

6

Developing Process Skills in Environment Studies

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Abstract

Environmental Studies (EVS) at the primary stage is understood as “an integrated approach to science, social science and environment education” (NCERT, 2005). The subject is taught by exposing children to real-life situations, by which they make sense of the natural, physical, social and cultural environment around them. It is focused not only on concept formation but also on the development of process skills.

It was observed in primary classrooms that teachers focused on labelling and memorisation of parts of the plant like roots, shoot, leaves, flowers, fruit and so on; they drew pictures of plants, despite the fact that plants are all around and the school (under study) has a beautiful garden. Why can't we take children to the garden regularly and make them observe changes in plants from sowing to flowering? Probably, in this way children may learn many more things than just labelling different parts of plants. This paper attempts to focus on the development of process skills among children from Class IV of a North Delhi Municipal Corporation School. For this, activities were designed according to the syllabus of EVS at the primary level during the school internship (practice teaching) experience, which gave space to children for constructing the conceptual knowledge and the process skills to enhance EVS learning. The findings showed that process skills in science develop when children work with hands-on activities. They also achieved better grades on their test.

INTRODUCTION

'Environmental Studies' as envisioned by National Curriculum Framework

(NCERT, 2005) “is an integrated study of science, social science and environment education.” This was a

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drift from earlier national policies of 1968 and 1986. Both these policies emphasised teaching science and social science separately; sometimes there were separate books labelled Science and Social Studies and other times there were separate chapters in one book labelled Environmental Studies. The integration of concepts was left to children. For instance, water is taught both in science and social studies but from different perspectives. In science textbooks, content is limited to properties of water, solubility and floatation whereas in social studies, it focuses on sources of water (river, pond, sea, ocean), water for irrigation, rainfall, dams, etc. This kind of compartmentalisation of knowledge into various disciplines exists in the school curriculum but it doesn't exist in the minds of children. It may lead to problems in concept formation among children. For instance, elaborating on the previous example of 'water', it is understood differently by different subject experts. A chemist would think of it as a covalent bonding between oxygen and hydrogen molecule, its chemical properties; water as a fire extinguisher; physicists would focus on water as a good conductor of electricity, as a source of electricity generation in Bhakra dam or any other hydropower plant; a biologist would intend to take it as an essential component of our diet and necessary for the survival of all living beings; a geographer would plan to take up different sources of water on earth ranging from rivers to lakes to oceans;

a political science expert would focus on politics of water such as disputes between neighbouring states like that of Karnataka and Tamil Nadu for Cauvery water or water essential for agriculture, enhancing the economy of a state and so on. It is very difficult for young children to integrate knowledge on their own. Thus, Environmental Studies as an integrated subject focuses on the natural, cultural and social environments. For making children understand this integration, it is important that they actively participate in activities in classrooms. Along with learning concepts, they also develop many process skills like classification, observation, comparisons (drawing similarities and differences), communication, raising questions, etc.

PROCESS SKILLS IN SCIENCE

Process skills are explained by Maranan (2017) in a very simple way as "these are the things that scientists do when they study and investigate. Observing, classifying, communicating, measuring, inferring and predicting are among the thinking skills used by scientists, teachers and students." Harlen & Elstgeest (1992) listed process skills as "observing — comparing and classifying, raising questions, measuring and calculating, manipulating materials and equipment, devising and planning an investigation, designing and making, communicating effectively, finding patterns, inference making, predicting and hypothesising". Not only in science experiments but

every activity, some process skills are involved. At the primary school level, the current environmental studies textbooks do not engage with laboratory-based experiments; they have simple activities based on learners' contexts. In those simple activities, process skills are used and emphasised. For instance, an experiment was conducted in Class IV to find out which fabric will be the most suitable for making a dress to be worn on Diwali. The following were steps taken by children.

Step 1— Discussion of criteria for the dress:

It should be bright and colourful, as it is a festive occasion. It should not catch fire easily, as during Diwali, people light up their houses with candles and *diyas* and occasionally there are firework displays too.

Step 2— Collection of samples of different kinds of fabric:

They cut different fabric samples into similar sizes (length 15 cm and width 2 cm)

Step 3— Prediction:

Children by touching the sample fabrics made their guesses about the most suitable cloth/ fabric.

