4 Enriching the Classroom Experience

STRUCTURE

4.1 Introduction
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4.4 Experiments and Demonstrations
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I hear and I forget
I see and I remember
I do and I understand

4.1
You must have heard the well-known Chinese proverb given above.
It is universally acknowledged that “learning-by-doing” leaves a lasting impact. When students are directly involved in the process of learning, they also develop practical skills which would be useful to them in their later lives.
In this process, your role as a teacher also changes. Rather than a transmitter of information/knowledge, you need to become a facilitator who ensures that the students are correctly oriented, that the process is effectively undertaken, and that the educational objective is achieved.
In this unit you can review some of the ways in which an activity approach could help you to better communicate environmental concepts and topics, and how to prepare for this. You will also get some ideas about the variety and range of active learning methods or approaches that you could use with your students.

4.2
On completion of this unit, you should be able to:
■ employ all opportunities to involve students in learning-by-doing.
■ adapt and use a variety of games to illustrate concepts.
■ design games to suit your requirements.
■ formulate demonstrations and experiments to communicate abstract concepts.

4.3 LEARNING-BY-DOING
The school is the institutional framework within which continuous interaction takes place between teachers, students and the curriculum. For meaningful learning to take place within this framework, this interaction has to be optimized.
The curriculum provides the framework of what should be taught. However the rich variety of methodologies or skills needed for the effective communication of all that needs to be taught is often not available to teachers.
Trends in recent years have highlighted the need for teaching methods other than the traditional “chalk and talk”. Textbooks themselves have a number of suggested activities. There is an acknowledged need for students to be actively involved in the process of learning, and to develop practical skills which will be useful to them in their later lives. Some ways in which this can be done are by “hands-on learning” and “learning by doing” or “activity approach”. These are part of the process of “experiential learning”. This also helps educators to provide students with rewarding and joyful learning experiences. Learning is more fun for the learner, teaching more fun for educators. How does this happen?

Learning-by-doing, or an activity approach:

- Helps to clarify abstract concepts through practical experience or demonstration.
- Helps in better understanding and contextualization through application of the principles of science, mathematics, etc. to situations familiar to students.
- Provides opportunity to use multiple senses (sight, hearing, etc.) and helps increase retention of what is learned.
- Integrates multiple teaching/learning methods, leading to maximizing creativity and flexibility.
- Focuses on learning more from view of the child, and less from an adult’s perspective.
- Facilitates the process of “discovery” of problems and solutions, and builds self-esteem.
- Teaches a variety of life skills instead of merely subject matter content.

A variety of teaching methodologies may need to be used for effective active learning. These should be such as to awaken interest, arouse curiosity, provide information and enable systematic processing of the information, help formulate codes of ethics and behaviour, and ultimately lead to positive action to improve the world around.

When you, the teacher, first start using the activity approach, it may take you a little more time to prepare than a lecture or a demonstration. But the activity approach will not add to your burden. Rather, it will promote and support you by providing a range of appropriate educational materials and ideas, and orientation on the creative use of the same. And the rewards for both you and your students will be significant and satisfying.

Think back to your school days of one happy memory that you have as a student and one bad memory that still lingers in your mind. It could be a subject, a teacher, an experience… Try to analyze why the memory was good or bad. Did either one have anything to do with the way in which something was taught?
4.4 FUN & GAMES

Have you ever observed a mother cat with her kittens? Often she twitches her tail to attract the kittens. When the kittens pounce on the moving object, she pulls it away. Again and again, the kittens try to catch the tail, and again and again the mother is quicker and pulls it out of reach. To an observer, the kittens are lost in play – jumping and pouncing and crouching. To the mother cat, this session of play is where the kittens are learning critical skills of hunting – how to stalk and catch prey.

Such examples of “play” to teach and learn vital survival skills is very common in the animal world.

Can you think of some other such examples from the animal world?

Often play is associated with something other than learning. Play is considered for pleasure, while learning is considered serious. Play is what takes place on the playground, while learning take place in the classroom.

