tr>
<td>➢ Biodiversity</td>
<td></td>
</tr>
<tr>
<td>➢ Eco systems</td>
<td></td>
</tr>
<tr>
<td>➢ Food chains and food web</td>
<td></td>
</tr>
<tr>
<td>➢ Diversity in flora and fauna</td>
<td></td>
</tr>
<tr>
<td>➢ Plantains</td>
<td></td>
</tr>
<tr>
<td>1. Thenmala visit</td>
<td>Observes the details (s)</td>
</tr>
<tr>
<td>➢ Ecotourism</td>
<td>Notices the relevant details (s)</td>
</tr>
<tr>
<td>➢ Bio diversity</td>
<td>Locates the spot(s)</td>
</tr>
<tr>
<td>➢ National parks</td>
<td>Identifies (u)</td>
</tr>
<tr>
<td>➢ Adventure parks</td>
<td>Compares with other areas (u)</td>
</tr>
<tr>
<td>➢ Boat house</td>
<td>Defines the terms (u)</td>
</tr>
<tr>
<td>2. Peppara dam site/forest</td>
<td>Observes the details (s)</td>
</tr>
<tr>
<td>➢ Peppara dam</td>
<td>Notices the relevant details (s)</td>
</tr>
<tr>
<td>➢ Electricity generation</td>
<td>Locates the spot(s)</td>
</tr>
<tr>
<td>➢ Forest ecosystem</td>
<td>Identifies (u)</td>
</tr>
<tr>
<td>➢ Bio diversity</td>
<td>Compares with other areas (u)</td>
</tr>
<tr>
<td></td>
<td>Defines the terms (u)</td>
</tr>
<tr>
<td>3. Ponmudi Hills</td>
<td>Observes the details (s)</td>
</tr>
<tr>
<td>➢ Bio diversity</td>
<td>Notices the relevant details (s)</td>
</tr>
<tr>
<td>➢ Grass land ecosystems</td>
<td>Locates the spot(s)</td>
</tr>
<tr>
<td>➢ Diverse flora</td>
<td>Identifies (u)</td>
</tr>
<tr>
<td>➢ Hills</td>
<td>Compares with other areas (u)</td>
</tr>
<tr>
<td>➢ Insectivorous plants</td>
<td>Defines the terms (u)</td>
</tr>
<tr>
<td>4. Neyyar Dam site</td>
<td>Observes the details (s)</td>
</tr>
<tr>
<td>➢ Neyyar Dam</td>
<td>Notices the relevant details (s)</td>
</tr>
</tbody>
</table>
Here 5 field activities are designed for learners as part of the investigation.

Details of the conducted programme listed below:

1. One is trip to Thenmala, which is part of eco tourism. This is a typical spot to observe biodiversity with its splendid ecosystems, and national parks. Thenmala is home to India’s first planned eco-tourism project. It is rich with ever green forests. It is a natural habitat of diverse flora and fauna. The peculiarities of this hot spot of biodiversity are the following:

   ➢ Rich ever green forests
   ➢ Water falls
   ➢ Lotus pond
   ➢ Canopy walk way
   ➢ Sway bridge
   ➢ Trekking and adventure park
   ➢ Boating
   ➢ Tea estates

| ➢ Dam site safari forest | Locates the spot(s) |
| ➢ Crocodile park | Identifies (u) |
| ➢ Flora & fauna | Compares with other areas (u) |
| ➢ Bio diversity | Defines the terms (u) |
| ➢ Forest ecosystem | |

5. Palode Tropical Botanical Garden
   ➢ Bamboo park
   ➢ Medicinal gardens
   ➢ Orchid gardens
   ➢ Green houses
   ➢ Ornamental garden
   ➢ Museums
   ➢ Tissue culture labs

   Observes the details (s)
   Notices the relevant details (s)
   Locates the spot(s)
   Identifies (u)
   Compares with other areas (u)
   Defines the terms (u)
One full day was set apart for the visit. After the visit, students submitted to field visit reports, followed by group discussions and clarifications in the classrooms. The photographs taken are also displayed in the notice board for the non visitors.

The investigator observed and recorded the student observations in the observation schedules. Also recorded some elements of visit.

2. Peppara Dam site:

Considering the ecological importance of the area, it was declared a sanctuary in 1983. The area is hilly in nature with different forest types. Western region includes semi evergreen forests, southern hill top is tropical evergreen, southern base part includes mixed deciduous forests etc. The sanctuary has a rich population of mammalian fauna. About 43 species of mammals, 233 species of birds, 46 species of reptiles, 13 species of amphibians and 27 species of fishes are reported from the sanctuary.

3. Ponmudi Hills (Golden Peak):

Ponmudi hills are part of Western Ghats. The place is blend with scenic beauty and natural beauty, with a carpet of thick tropical forest. The Golden valley is another attraction. The area is blended with forests and plantations. Ponmudi hosts about 83 species of birds (Many are endangered and threatened), and 195 species of butterflies. The site also host to many species of rare reptiles and amphibians, the highly endangered Tranvancore tortoise, the Malabar Flying Frog and Malabar tree toad.
4. Neyyar Wildlife Sanctuary:

This sanctuary has a substantial natural vegetation cover. The diversity of its flora makes the sanctuary an ideal gene pool preserve. The peculiarities are:

- Species of mammals (39)
- 176 species of birds
- 30 species of reptiles
- 17 species of amphibians
- 40 species of fishes etc. are reported from this sanctuary.