Step 4— Experimentation:

They lit a candle and brought fabrics one by one near the burning candle. They made observations regarding the time taken by the fabric to burn and how it burnt (slowly, or vigorously).

Step 5— Communication:

Children discussed their findings with others and explained their

reasons for selecting a particular type of cloth for the dress.

Thus, it was observed in this activity that children are doing a lot of things:

- raising questions;
- comparing different samples of cloth and drawing out similarities and differences;
- predicting — which fabric is the least fire hazard (should not catch fire easily);
- investigating/experimenting — controlling variables (size of cloth strips), independent variable (a type of cloth-like silk, nylon, cotton, polyester or any other) and dependent variable (burning time and type of burning);
- recording observations;
- making inferences;
- communicating findings to others.

All these are processes involved in the activity called process skills. These skills in a way determine how well content is learnt. These process skills are part of the investigation. Children may forget the content they have learnt in school but if they learn these process skills, these will remain with them throughout life. These process skills are only learnt by doing. This is one of the rationales for doing activities and experiments in classrooms.

OBJECTIVES

1. To develop an understanding of how children learn process skills using classroom activities.

2. To try out a variety of activities for teaching-learning of EVS at the primary level and identify the process skills learnt by children.

SAMPLE

This research was conducted with the help of two B.El.Ed. (Bachelor of Elementary Education) final year students. In the final year, students are placed in primary schools for an internship (also called practice teaching) for 12 weeks. The Class IV students of a Municipal Corporation Girls school, Avantika Rohini Sector 2 located in North West Delhi participated in this research. The study was conducted in two different sections of Class IV. A total of 60 Class IV girls participated for four months.

PROCEDURE

The content in NCERT's environmental studies textbooks is developed around six themes, namely:

1. Family and Friends (it is divided into four sub-themes — Relationships, Plants, Animals, and Work and Play)
2. Food
3. Shelter
4. Water
5. Things we make and do

For this research, themes chosen were Water, Plants (sub-theme of family and friends), Work and Play (sub-theme of family and friend) and Food. Different activities were planned on the concepts related to the above-mentioned themes. Children's ideas

about the concepts were explored through unstructured interviews, worksheets and discussions. The effect of activities on children's development of process skills and attitudes towards science was investigated. The activities planned were hands-on activities, group activities involving experimentation, field visits to the school garden, and visiting sites of water stagnation in the school.

DATA COLLECTION AND ANALYSIS

Water

Floating and sinking

The objective of the activity was to identify things that float and things that sink from a group of given objects. Children were divided into groups of four. Each group was provided with a plastic tub (which they filled with water) and some materials like chalk, bottle caps, paper plates, stones, empty plastic bottles, erasers, board pins, caps of pens, corks, marbles and screws to perform the experiment. Before experimenting, children were asked to predict whether the object will sink or float and make a record in their notebooks. Then they investigated and recorded observations next to the column where they recorded their guesses about sinking and floating. They were cooperating with each other in groups and manipulated the material, which facilitated the construction of knowledge. They classified things that float and things

that sink. They shared their results and also raised questions like “the empty plastic bottle which was large in size floated but the eraser was so small in size that it sank.” Another child remarked, “floating and sinking are not dependent on size, we see large ships floating in the sea.” In another group, a child remarked that heavy objects sink like marbles, but the lighter things like paper plates initially floated but gradually soaked water and began sinking. In group work, children not only explored the nuances of the concepts but also developed process skills like observing, recording, classifying, predicting, comparing, raising questions and experimenting.

Solubility

The objective of the activity was to make children understand the concept of solubility. Children were divided into groups of five. Each group was given a transparent tumbler (which they filled with water) and five different things for the experiment — sand, salt, sugar, oil and chalk powder. Before starting the investigation on what is soluble and what is not, children were asked to make predictions about the solubility and record them in their notebooks. Children began an investigation and recorded their observations. Most children predicted that chalk powder would be soluble in water. They asked questions to clarify their doubts. They also raised questions like how much salt/sugar can be dissolved in one glass of water? Children drew the

inference that chalk powder is partially soluble. They expressed curiosity to find out the solubility of some other things like honey, turmeric, chilli powder, etc. They were able to classify the things as soluble and insoluble. They compared that sand settled down in the glass, oil was floating on the surface of water, and sugar and salt disappeared in the water. Along with developing an understanding of the concept of solubility, children developed process skills like observing, recording, classifying, predicting, comparing, questioning, manipulating materials and investigation. Although a lot of children understood solubility as ‘disappearing’, which is a misconception commonly found among children of age 8 to 9 years.