The use of games or play methods could in fact be very effective as a teaching-learning methodology. Educational games became specially useful in the context of environmental education.

Have you ever used a game to teach a textbook concept? If yes, what game? If not, why not?

4.4.1 What is an educational game?

An educational game is an activity in which players use data and/or skills, usually in a competitive situation. It is useful in presenting repetitive learning in novel ways. Games can help in creating awareness, reinforcing facts and knowledge, teaching skills and building values. Games provide an innovative, educative, entertaining and participatory approach to learning.

In EE games, the situation in which the information and skills are used may not always accurately reflect some aspects of reality. However they are still useful tools for making children sensitive about the environment, and ultimately encouraging them to take action.
4.4.2 How can use of games help in EE?

Games can:

- Help generate high levels of motivation
- Generate an atmosphere of enjoyment and participation
- Help a high degree of retention of what has been learnt, due to the dynamic nature of the activity and also the pre and post discussions
- Help to demonstrate effects of decisions and actions, which would be used to reinforce appropriate behaviour.
- Help to create an altered relationship between the students and the teacher whose role becomes that of a facilitator, while students become active partners in the process of learning.

4.3.4 Some Types of Educational Games

Given below is a brief description of some well-known games, as well as examples of how the basic format could be used to develop games that could help to convey environmental concepts; The games include both outdoor and indoor games.

<table>
<thead>
<tr>
<th>Type</th>
<th>Format</th>
<th>Example</th>
<th>Game for EE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race Games</td>
<td>Players compete to complete a circuit on a track on the game board. Moves are governed by random numbers cast up by dice.</td>
<td>Ludo or Snakes &amp; Ladders</td>
<td>Water Conservation Game</td>
</tr>
<tr>
<td>Strategy Games</td>
<td>Require players to eliminate the element of chance by planning the moves</td>
<td>Chess</td>
<td>Prey-Predator</td>
</tr>
<tr>
<td>Games of manual skill</td>
<td>Involve manual dexterity and good hand-eye coordination</td>
<td>Carrom Darts</td>
<td>Segregate your Garbage</td>
</tr>
<tr>
<td>Mathematical Games</td>
<td>Explicitly require mathematical reasoning. Games to which some mathematical theory can be applied, although not required for playing the game</td>
<td></td>
<td>Oh Deer</td>
</tr>
<tr>
<td>Word Games</td>
<td>Involve manipulation of basic units of language. They challenge the imagination and increase GK &amp; vocabulary. Use of deductive logic is the key to many of these games</td>
<td>Twenty questions</td>
<td>Who am I?</td>
</tr>
</tbody>
</table>
4.3.5 Conducting Games: Some Guidelines

The idea of using different kinds of games to communicate various aspects of subjects is attractive as it provides a new experience for the students.

However do keep in mind some of these points:

- Do not overuse games, otherwise participants may reach a point of saturation.
- Incorporate the activity into the overall structure of a learning unit. For example if the learning unit talks about energy transfer in a food chain, “Predator-Prey” (p.42) can be played.
- The game should be adapted for the needs of a particular level of students with a particular subject/class. For example if the class is on mathematics/economics and the teacher wants to teach about the importance of resources in a system at upper primary level, then one can play “Oh Deer!” (p.43) and interpret the results through discussions and calculations.
- While choosing or designing a game, ensure that the exercise embodies the material to be learnt, and yet can be played by those who have not yet mastered the material. It is important to ensure that students really have to use the material in order to play. For example, in “Who Am I?” (p.44) the child gets to understand the basics of plant and animal classification. However it is not essential that to play this game the child needs to have prior knowledge of classification.
- Do not emphasize winning. Encourage students to see their achievement within the context of the concept in the learning unit.
- Encourage group student activities.
- Ensure that students see the activity as part of an integrated unit, discuss the purpose of the activity and list learning objectives.
- Keep all rules and directions to a minimum, especially at the start of the activity.
- Do have a discussion after the game. The discussion should be centered around the main concepts the game tries to convey and any other variations that have been tried out.