Students there attend a seminar on Biodiversity conservation. They are taught about the biodiversity hot spots of India, importance of preserving hills and mountains natural resources etc. They also observe the varied biodiversity, safari park, crocodile Park, dam site, national park and biosphere reserves. All the learners were familiarized about plantain, cultivation, grazing, conservation and preservation of forest and wild life along with the ill effects of deforestation.

5. Tropical Botanical Garden, Palode

Jawaharlal Nehru Tropical Botanical Garden and Research Institute is renamed in the fond memory of visionary Prime Minister Shri. Jawaharlal Nehru, is an autonomous institute established by the Government of Kerala, in 1979. It has the following peculiarities, inspite of achievements in research.

- Large collections of trees and woody lianas (1000 species)
- Bamboo forest (60 species)
- Medicinal, Aromatic and spice plants (1500 species)
- Orchids (600 species and 150 hybrids)
- Rare and threatened plants (550 species)
- Ferns (165 species)
- Palms (105 species)
- Aquatic plants including Victoria regia etc.

**Phases of Experiential Learning**

**Phase I  Preparatory Phase (what do you know?)**

The select groups of students are made prepare for the activity, by eliciting their previous knowledge related to concepts like pollution, bio-diversity, ecosystems, waste management etc. Then the teacher/facilitator makes connections between prior knowledge and experiences with what is going to present. Find out what learners ideas are on the topic. Then introduce the content of the new experiential learning activity, the field trip. The select groups of 60 students are again grouped into 5 groups, each group composing of 12 students.

**Phase II  Procedure Action Phase (what is happening?)**

Here the real experiential learning occurs. Learners perform or do the activity with the help of the facilitator/teacher. The important aspect is that the experiential activity may be an individual or group experience, involving doing action. 60 secondary level students are taken to the campus field for conducting field trips to five environmentally and ecologically important places. They are informed that they are going to learn the significance of observing important areas/fields of ecological importance. They are asked to observe, perform and understand the concepts from the available resources in the visiting field, as per the objectives. A plan of action is then prepared. Students are divided into 5 groups, each group having 12 students each. Each group is assigned to work under the supervision of a teacher/facilitator.
The groups are assigned with particular tasks to carry on. Each member of the group has to work independently with the group without losing group consciousness. The overall monitoring is done by the investigator.

**Phase III Sharing phase (What happened?)**

Here the learners share the reactions and observations. Participants are ask to explain, and write the report of the activity based on their experiences. They can discuss their feelings generated from the experience.

**Phase IV   Processing Stage (What’s Important?)**

Here the learner discuss and analyze and look at the gained experience at a cognitive level. With the help of the teacher, they internalize the themes and concepts gained though the experience.

**Phase V   Generalization /Reflection Phase (so what?)**

Here the learners connect the gained experience with the real world situations. They internalize the importance of plants to humans and develops positive attitude towards cultivating plants and also understands the importance of preserving our valuable flora for the future generations. They also learn to appreciate the biodiversity and richness of Mother Earth and develop positive attitude towards conservation and preservation of natural resources.

**Phase VI   Application Stage (Now What?)**

Here learners try to apply the gained experience to new situation. They started planting saplings and herbs in the campus as well as in their homes. They shows interest in reading articles related to environmental issues from newspapers started
noting down such aspects from television. They also write articles/prepare power points based on endangered species, biodiversity etc.

**Phase VII Assessment Phase (How much experience achieved?)**

Here the investigator assesses the performance of students in observation and comprehension using evaluation techniques. Two types of evaluation measures are employed:

- Achievement test to test cognitive skills
- Observation/Skill assessment schedules to record and analyze the observation and collection skills.

By monitoring the activities of students, the investigator and staff members analyze the student’s skills in selection, collection and identification of plant species, other live specimens, organizing these specimens in a hierarchy, arranging in herbariums, album preparation, writing the reports, role in discussions etc. Also their skills in observation, communication, and reporting are evaluated. The final reports are also discussed.

**Discussion**

An outdoor classroom will enhance opportunities for learners to enhance their skills, attitudes and knowledge. It also provide place for long term observation as students learn how their activities effect their environment. Field trips provide a prime activity to enhance social and technical skills also. Students can learn natural cycles, biodiversity, impact of pollution, variety in diversify of life forms etc through field trips. All ages can take advantage of teaching opportunities provided in the fields and an outdoor classroom can facilitate the learning process.
C. Field Awareness Programmes

LESSON
TRANSCRIPTS

FOR

FIELD AWARENESS
PROGRAMMES
(LESSON PLAN & PHASES)
Table 4.4
Lesson Plan on Field Awareness Programme