Viscosity

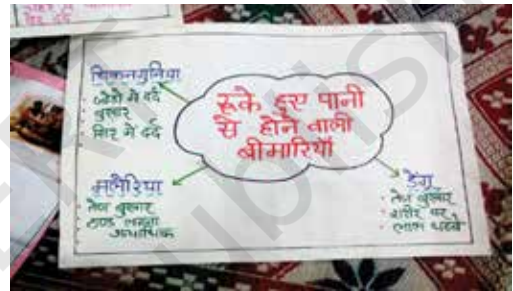
The activity was conducted to develop an understanding of the concept of viscosity. Cardboard covered with a plastic sheet was used for this activity. Five liquids — honey, fevicol, water (coloured), milk and oil were taken for the experiment. Children worked in groups of five and put the drops of these liquids on the cardboard and observed which drop slipped down fastest followed by the others. They recorded observations in a table (along with their prediction, made before the start of the experiment). They found that water drops slipped the fastest and fevicol (an adhesive) was the slowest. After discussion, they inferred that the liquid which slips down fastest is the least thick than

others and the liquid which slipped down slowest is the thickest and most vicious. Another interesting conclusion they discovered was ‘the relationship of the slant of the cardboard with the time to slip down from the cardboard’. They compared the thickness of drops by observing. The process skills learnt through this activity were: observing and recording, comparing, predicting, question raising, communicating, manipulating material, investigating and inferring.

Stagnant Water

The objective of this activity is to identify the problems related to stagnant water. Generally, charts displayed in classrooms give information to children on photosynthesis, food chain, solar system, states of India, weather and many others. Thus, the main purpose is information dissemination. Then, there is another category of interactive charts, which have spaces to write and share responses/observations (for instance, weekly recording of growth of plants)/thoughts (problems related to traffic). These charts are collectively prepared by children and teachers. For this activity, various locations of stagnant water were identified in the school. Children observed those sights and found the larva of mosquitoes in the water. An interactive chart was prepared, where children shared their observations about how that water may be collected; what was there in the water; what can be its harmful effects; what diseases are caused by mosquitoes’ bite; what are the

symptoms of dengue, chikungunya and malaria; what kind of preventive measures can be taken. They connected their real-life experiences with this activity. They shared about people infected with dengue, chikungunya and malaria in their neighbourhoods. Some of them even shared symptoms of the diseases. They shared how these can be prevented. The process skill focused were identification, observation and recording, explanation, communication, questioning and inferring.



Plants

Growth, Seeds, Flowers

Children planted a few saplings at two locations — one in the corridor, where it received sunlight and the other in one of the dark corners of the classroom. Both were given water regularly. They found that sunlight is necessary but even if saplings were kept in dark corner of the class, they survived for several days, almost a week and after that started withering. They recorded the growth pattern of saplings for more than a month in the chart. They inferred that sunlight is essential for plant growth but it is

not necessary to keep plants in direct sunlight every day. This helped them in differentiating between the conditions essential for the growth of plants and making inferences. The school compound has a lot of plants. Its advantage was taken and children were taken to the garden on a regular basis. Children identified different flowers and listed their features — colour, shape, size, and location (isolation or in bunches) in the worksheet provided to them. In the other task, children also categorised plants like herbs, shrubs and trees. They focused on the size and appearance of the plants.

In further extension to this activity, children were given different seeds (kidney beans, lentils, gram, fenugreek, fennel, mustard and canola) in groups along with a worksheet. They observed the seed's shape, colour, texture (smooth or rough) and smell. Finally, they classified the seeds according to their different attributes. For instance, one group classified the seeds according to their colour, other group classified the seeds according to their texture. The process skills focused were observation and recording, comparing, discussion, classification, explanation, investigation (controlling and manipulating variables) and inference.

Work and Play

Types of Work

A discussion in the classroom was organised to identify different types

of work done by people in our society. It was initiated with the presence of different helpers in the school and society. An interactive chart, on which pictures of various workers were pasted was clipped on the wall of the classroom. They were required to answer the questions related to the occupation of the workers. They identified the worker, his/her occupations and the importance of that work for the society. The process skills focused were observation and recording, explanation, reasoning and communication.