Planning the Games

Once you are convinced and excited about the potential of games as effective tools of EE, you could begin to review your teaching content, and look for appropriate concepts/opportunities to introduce and conduct a game.

Adaptation/Interpretation

Adapting or interpreting a game to convey certain concepts is an important activity. Adapting a game to suit a particular learning situation is a game in itself. Students could also be encouraged to create their own games.
Assessing Games

It is very important on the part of the educator conducting games to assess the educational value of particular games. The following questions should be kept in mind before carrying out these activities.

- Do the objectives of the activity conform to the objectives of the section of the course being studied?
- Is the game appropriate for the students?
- Is the game interesting?
- Does the game convey the desired concepts?
- What is the central theme presented in the game?
- What are the choices available to the participants?
- What are the different moves or activities provided for the participants?
- What are the rules?
- How is the activity organized?
- What kind of discussion and debriefing is required to conclude the game?

The last question is very important in case of games in EE. The discussion and debriefing which follow becomes an occasion for exploring concepts that have become apparent during the course of the game, and is also an opportunity to draw out attitudes, experiences, and knowledge from the participants, and relate these to the theme or concept.

Most important, do remember games need time to prepare, time to conduct, and in particular, time to brief and discuss.

**Given your classroom situation, what kind of games do you think it would be practical to involve students in?**

**Think of two games that your students play, and how you could use these to teach some concepts from the textbook.**
4.4 EXPERIMENTS AND DEMONSTRATIONS

You would be teaching a variety of concepts such as the distribution of water on earth; vegetation in soil conservation; loss of energy in transfer and more. These are presented in a textual format, supplemented at best by an illustration, a graph, or a photograph. Children learn these by reading and repeating, as they do everything else in their books. Rarely is there an opportunity to ‘experience’ these concepts by doing. As a result children may not fully understand the principles, nor are they able to make the linkages between what they read in their books and how this relates to their own life.

A small demonstration or experiment can be useful in several contexts:

- To help transform an abstract textbook concept or fact into a tangible real-life subject.
- To help develop students’ skill of observation, recording, measurement, estimation.
- To help in building an understanding of place, time, change and relationships.
- Become a good take off point to generate a wider discussion on the theme.

It is possible to devise simple demonstrations and experiments for many of the science and mathematic concepts in the textbook. It is not difficult to devise experiments and demonstrations that can generally be fitted within the time allocated to teach a particular topic. In some cases, student participation can also become part of preparing demonstrations and experiments (e.g. preparing models).

Let us see where experiments are more suitable, and where demonstrations are effective.

An experiment usually helps to establish a cause-effect relationship. It includes enquiry, observation, inferring, and testing of a hypothesis.

For example an experiment can help to prove that vegetation cover can help to prevent soil from being washed away. (Protective Cover p 48).

Or by measuring the quality of water lost by a dripping tap in one minute, students can calculate the water loss from that tap over a period of one hour, one day or one month. (Every Drop Counts p 46).

A demonstration by and large illustrates something. It could be an abstract concept such as energy loss in transmission, or a process or cycle such as the water cycle, or even help to translate numbers into simple and calculable quantities (such as the distribution of water on earth) (Twelve Spoons p 47).

Both experiments and demonstrations are useful in illustrating a variety of textbook concepts. In case of environmental concepts, demonstrations are an especially effective way of translating abstract, isolated facts into tangible, real-life subjects. (Web of Life - Module 1 p 21)
4.5 Some Examples of Games

Predator- Prey

Objective: To understand and appreciate predator-prey interactions.

Materials: Chalk, pieces of crumpled waste paper or pebbles, etc. to represent food for prey animals (there should be at least two food tokens per prey animal).

Activity: Divide the students into three groups representing frogs, snakes and eagles respectively. Mark three areas as “home” for the three groups in the play areas.