<table>
<thead>
<tr>
<th>Learning Activity</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners are made familiar with the significance of conducting awareness...</td>
<td>Recalls (k)</td>
</tr>
<tr>
<td>programmes related to biological concepts. They’re taught the different ways...</td>
<td>Recognises (k)</td>
</tr>
<tr>
<td>and means of organizing programmes for the benefit of students and public.</td>
<td>Compares the different strategies (u)</td>
</tr>
<tr>
<td>Learners are made familiar with the importance of observing the following days,</td>
<td></td>
</tr>
<tr>
<td>related to Environment.</td>
<td>Infers (A)</td>
</tr>
<tr>
<td>➢ Earth Day (2 April)</td>
<td>Analysis the significance (A)</td>
</tr>
<tr>
<td>➢ Mosquito Eradication Day (20 August)</td>
<td>Identifies the importance (U)</td>
</tr>
<tr>
<td>➢ World Ozone Day (16 September)</td>
<td>Notices the relevant details (S)</td>
</tr>
<tr>
<td>➢ Anti Filarial Day (5 December)</td>
<td>Defines (U)</td>
</tr>
<tr>
<td>➢ World Wetland Day (2 February)</td>
<td>Reasons out (A)</td>
</tr>
<tr>
<td>Awareness programme on Earth Day:</td>
<td></td>
</tr>
<tr>
<td>The local people are invited to the school and given lectures by the students...</td>
<td></td>
</tr>
<tr>
<td>‘Environment clean drive’ taken by learners. They are asked to clean the</td>
<td></td>
</tr>
<tr>
<td>nearby environment (both in campus and locality) by removing articles made</td>
<td></td>
</tr>
<tr>
<td>of plastic and polythene.</td>
<td></td>
</tr>
<tr>
<td>On Mosquito Eradication Day, the select group of students along with the</td>
<td>Locates the spot (S)</td>
</tr>
<tr>
<td>facilitator and teachers, visited the nearby Tribal locality and conducted</td>
<td>Identifies the concept (U)</td>
</tr>
<tr>
<td>an awareness programme about the various diseases caused by mosquitoes, their</td>
<td>Explains the importance (U)</td>
</tr>
<tr>
<td>symptoms, and</td>
<td>Notices the details (S)</td>
</tr>
<tr>
<td></td>
<td>Locates the objects (S)</td>
</tr>
<tr>
<td></td>
<td>Observes the details (S)</td>
</tr>
<tr>
<td></td>
<td>Establishes cause effect relationship (A)</td>
</tr>
<tr>
<td></td>
<td>Reasons out (A)</td>
</tr>
</tbody>
</table>
preventive measures. They also distributed pamphlets explaining methods to eradicate mosquitoes.

In the World Ozone Day, the learners conducted a rally from the school campus to the nearest main junction with banners and posters related to the theme. They uttered slogans which revealed the importance of observing ozone day.

On anti filarial day, a team of Health experts from the primary health centre visited the school. The parents and local people were also invited to the programme. Paper presentations based on filarial infection and related themes were held by select group students with the help of LCD projector. They prepared and displayed related posters also. Finally they distributed anti-filarial drugs to other students, staff members, parents and to the residents near the campus. The learners also organized an awareness rally.

An awareness programme was conducted by the select group of students at the school campus on world wetland day. The near by local people were invited to the program. Students explained the importance of conserving wet lands with the help of posters and pictures. A documentary on wetlands of Kerala was also shown.

Knowledge (K), Understanding (U), Skill(S), Application (A)

Details of conducted field awareness programmes listed below:

1) On Earth day, an awareness programme was conducted by the select group of learners to protect Mother Earth. The local people were invited to the school, and the learners give the necessary explanation with the aid of power point presentations. An ‘Environment clean drive’ was also initiated by the learners, whereby they clean the surrounding environment in the campus as
well as the nearby locality by removing the objects and wastes made of plastic and polythene.

2) On Mosquito Eradication day, the select group of students along with the investigator and teachers, visited the tribal locality near the school and conducted an awareness programme about the importance of mosquito eradication, the various diseases spread by mosquitoes, their causative organisms, preventive measures etc. The students also distributed pamphlets explaining the various methods of mosquito eradication.

3) A rally was organized by the learners from school to the nearest main junction on World ozone day, the spread awareness among the local people on the importance of ozone day.

4) On anti filarial day, a team of Health experts from the primary health centre visited the school. The parents and local people were also invited to the programme. Paper presentations based on filarial infection and related themes were held by select group students with the help of LCD projector. They prepared and displayed related posters also. Finally they distributed anti-filarial drugs to other students, staff members, parents and to the residents near the campus.

5) An awareness programme was conducted by the select group of students on world wet land day. The near by local people were invited to the program. Students explained the importance of conserving wet lands with the help of posters and pictures. A documentary on wetlands of Kerala was also shown.
Phases of Experiential Learning

Phase I  Preparatory Phase (what do you know?)

The select groups of students are made prepare for the activity, by eliciting their previous knowledge related to concepts like pollution, bio-diversity, ecosystems, waste management, environmental cleanliness etc. Then the teacher/facilitator make connections between prior knowledge and experiences with what is going to present. Find out what learners ideas are on the topic. Then introduce the content of the new experiential learning activity, the field awareness programmes. The facilitator explains the students the importance of conducting awareness programmes as it helps in conscientizing the mass. The select groups of 60 students are again grouped into 5 groups, each group composing of 12 students.

Phase II  Procedure Action Phase (what is happening?)

Here the real experiential learning occurs. Learners perform or do the activity with the help of the facilitator/teacher. The important aspect is that the Experiential activity may be an individual or group experience, involving doing action. 60 secondary level students are given training to organize awareness programmes in the campus/field for conducting awareness programmes for conscientizing the learners as well as the public. They are informed that they are going to learn the significance of observing important days related to environment. They are asked to observe, perform and understand the concepts from the available resources in the visiting field, as per the objectives. A plan of action is then prepared. Students are divided into 5 groups, each group having 12 students each. Each group is assigned to work under the supervision of a teacher/facilitator. The group is assigned with particular tasks to carry on. Each member of the group has to work independently with the group
without losing group consciousness. The overall monitoring is done by the investigator.

**Phase III  Sharing phase (What happened?)**

Here the learners share the reactions and observations. Participants are asked to explain, and write the report of the activity based on their experiences. They can discuss their feelings generated from the experience.

**Phase IV  Processing Stage (What’s Important?)**

Here the learner discuss and analyze and look at the gained experience at a cognitive level. With the help of the teacher, they internalize the themes and concepts gained though the experience.