Breathing

Inhaling and Exhaling

The concept of breathing — inhalation and exhalation was explained using a story cited in the textbook. After that meter tapes were given to groups of children. They were asked to measure and record chest size of each other after breathing in and out. They learnt how to measure using the tape. Children inquired about how to read measurements on measuring tape and learnt to calculate the expansion of the chest. After discussion, they inferred

that the measurement of the chest after inhaling was more because the chest expands after breathing in, as air goes in, and the measurement of the chest after exhaling was less because the chest contracts after breathing out, as air goes out. They shared their findings with everyone. The process skills focused were observing, estimating, measuring, comparing, inferring and communicating.

Food

Spoilage

A slice of bread was taken for the experiment. Some water was sprinkled on it and it was kept in a box. Children observed this slice daily for four days and recorded the observations regarding the change in appearance (by seeing), texture (by touching) and smell of the bread.

Day 1: Children discussed spoilage of food and shared examples from their experiences.

Day 2: They observed that the colour of the bread slice has become dull, and a little hard in texture and no such change was noticed in the smell.

Day 3: They recorded a few yellow spots on the bread which was harder in texture and had a foul smell.

Day 4: They observed green spots on the slice and the colour of the bread also turned yellowish, the texture was harder than the previous day and had a foul smell.

In this activity, children were curious and patiently recorded the observations for four days. After that,

they discussed how food gets spoilt. The process skills focused were observing and recording, comparing and communicating.

CONCLUSION

The organisation of the above activities whether it was an investigation on food spoilage or finding the solubility created interest in children in the classroom interaction. Children were found to be excited to participate in discussions. It was also observed that they used to look forward to the environmental studies (EVS) class. In the classroom discussion, their observations were shared, discussed and valued in class. This motivated them to observe more precisely the next time. They started observing minute details. Their grades in the assessment of EVS also improved.

We often come across complaints like children make a lot of noise when they work in groups. In our research, a classroom culture was always emphasised where whenever they are working in groups, they communicated in a very low tone. We drew their attention to differentiate between purposeful/meaningful talk and purposeless/meaningless talk. They learnt to distinguish between talk and noise. They learnt to listen to others. Listening is a very important skill like talking. These qualities were not developed overnight. This required continuous focus and reminders to the children in every class. Later in classes,

they made groups themselves and were seated group-wise within a few minutes. Working in groups for these two classes had become like a habit. Thus, the concerns about classroom management during group activities gradually improved with these groups of children. In groups, they discussed their ideas related to concepts. It provided opportunities for peer learning on one hand and the other hand, their misconceptions about concepts were also addressed.

A variety of activities were planned and organised such as hands-on activities, interactive charts, discussions, field trips and experimentation. It enhanced the active participation of children. They were not passive receivers of information but rather active learners and constructed their knowledge. They got several opportunities to reflect upon their learning and simultaneously developed process skills.

It was observed that by conducting activities on a regular basis, children improved their process skills. For instance, during initial activities teacher is required to draw children's attention towards minute details. She prompted them many times to use all of their senses asking them how they feel when they touch. And how does it smell. Gradually with engagement in various activities their skills improved in later stages, children were able to draw similarities and differences between flowers/plants/

seeds. They were able to record fine details related to the investigation in the food spoilage activity. They learnt to conduct investigations, for instance, in the solubility activity one group of children concluded that only a limited amount of sugar can be dissolved in water. After that point, if one wants to add more sugar to water then one needs to heat it. Such kind of inference can only be arrived at by children when they are given the freedom to explore on their own. Thus, by conducting activities related to the daily lives of children process skills can be developed. These activities not only helped in developing process skills but also exploring various concepts in Environmental Studies, making learning meaningful and long-lasting.

Another interesting finding was that when children go outside the boundaries of a physical classroom, then it makes the journey of learning more enjoyable. It breaks the monotony of the class and adds variety to the regular classroom. Activities outside the classroom allow children to have a real-world experience, as in the activity on flowers, thus enhancing experiential learning. I would like to end with the famous quote:
"I Hear and I Forget,
I See and I Remember,
I Do and I Understand".

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