Place food tokens at the centre of the play area. Explain to the students that at each blow of the whistle the frogs, snakes and eagles must enter the area, try to collect their food and rush back to “home” area. A predator cannot catch prey that has reached its home. The predator that catches its prey, takes it to its home. Even if they are not captured, animals die if they do not have enough food at the end of the activity. Each round of the game begins with the first whistle. The frogs go the centre of play area to get the food tokens. Each frog has to collect at least two tokens. While the frogs are collecting the tokens, blow the whistle again. At the whistle, the snakes, which are the predators of frogs, reach the centre of the play area to catch the frogs. The frogs have to collect food and reach their “home” area, without being eaten by the snakes. At the final blow of the whistle, the eagles reach the centre of the play area to find their prey, the snakes.

The activity could be conducted for three or four rounds. Record the number of captures in each round. Ask the students who are captured to become predators, and each predator not getting enough food become a prey animal in the succeeding round. This quickly leads to the concept of dynamic balance as prey and predator populations fluctuate in response to each other.

Discussion: Notice that an animal is both predator and prey at the same time. For example, the frog is a predator to the insects but is a prey to the snakes.

- What methods did the prey use to escape?
- Which methods were easiest?
- Which methods were effective?
- What means did the predators use to capture prey?
- Which ways were the best?
- What happens to the predator population if the prey is less in number?
- Discuss the need for animals to strike a balance between safety and food.
Oh Deer!

Objective: To help understand that food, water and shelter are the essential components of a habitat; and the concept of ‘limiting factors’; and to recognize that some fluctuations in wildlife populations are natural, as ecological systems undergo constant change.

Materials: An open space for participants to run, paper and pencil.

Activity: Divide the students into four groups. All the groups should have an equal numbers of students. Give one of the following names to each group: Deer, Food, Water, Shelter. Mark two long parallel lines on the ground or floor. The lines should be 3-5 meters apart. Have the ‘deer’ line up behind one line; the others should line up behind the other line. Tell the students that the essential components of a habitat are food, water and shelter. Deer need good habitat in order to survive. Decide different hand gestures to symbolize the three basic needs—food, water and shelter. Ask the students to remember the gestures.

The activity starts with all students lined up behind their respective lines (deer on one side, habitat components on the other side). The ‘deer’ and the ‘habitat components’ should not face each other. Instead, they should stand with their backs to each other.

Begin the round by asking all of the students to make their symbols. Each student (both the deer and the habitat components) has to choose one of the three symbols: food, water or shelter. If a deer is making the ‘water’ symbol, it means that it needs water. Making the ‘shelter’ symbol means it needs shelter, and so on.

At the count of three or at a whistle or clap, the deer must run towards the habitat line, select the component it needs and stand in front of it. Each deer must keep the sign of what it is looking for, until it gets to the habitat component with the same sign. Each deer that reaches its necessary habitat component takes the ‘food’, ‘water’, or ‘shelter’ back to the ‘deer’ side of the line. This represents the fact that the deer has successfully met its needs. A deer that fails to find its food, water, or shelter partner dies and becomes one of the habitat components.

Record how many deer are there at the beginning of the activity, and at the end of each round. Continue the activity for approximately four to five rounds.

Discussion: At the end of the activity, discuss the game. Encourage students to talk about what they experienced and saw. For example, at the start there was a small herd of deer that could meet its needs in the habitat. As the population of the deer expanded over two to three rounds of the activity, the habitat become depleted. As a result there was not sufficient food, water and shelter to satisfy the needs of the members of the herd. At that point, some deer starved or died of thirst or lack of shelter. Explain that such things also happen in nature.
Who am I?

Objective: To identify the distinguishing features of various elements and the use of deductive logic to identify an animal or a plant that gives an insight into the characteristics of a particular element.

Materials: Cards with names of elements of nature/ Cards with components of ecosystem, paper clips or safety pins.

Activity: Let the students stand or sit in a circle. Ask one student to volunteer. Affix a card on the back of the student. The student is not told what the card is. Now ask the student to walk around the circle, so the other students can see what the card represents.