**Phase V  Generalization /Reflection Phase (so what?)**

Here the learners connect the gained experience with the real world situations. They internalize the importance keeping the environment neat and clean as it is necessary for the well being of both man and nature. They also develops positive attitude towards conducting awareness programmes related to preserving our valuable flora for the future generations. They also learn how to conduct awareness programs for the benefit of the learners as well for the society. **Application Stage (Now What?)**

Here learners try to apply the gained experience to new situation. They started planting saplings and herbs in the campus as well as in their homes. They shows interest in reading articles related to environmental issues from newspapers started noting down such aspects from television. They also write articles/prepare power
points based on endangered species, bio diversity etc. The learners internalize the importance of environmental cleanliness for the well being of the man.

**Phase VII  Assessment Phase (How much experience achieved?)**

Here the investigator assesses the performance of students in observation and comprehension using evaluation techniques. Two types of evaluation measures are employed:

- Achievement test to test cognitive skills
- Observation/Skill assessment schedules to record and analyze the observation and collection skills.

By monitoring the activities of students, the investigator and staff members analyze the student’s skills in preparation, presentation and organization of awareness programmes in the school and in the locality. The final reports are also discussed.

**Discussion**

The methodology for imparting field awareness programmes should also include attempts like keeping the home premises and school campus clean, encouraging the maintenance of school gardens, declaring campus litter and plastic free. Other attempts may include keeping sign boards, tree plantation drives, giving saplings to public, and initiating minor projects to conserve the surrounding flora and fauna. Awareness programmes and competitions based on environmental issues will encourage learners to go deep into the existing environmental problems.
LESSON TRANSCRIPT

FOR

ICT BASED ACTIVITIES
(Power Point Presentations)
Lesson Transcript for Experiential Learning

(ICT based Experiential Activities)

Main Units


Sub Units

Biodiversity, Pollutions, Plant cell & Animal cell, Five kingdom classification, Algae, Fungi, Pteridophytes & Bryophytes, Methods of food preservation, Seed dispersal, Class Amphibia, Annelida & Arthropoda, Reptiles, Birds etc.

◆ Number of students:

60 secondary level students

◆ Specific Learning Objectives:

1. Process domain:

The learner observes the details of ICT based lessons given by the instructor and recognizes the strategies for preparing power point presentations. They also collect the needed reference materials from reference books, e-books, journals, and also browsing the internet.

2. Attitudinal domain
The learners develop a positive attitude towards searching the internet for reference materials. They also develop a favorable attitude towards ICT-based instruction for teaching biology in schools.

3. Application domain

The learners apply the gained and learned ICT principles in new situations. That is, they began to prepare ICT-based lessons (Power points) in other subjects also. They also use power points in conduction of seminars and awareness programmes.

4. Creativity domain

The learners began to apply graphics, animations etc in the presentations to make it an outstanding presentation.

- **Pre-requisite**

  Learners know how to simply prepare power points. They also know the concepts related to presentation. They also know how to use internet for browsing information.

- **Learning Environment**

  Smart classrooms, computer laboratory, class rooms etc.

- **Learning Materials/support materials**
  1. Computer /laptop
  2. CD/pen drive/presentation loaded in the computer
  3. LCD projector
  4. Handouts on the important points (if necessary)
Table 4.5

Experiential Lesson plan for Power point presentations

<table>
<thead>
<tr>
<th>Activity</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction:</strong></td>
<td></td>
</tr>
<tr>
<td>The learner presents the topic by laying out the overall structure of the presentation. The class begins by a question or an activity to elicit the previous knowledge of the learners.</td>
<td>Recognizes (k) Recalls (k) Recognizes(k)</td>
</tr>
<tr>
<td><strong>Presentation:</strong></td>
<td></td>
</tr>
<tr>
<td>The learner presents the points one by one with the help of slides in a logical sequencing. The presentation is moderated by questioning related to the content.</td>
<td>Identifies (u) Explains (u) Illustrates (u)</td>
</tr>
<tr>
<td><strong>Closure:</strong></td>
<td></td>
</tr>
<tr>
<td>The learner concludes the class by giving the lesson summary.</td>
<td>Concludes the lesson</td>
</tr>
</tbody>
</table>

Knowledge (K), Understanding (U)

Phases of Experiential Learning

**Phase I Preparatory Phase (what do you know?)**

The select group of students is made prepare for the activity, by eliciting their previous knowledge related to power point presentations and web browsing,

**Phase II Procedure Action Phase (what is happening?)**

Here the real experiential learning occurs. Learners perform or do the activity with the help of the facilitator/teacher. The learners here prepare power points on select topics in biology.
Phase III  Sharing phase (What happened?)

Here the learner’s share the reactions and observations. Participants can explain, or write the report of the activity based on their experiences. They can discuss their feelings generated from the experience. They can also present the power points with the help of projectors.

Phase IV  Processing Stage (What’s Important?)

Here the learner discuss and analyze and look at the gained experience at a cognitive level. With the help of the teacher, they internalize the themes and concepts gained through the experience.

Phase V  Generalization /Reflection Phase (so what?)

Here the learners connect the gained experience with the real world situations.

Phase VI - Application Stage (Now What?)

Here learners try to apply the gained experience to new situation. They began to prepare power point presentations based on other subjects also. They also browse the web for gathering additional information necessary for learning.

Discussion

Information and communication technology is a valuable tool in transforming classrooms. It has the power to support students and teachers in gathering, organizing, manipulating and presenting information. Thoughtful and purposeful use of technology has a great impact on student achievement. It allows other avenues to be explored and helps in the process of differentiating instruction. A curriculum that incorporates technology (ICT) and time-based theories as MI, supplements students’ knowledge and expands their possibilities.
Empirical Validation of the Experiential Learning Package developed

The experiential learning package developed by the investigator is administered to 60 students learning biology at secondary level. Experimental method was used for determining the effectiveness of experiential learning strategies on the achievement in Biology, environmental experiences and pro-environmental behaviour using one group pre-test post-test design. Separate lesson transcripts are prepared for these activities.

- Suitable learning environments are located for the conduction of Experiential learning activities. (area for cultivation, field visits, field awareness programmes, smart rooms etc)

- The topics in the secondary curriculum that can be learned through Experiential learning are identified

- Lesson transcripts based on experiential learning activities are prepared based on select topics from secondary biology

- Learners were taken to the selected sites and allowed to learn through select experiential learning activities

- Student’s achievement in biology was assessed before and after experiential learning

- The extent of skill development (observation, manipulation, presentation, collection of specimens) is assessed using observation schedules.

- The effectiveness of experiential learning strategies of students was analyzed using appropriate statistical techniques.

The evaluation of performance of students was carried out in different ways. The major focus was on evaluating the achievement of theoretical concepts.
An achievement test in biology was prepared for this purpose. The test was administered as pretest and posttest to the experimental group. Observation Schedules prepared by the investigator was used for a formative evaluation of the performance skills in doing various activities like observation, recording of data, manipulating the equipments to the extent possible, communication with members of the staff and the like. A consolidated report of the observations made by the investigator was recorded in the Observation Schedule.
Students gaining experiences……

Agricultural Activities

Weeding

Harvesting

Land Preparation

Manuaring

Harvesting

Irrigation Process

Harvesting
Field based Activities (Field Visits)

Surveying biodiversity and ecosystems

Biogas plant in the campus

Field visits
Planting saplings

Forest Survey

Cleaning the environment

Survey of bio diversity

Field visits
Field based activities (Field Trips)

Peppara dam site/forest reserve

Ponmudi hills/tropical forest

Tropical Botanical garden, Palode
Thenmala Ecotourism /National parks
Neyyar Wild life Sanctuary/ dam site

Field based Activities (Field Awareness Programmes)

Mosquito Eradication Day Observation
Anti filarial day observations

World Ozone Day (Rally by foot)

World wetland day observations
ICT Based Activities
4.7.5. **Achievement Test in Biology**

An achievement test in biology was prepared by the investigator of multiple choice types, based on the blueprint prepared by the investigator. The draft test consists of 85 items related to the select areas of content of secondary biology syllabus. The test was administered to a population of 30 secondary students and item analysis was conducted. Finally, 73 items are included in the final test. The print copy of the draft form of achievement test and the final test are given as Appendices IX and X respectively. The face validity of the test was ascertained by showing the prepared test to experts for their assessment. The Scoring key of achievement test is given as Appendix XI.

4.7.6. **Pro Environmental Behaviour scale**

This tool was developed to measure the ecological behaviour of the secondary school students of Kerala by Arjunan and Dr. Mercy Abraham (2003), is taken to measure the ecological behaviour of experimental group of students in this study. This tool provides an objective measure of the extent of environmentally friendly behaviour of the subjects. A careful analysis of the literature and consultation with guide and experts were also undertaken before the adoption of the tool. The scale consists of 30 items. The pro environmental behaviour scale is given in Appendix XV.

4.7.7. **Environmental experience inventory**

Environmental experience refers to the sum or range of environmentally significant situations, conditions, incidents etc. than an individual personally encountered, witnesses, perceived, observed or directly participated as they occur in the course of time. The Environmental experience of the experimental group of students was measured using the Environmental experience inventory developed by
4.7.8. Naturalistic Intelligence Inventory

Nature and purpose of the Naturalistic Intelligence Inventory

The Naturalistic Intelligence Inventory is a device used for measuring the naturalistic traits of students in the age group 13 to 16 or its equivalent groups. The inventory may also find its utility in measuring the naturalistic intelligence traits of people from other walks of life. The inventory consists of 70 items, selected from 7 core trait areas related to naturalistic intelligence, which is highly sufficient to produce a valuable measure of naturalistic traits of an individual. The inventory is designed to produce quantifiable data that may be subjected to statistical analysis to draw scientific inferences.

Preparation of the draft form of the Naturalistic Intelligence Inventory

After analyzing various literatures related to Multiple Intelligence theory and the work done by other educationalists and others in this field, it was found that there was no reliable tool to measure Naturalistic intelligence at any levels. For preparing the same, the investigator followed the following procedure:

- Reading all the available literature related to MI and naturalistic intelligence from books, journals as well as browsing from internet.
- Collection of statements and aspects related to Naturalistic intelligence traits
**Construction of items for the Inventory**

The first step in the construction of the tools is the collection of statements related to the topic. From the extensive review of literature, the investigator identified about 156 statements, related to naturalistic personality traits. Later 10 personality traits related to naturalistic intelligence are located from the theoretical constraints, and the select statements are classified under each category.

Thus a naturalistic personality trait list is prepared by the investigator, which was examined by the guide and submitted to experts (including Prof. Howard Gardner) for validation. After validation, 100 items are classified under 10 personality traits, which was again send for validation. Based on the validation of experts, certain items are discarded from the list. Details of the trait list are given in Appendix-1. Next step is to prepare a Naturalistic intelligence inventory, which is the main tool for correlation. From the prepared naturalistic trait list, 7 naturalistic intelligence components/traits were identified. Appropriate traits were included under each component, and the inventory consists of 89 statements. Again the inventory is analyzed by the guide and sends to experts. The Naturalistic draft form is administered to a student population of 50 secondary level students and item analysis was conducted. The draft form of the Naturalistic Intelligence inventory is given as Appendix II.