The task for the student is to identify who he/she represents by asking the group relevant questions. The others must answer questions only with either a ‘yes’ or a ‘no’. The student can ask up to a maximum of 10 questions. (It may vary depending on the age group)

As the number of questions is limited, the student should be very careful in the choice of questions and should frame them logically, e.g. based on classification of animals and plants. For example, they may ask:

- Am I a mammal?
- Am I a bird?
- Do I eat meat?
- Am I domesticated?

As the game progress, bring down the number of questions to make it more competitive. Play the game in 10–15 rounds with different students as volunteers.

Discussion: How did the students arrive at the answers?
Which classification principles did they use?
Segregate Your Garbage

Objectives: To enable students to:

i. recognize the importance of segregation of garbage;

ii. identify that solid waste can be divided into dry waste, wet waste, infectious waste and toxic waste.

Materials: Writing materials; four empty baskets/bins

Activity: Make a list of solid waste items under the heads ‘dry waste’, ‘wet waste’, ‘infectious waste’ and ‘toxic waste’- e.g. paper, vegetable peels, discarded bandages, medicine bottles, etc.

Write down four names from these lists on four pieces of paper. Mix them together and spread them out on a table or floor.

Label the four baskets/bins as ‘Dry Waste’, ‘Wet Waste’, ‘Infectious Waste’ and ‘Toxic Waste’ respectively. Place the bins with the labels facing the students. The baskets/bins should be kept at least one to one-and-a-half metres away from the table where the paper pieces are.

At a clap or whistle one student has to separate the components, crumple each piece of paper into a small ball and throw it into the appropriate basket from the distance indicated above. The activity has to be completed within 2 minutes.

After this, the student should explain as to why he/she threw a particular component (say banana peel) into a particular basket.

Put out four different chits having different names of different items of garbage and call another student and continue similarly.
4.5.2 Some Examples of Demonstrations

Every Drop Counts

Objective: To estimate the amount of water wasted through leaks and understand the importance of preventing wastage, thus conserving water.

Materials: a measuring cylinder, a stop watch or an ordinary watch

Activity: Gather the students around a water tap. Place a bucket under the tap and adjust the tap so that the water drips drop by drop.

Let one student take charge of the stopwatch or minute glass and be the time keeper. Ask another student to hold a measuring cylinder under the dripping tap. As soon as the time keeper gives a signal at the end of one minute the cylinder should be removed from under the tap. The water collected in the cylinder should be measured. Based on the amount of water collected in one minute, ask the students to calculate the amount of water that would be wasted in one hour or in a day from the dripping tap.

You could lead a discussion on the most common causes of water wastage in our homes, schools, offices, etc. and on methods of preventing water wastage.

Discussion: Seldom do we realise that from a dripping tap there is an immense loss of water resource. Households, schools and offices that have dripping taps are not only allowing wastage of treated water but also using the resource poorly. Women and children in some parts of our country walk miles for a pot of drinking water.

Compare the amount of water lost from a single dripping tap to the daily requirement of water per person, which is about 90 – 120 litres as per the World Health Organization.
12 Spoons

**Objective:** To demonstrate:
- the distribution of water on earth
- that there is finite amount of water on the earth
- that only a small fraction of it is only available for use.

**Materials:** An empty soft drink bottle of 300 ml capacity, a small bucket (2.5 litres), a transparent container, two small dishes, ink dropper, teaspoon.

**Activity:** Measure 2200 ml of water into a container (use a soft drink bottle if a measuring cylinder is not available). Assume that this 2200 ml represents all the water on earth.

Measure 12 spoons of water into a small container. This represents all the fresh water on earth. The remaining water in the bucket represents salt water found in oceans and seas.

From the container having 12 spoonfuls of water, measure out 2 spoons into a dish. This represents ground water.

Remove half a spoon from the container which has 10 spoonfuls of water. This represents the water found in freshwater lakes.

From the remaining water in the container having about 9½ spoonfuls remove one drop. This represents water found in the rivers.

The water left in the small container represents the amount stored in ice-caps.

**Discussion**
- Can fresh water stored in ice-caps become available to us?
- Can sea water be converted to fresh water for our use?
- What are the problems caused by over-extraction of groundwater?