**Standardization of the Naturalistic Intelligence Inventory**

For try out, the Naturalistic intelligence inventory was administered to 50 secondary students in Trivandrum district. Students were given enough time to complete the inventory.
After calculating the Difficulty Index (DI) and Discriminating Power (DP), the items with Difficulty Index between 0.4 and 0.6 and Discriminating Power greater than 0.45 were selected for the final test.

Preparation of the Final Naturalistic Intelligence Inventory

Out of the 89 items included in the try out, 70 items were selected for the final inventory (10 items under each naturalistic trait). The final inventory was printed with manual with all the necessary instructions. Details of Item Analysis and Manual of Instructions of the final inventory are given in Appendix III & IV respectively.

Thus an inventory with 70 items is prepared under 7 core trait headings. The final tool was used to find out the level of naturalistic intelligence of students at secondary level. The final version of the tool is given as Appendix V. Table 4.6 shows the inventory with the corresponding item numbers in the final version and table 4.7 shows the item numbers in the final Naturalistic Intelligence Inventory, corresponding to the Traits.

Table 4.6
Naturalistic Intelligence Inventory

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Statements</th>
<th>Item No in the final tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>NATURAL ORIENTATION</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>I am interested in locating the habitats of animals</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>I can easily classify plants and animals</td>
<td>67</td>
</tr>
<tr>
<td>3</td>
<td>I recognize the feeding habits of some birds (pet birds and common birds)</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>I recognize the feeding habits of some animals</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>I care and rear pet animals and birds, aquarium keeping etc.</td>
<td>70</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Statements</td>
<td>Item No in the final tool</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>6</td>
<td>I interact /play with pet animals</td>
<td>27</td>
</tr>
<tr>
<td>7</td>
<td>I know the names of different species of plants, animals and insects</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>I kept a garden in front of my house</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>I notice and recognize birds’ nests/borrows etc</td>
<td>47</td>
</tr>
<tr>
<td>10</td>
<td>I have an affinity for natural habitats (ecosystems)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>ATTRIBUTE ORIENTATION</strong></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I can Identify the sounds of birds in nature</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>I am a patient observer of flowering plants</td>
<td>18</td>
</tr>
<tr>
<td>13</td>
<td>I have strong sensory observations- feeling, smelling and listening</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>I like to ‘touch’ and ‘explore’ animals (tortoise, snails, larvae of dragon fly, cocoons of butterflies)</td>
<td>64</td>
</tr>
<tr>
<td>15</td>
<td>I have an affinity to group natural objects (shells, feathers, pebbles)</td>
<td>35</td>
</tr>
<tr>
<td>16</td>
<td>I can identify shapes and patterns in natural setting (clouds, hills, plateaus, grass lands)</td>
<td>8</td>
</tr>
<tr>
<td>17</td>
<td>I can easily classify common species of plants and animals in my locality</td>
<td>49</td>
</tr>
<tr>
<td>18</td>
<td>I find patterns and attributes across a variety of organisms</td>
<td>62</td>
</tr>
<tr>
<td>19</td>
<td>I observe even the minute aspects in my natural environment</td>
<td>46</td>
</tr>
<tr>
<td>20</td>
<td>I notice even the minute changes taken place in the environment</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>CATEGARIZATION</strong></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I can categorize different types of leaves and specimens</td>
<td>12</td>
</tr>
<tr>
<td>22</td>
<td>I can group natural objects based on classification</td>
<td>22</td>
</tr>
<tr>
<td>23</td>
<td>I enjoy collection of natural objects (different varieties of sea shells) and arrange them based on categories</td>
<td>54</td>
</tr>
<tr>
<td>24</td>
<td>I enjoy collecting stamps related to nature, environment</td>
<td>24</td>
</tr>
</tbody>
</table>
25. I have the ability to discriminate between objects and materials in nature and finds minute differences among them.

26. I keep a keen eye for detailed observation of seasonal changes.

27. I have taken pain in mounting specimens and preparation of herbarium sheets based on classification.

28. I can identify plant species based on classification (algae, fungi, angiosperms etc).

29. I can identify insectivorous plants like Nepenthes.

30. I enjoy the habit of labeling and arranging natural specimens.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Statements</th>
<th>Item No in the final tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>HIERARCHICAL REASONING</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>I have the habit of collecting and categorizing specimens, posters, stuffed animals and herbariums related to nature and wild life</td>
<td>31’</td>
</tr>
<tr>
<td>32</td>
<td>I have spent leisure time in organizing collected specimens/herbarium sheets</td>
<td>3</td>
</tr>
<tr>
<td>33</td>
<td>I always note down the keen observations about natural changes, interconnections and patterns in nature in hierarchy (sort information into hierarchies)</td>
<td>33</td>
</tr>
<tr>
<td>34</td>
<td>I easily learns the characters, and names of plant species found in nature</td>
<td>53</td>
</tr>
<tr>
<td>35</td>
<td>I have the habit of analyzing similarities and differences in collected natural objects (sea shells, feathers, pebbles, seeds)</td>
<td>57</td>
</tr>
<tr>
<td>36</td>
<td>I know how to compare natural observations related to natural phenomenon’s like seed dispersal</td>
<td>36</td>
</tr>
<tr>
<td>37</td>
<td>I enjoy learning about the works of famous environmentalists and naturalists</td>
<td>60</td>
</tr>
<tr>
<td>38</td>
<td>I am always curious about nature and asks questions</td>
<td>56</td>
</tr>
</tbody>
</table>
related to nature and natural phenomena

39 I am constantly aware of the changes taking place in my surroundings

40 I have visited/explored local environments to identify the flora and fauna

V SCHEMATIC MEMORY

41 I automatically uses the senses to explore environment-experienced the smell of flowers, fruits, foul smell from industries, pollutants etc)

42 I easily internalize the concepts related to environment

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Statements</th>
<th>Item No in the final tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>I have the affinity to notice patterns and things from nature easily</td>
<td>59</td>
</tr>
<tr>
<td>44</td>
<td>I have understanding in doing research on plants and animals that are indigenous to the country</td>
<td>44</td>
</tr>
<tr>
<td>45</td>
<td>I have heightened awareness for endangered species of flora</td>
<td>63</td>
</tr>
<tr>
<td>46</td>
<td>I am always conscious about the environment and surroundings</td>
<td>19</td>
</tr>
<tr>
<td>47</td>
<td>I give heightened awareness for endangered species of fauna</td>
<td>9</td>
</tr>
<tr>
<td>48</td>
<td>I always think divergently in writing articles related to nature</td>
<td>48</td>
</tr>
<tr>
<td>49</td>
<td>I had enough understanding in interdependence of man with nature</td>
<td>17</td>
</tr>
<tr>
<td>50</td>
<td>I have taken pains in learning and internalizing characteristics of the natural world</td>
<td>68</td>
</tr>
</tbody>
</table>

VI CREATIVE REFLECTION

51 I read and internalize concepts related to stories/articles/newsletters/articles in newspapers related to nature and bio diversity

52 I practice gardening/agricultural activities

53 I take initiation in wildlife protection projects
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Statements</th>
<th>Item No in the final tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>I show interest in conservation of wild life/nature</td>
<td>23</td>
</tr>
<tr>
<td>55</td>
<td>I often stand apart from the crowd, involving in environmental issues</td>
<td>55</td>
</tr>
<tr>
<td>56</td>
<td>I keep scrap books, log books, and journals about nature</td>
<td>15</td>
</tr>
<tr>
<td>57</td>
<td>I enjoy photographing and preparing albums based on nature and biodiversity</td>
<td>6</td>
</tr>
<tr>
<td>58</td>
<td>I observe TV shows and programmes related to nature (Animal planet, national geographical channel etc)</td>
<td>58</td>
</tr>
<tr>
<td>59</td>
<td>I prepare CD’s/ scrap books related to nature and natural world</td>
<td>43</td>
</tr>
<tr>
<td>60</td>
<td>I participate in volunteer projects the benefits plants, animals, waste disposal, water conservation, energy conservation etc.</td>
<td>37</td>
</tr>
<tr>
<td>VII</td>
<td><strong>NATURALISTIC METACOGNITION</strong></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>I design projects/equipments for the benefit of nature</td>
<td>61</td>
</tr>
<tr>
<td>62</td>
<td>I Participate in awareness generation programmes related to nature and bio diversity</td>
<td>21</td>
</tr>
<tr>
<td>63</td>
<td>I have interest in organizing nature protection campaigns</td>
<td>1</td>
</tr>
<tr>
<td>64</td>
<td>I am interested in organizing workshops/nature camps for the benefit of learners</td>
<td>25</td>
</tr>
<tr>
<td>65</td>
<td>I have affinity towards discovering schemes for non conventional energy utilization</td>
<td>28</td>
</tr>
<tr>
<td>66</td>
<td>I submit nature friendly/eco friendly projects for funding</td>
<td>66</td>
</tr>
<tr>
<td>67</td>
<td>I wish to enhance my naturalistic thinking skills</td>
<td>2</td>
</tr>
<tr>
<td>68</td>
<td>I work hard to promote outdoor education</td>
<td>50</td>
</tr>
<tr>
<td>69</td>
<td>I have the habit of encouraging learning through experimentation</td>
<td>69</td>
</tr>
<tr>
<td>70</td>
<td>I write/publish articles, papers or even books related to nature conservation.</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 4.7 shows the item numbers in the final naturalistic inventory corresponding to the traits.

Table 4.7

<table>
<thead>
<tr>
<th>No</th>
<th>Naturalistic Traits</th>
<th>Item Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Natural Orientation</td>
<td>4,7,10,16,27,32,38,47,67,70</td>
</tr>
<tr>
<td>2</td>
<td>Attribute Orientation</td>
<td>8,13,18,20,35,40,46,49,62,64</td>
</tr>
<tr>
<td>3</td>
<td>Categorization</td>
<td>12,22,24,26,30,42,45,51,54,65</td>
</tr>
<tr>
<td>4</td>
<td>Hierarchical Reasoning</td>
<td>3,11,31,33,36,39,53,56,57,60</td>
</tr>
<tr>
<td>5</td>
<td>Schematic Memory</td>
<td>9,14,17,19,41,44,48,59,63,68</td>
</tr>
<tr>
<td>6</td>
<td>Creative Reflection</td>
<td>6,15,23,29,34,37,43,52,55,58</td>
</tr>
<tr>
<td>7</td>
<td>Naturalistic Meta cognition</td>
<td>1,2,5,21,25,28,50,61,66,69</td>
</tr>
</tbody>
</table>

Duration and scoring of Naturalistic Intelligence Inventory:

The duration of the test was 70 minutes, one minute for each item. The maximum marks for inventory was 210 and minimum score, 70. Responses of the students were collected and scored according to the scoring key. The print copy of the manual of instructions of the tool and the scoring key are given as Appendices IV and VI.