<table>
<thead>
<tr>
<th>Distribution of Water on Earth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceans</td>
</tr>
<tr>
<td>Ice-caps</td>
</tr>
<tr>
<td>Groundwater</td>
</tr>
<tr>
<td>Freshwater lakes</td>
</tr>
<tr>
<td>Inland seas and salt lakes</td>
</tr>
<tr>
<td>Atmosphere</td>
</tr>
<tr>
<td>Rivers</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Protective Cover

Vegetation protects soil from being blown away by wind or washed away by water. It also slows down movement of runoff, allowing water extra time to soak into the soil.

Objective: To help understand the importance of conserving soil in nature and to demonstrate the role of vegetative cover in conserving soil.

Materials: Two trays or cardboard boxes, plastic sheet, piece of tin for spout, one tin can with a perforated base, brick pieces, pebbles, ordinary soil, mustard or jowar seeds, two glass jars (one litre capacity)

Activity: Take two cardboard or wooden boxes or trays approximately 90cm X 50cm X 15cm. Line them with a plastic sheet to make them leak proof. These sheets can be made by cutting open old plastic bags and fusing the edges together with the help of a candle. At one end of each box cut a 'V' notch 10 cm deep to draw the runoff water into a glass jar.

Fill each box with 3-4 cm layer of brick pieces and pebbles, followed by 3-4 cm layer of manured soil.

Sow mustard seeds or any other quick growing plant seeds in one box. Leave the other box bare. Sprinkle water on Box 1 regularly till the plants are 8-10 cm high.

Now set the boxes on a table towards the edge. Place a brick or a stick under the other end to give them slope. Place empty glass jars on stools beneath the notch (as shown in the animation). Now, gently pour equal amounts of water over the boxes

Check the rate of flow and collect the water that flows out from the two boxes in the glass jars. Note the difference in the quantity and quality of water collected in the two jars.

Discussion: The demonstration can be followed up with a discussion on points such as:

- Why is the amount of water that flows out from the vegetated box less than that from the bare box?
- In which jar is the water more muddy?
- How do plants help to conserve water?
- Why is it necessary to protect the soil by natural means?

Vegetation helps percolation of water through soil to collect as water table and also protects top soil.
4.6

- A small demonstration or experiment can be useful in several contexts. Give one example for use of a demonstration or experiment for each of the following:

- To help transform an abstract textbook concept or facts into a tangible real-life subject.
- To help develop students skill of observation, recording, measurement, estimation.
- To help in building an understanding of place, time, change and relationships.
- Become a good take off point to generate a wider discussion on the theme.
- Given below are instructions for conducting a game called ‘How Much Rain’. Based on this description fill in the following blanks.

Objective:
Topic:
Subject:
Group size:
Duration:
Place:
Suitable Time:
Materials:

**Activity**

Ask each student to bring a funnel and a transparent bottle from their homes. The diameter of the base of the bottle and that of the wider end of the funnel should be the same.

At the beginning of the rainy season, take the students to an open area near the school. The area should be more or less flat. Ask them to keep their tin cans or bottles on a spot chosen by them and place the funnel in it. They must ensure that the container is not disturbed during the period of rain and is not toppled over by the wind. It would be a good idea to place the bottle in a shallow depression created by digging the soil up to a depth of a few centimeters.
Every day, let the students collect their containers carefully without spilling the water in it, and using a scale, measure and record the height of the water that has collected in it. The containers should be emptied and put back in the same place. Let them maintain a record of their daily measurements.

Ask the students to compare results with each other. They may also compare their results with what is recorded at a nearby meteorological station. They can get this information from the next day’s paper or from the weather bulletins on radio or TV. The students can make this a daily activity for one rainy season and compute the annual rainfall for their area.

A discussion on how rainfall affects various people like farmers, pilots, fishermen, etc, can be carried out along with the activity.

3. Reflect and Answer

Rate yourself in the context of skills that you have that could be useful for teaching through the activity approach.

I have skills in …
I really want to be able to …
I need to develop skills in …

(credit points: 5)