Reliability:

The reliability of the test was found out using split half method. The scores obtained by each individual in the test were divided into two groups by pooling odd number items and even number items. Correlation was found for the half tests. From the reliability of the half tests, reliability coefficient of the whole test was estimated by the Spearman-Brown prophecy formula. (Garret, 1985 pp.339). The reliability
coefficient obtained was 0.813. which shows that the test is highly reliable for the purpose.

**Content Validity:**

Freeman (1965) says that each test item is a sampling of knowledge or performance which the test intends to measure. Content validity is estimated by evaluating the relevance of the test items in relation to instructional objectives and actual subject matter studied, individually as a whole.

In this content validity of the Naturalistic Intelligence inventory was established in two ways:

1. The content validity of Naturalistic intelligence inventory was established based on the judgment of subject experts including Prof. Howard Gardner. The investigator, after carefully examining the different components of Naturalistic intelligence, prepared a Naturalistic Intelligence personality trait list. Based on the trait list, items are included in the inventory which was further submitted to a group of experts for validation. Based on their suggestions, some of the statements are modified and some deleted.

2. According to Singh (1996) data relating to the item discriminating power may also provide circumstantial evidence for the content validity. Items showing such power, that is items discriminating among superior and inferior examinees are said to have content validity. Hence the items in the draft naturalistic inventory are subjected to item analysis and the items having discriminating power greater than 0.45 were selected for the final inventory. Thus the content validity of the test is ensured.
4.7.9. Naturalistic Intelligence checklist

The Naturalistic Intelligence checklist is intended to check whether the naturalistic intelligence of students can be enhanced through experiential learning activities. The checklist is prepared in accordance with the naturalistic inventory based on the experience of the learners.

Preparation: An initial pool of 55 questions was prepared based on naturalistic traits. On the basis of the validation from experts, some items are rejected and out of the 55 questions only 30 questions were retained in the final checklist. The draft form of Naturalistic checklist and the final checklist are given as Appendices VII & VIII respectively.

4.7.10. Observation schedule for evaluation of skill based performance of students during experiential learning (Field trips, ICT based lessons, Agriculture)

Observation Schedules were prepared by the investigator was used for a formative evaluation of the skill in doing various activities like observation, recording of data, manipulating the equipments to the extent possible, and also to report the performance skills of the experiential learners. The observations are recorded in the analysis sheet for each and every activity of the experiential activity and on the basis of it; a consolidated report of the observations made by the investigator was recorded in the Observation Schedule. Observation schedules/ rubrics are made on the following activities:

- Observation schedule to record the ratings of performance skills of Learners in Agriculture
Observation schedules to record the ratings of performance skills of learners in Field Based Activities (Field visits, Field trips and field awareness programmes)

Observation schedules to record the ratings of performance skills of learners in ICT based activities (power point presentations).

Separate consolidation/analysis sheets are prepared for each activity in the observation schedules. The copies of observation schedules and the sample of the consolidation sheet are placed in Appendices XVI & XVII respectively.

4.8. Sample for the study

A sample is the subset of the population in which the investigator intends to generalize the results. The population for the present study comprises of secondary school students of Kerala. Teachers teaching biology in secondary level are included as sample for the present study, considering the objectives of the study. The sample for the study was selected from the population in such a way as to yield generalizable results from the study.

The sample for the study constituted 360 students learning biology at secondary level and 50 teachers teaching biology at secondary level, from three districts of Kerala. The experimental part of the present study was conducted on 60 secondary level students of Trivandrum district selected from among the 360 students.

4.9. Statistical techniques employed

Statistical analysis of data was undertaking using procedures appropriate for the purpose of the study. The statistical techniques used in the present study are Mean, Standard Deviation, Critical Ratio and Coefficient of Correlation.
4.10. Procedure

The purpose of the present investigation is to study the correlation between experiential learning and naturalistic intelligence of secondary level biology students. To provide valid answers to specific research questions rose in the study, it was decided that Experimental cum Normative survey method should be adopted for the study. Normative survey was selected for collecting data relevant for the study, considering the objectives of the study and the nature of data required for their realization. The methods thus selected were in accordance with accomplishing the objectives which in turn will help in verifying the hypotheses of the study.

To find out the potential of secondary level curriculum for Experiential learning, Content analysis of the secondary level biology curriculum was done. Before developing the Experiential learning package for learners, the investigator find out the extent of usage of experiential learning in biology teaching at secondary level and also the difficulties encountered by teachers while incorporating experiential learning strategies in teaching biology lessons.

Then the investigator prepared an Experiential learning package consists of lesson transcripts of the selected experiential learning activities. Three main experiential strategies were selected for the study. They are:

- Agriculture based activities
- Field based activities
- ICT based activities

In Field based activities, three categories were selected. They are:

- Field visits
Field trips and
Field awareness programmes

Separate Lesson transcripts were prepared based on these activities.

The experiential learning package is administered to the select experimental group of 60 students. After administering the package, its effect on Achievement, Environmental experience, Pro-environmental behaviour and Naturalistic intelligence is find out. The correlation between experiential learning and Naturalistic intelligence is find out with the help of the Naturalistic Intelligence Inventory, prepared and standardized by the investigator. A thorough analysis of the theories and literature related to naturalistic intelligence were analyzed for the preparation of the inventory. The behaviour changes in the experimental group of secondary learners are further find out with the help of a Naturalistic intelligence checklist.

4.11. Discussion

Selection of suitable methods, techniques, tools and statistical techniques in educational research is very important for the success of the research effort. The methods and techniques used must be in harmony with the broad scientific principles of research and it must lead to valid generalizations and plausible conclusions. The details of the analysis and interpretations of data gathered by the tools and techniques/statistical techniques mentioned in this chapter are given in next chapter.