DPEP

DISTRICT PRIMARY EDUCATION PROGRAMME

ISSUES IN PRIMARY EDUCATION

Vol. III No. 3 October-December 2001

A Despatch on Primary Education

EXPLORING SCIENCE IN PRIMARY YEARS

FEEDBACK

I am seeing this journal for the first time. I would like to congratulate you for bringing out such informative and thought provoking reading material for all those who are interested in literacy and books. It is also very well designed and laid out.

Dr. Varsha Das
Chief Editor & Jt. Director
National Book Trust, India
New Delhi

I read the latest issue on 'Reading, Learning and School Libraries'. Earlier one NBT book van visited number of schools and DIETs in AP. Still the issue remains non utilization of reference books given in OBB.

Prof. V.R. Rangachary
Prof & Head, SCERT
Hyderabad

Many thanks for sending me a copy of this publication which is quite informative.

Faisal Beg
Canadian High Commission
New Delhi

It was nice to get the copy of 'Reading and Learning and School Libraries' – issue of primary education. The articles took me back to Alarippu days when we did extensive work with library books for five years. Now it seems like a distant past! The first four articles clarify a lot of issues on pedagogy of early literacy and it will be useful to share with teachers.

Ms. Saraswathi
Abhiramapuram, Chennai

Thanks for Issues on School Libraries. I read the articles with great interest the articles. These are interesting and informative. I got a lot of new information.

Prof. Uday Pareek
Jaipur

I have read your DPEP magazine and I find all the contents very interesting, especially "The genre of children's literature". It shall prove very useful in teaching and in understanding the psychology of children. Also the articles "Emergent Literacy – An Alternative Approach" and "Broadcasting the Seeds of Learning" are very interesting and useful.

V. Kannaiyan
Lecturer – DIET
Tamil Nadu

This newsletter is a significant and appreciable attempt to initiate a dialogue on key issues in Primary Education. It motivates one to reflect and intervene in the system. I think that articles in this newsletter should be discussed in DIET, Block and Cluster level monthly meetings. These discussions will not only inspire the new innovations reach the classrooms but will also inspire the teachers to innovate themselves.

Dev Nath Trivedi
Lecturer, DIET
Uttar Pradesh

This issue on Reading, Learning and School Libraries has interesting and informative articles on promotion of reading and interactive libraries. We, in Gyan Barati School, have made an attempt to try out alternative approaches to teaching reading and language learning. Articles in the Issue encouraged us to have book reading sessions with our teachers. The purpose was to reflect on issues discussed in these articles and on how to integrate them in our programme. It also helped the teachers to discover how some of the practices adopted in the schools already incorporated the ideas in the articles and reassured them on the relevance and appropriateness of their own practices. Teachers from Nursery to III standard were placed in groups of five to six. Different articles from the Newsletter were distributed to different groups and they were asked to read together and discuss. After the group work, teachers made interesting group presentations demonstrating different activities. At the end of the session, they decided to carry out certain activities like 'King and Queen' and 'Word Walla'. They appreciated the articles and demanded for many more book reading sessions! Thank you for providing such stimulating articles.

Amita Govinda
Gyan Bharati School
New Delhi

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CONTENTS

FROM THE EDITORS' DESK

EXPLORING SCIENCE
IN PRIMARY YEARS

This issue includes the following themes:

a) Environmental studies – What and Why ?
b) Environmental studies – a process or information?
c) Problems and possibilities in EVS teaching
d) Role of drawing in learning science
e) Some good examples of EVS teaching

The story titled 'What is Science' and the book-extract 'The Basics of Science' touch upon the theme 'EVS-what and why?'. 'Science teaching – Constructing an Alternative' and 'Perspectives for Environmental Education – Some Reflections' narrate the problems and possibilities in our present EVS teaching. 'Exploring the Environment in True Spirit' opens a good possibility of learning science together in an organised way. 'The Role of Art in Learning Science' clearly depicts the role of illustration in science education.

To highlight the various positive practices in the field of science teaching we have drawn from Eklavya's Hoshangabad Science Teaching Programme, Uttarakhand Seva Nidhi Paryavaran Shiksha Sansthan's Environment Education Programme, etc. Besides these several initiatives have also been taken in various DPEP states like Assam, Haryana etc. to give a direction to their science teaching programme. These have also been briefly explained.

The Activity Pool has been designed to integrate interesting activities from various resource materials. Readers can also find the lists of different magazines and resource centres to be useful.

The poster on the centre pages can be pasted in front of your study table or in classroom for reminding continuously about the real method of Science in our daily activities.

We look forward to your comments.

What is Science?

Vinod Raina and D.P. Singh

Once there was a king. He had everything: a beautiful palace, delicious food to eat and attractive clothes to wear. He had a large number of servants who were always ready to fulfil all his desires. He even had a little son. But despite all this sometimes the king was not satisfied!

नन्हा राजकुमार उससे ऐसे सवाल पूछने लगा था, जिनके जवाब वह नहीं दे पाता था,

The real problem was that the little prince, whom the king loved very much, sometimes asked questions that the king could not answer.

Sometimes the prince asked, "Dear Father, how do birds fly?"

Or sometimes he would say, "Dear Father, why do things fall down to earth? Why don't things go up? . . . See - I threw a stone and it came down."

A few years ago, whenever the prince saw the moon he would keep on asking many questions about the moon.

The king did not have the answers to all these questions. Sometimes he got tired of listening to so many questions and he scolded the little prince. Later he would feel sorry about it. But the prince started distancing himself from the king to avoid his scoldings.

All those questions also remained in the king's mind and kept bothering him.

Finally one day the king called his most competent and intelligent minister and said to him, "Dear minister, the prince is asking me lots of questions that I am not able to answer. Now my mind is full of so many different questions. . . I have heard that may be these questions can be answered through science. You are wise and intelligent. Kindly tell me, what is science?"

The minister started thinking it over. It was true that he had studied science to some extent, but had never thought much about what science is. Besides, the other problem was to explain what science is to a person like the king who was science-illiterate.

एक सप्ताह तक मंत्रीजी ने बहुत गहराई से विचार किया,

The minister spent a whole week thinking it over. Then he reported to the king, "Your Majesty, you have raised a big question by asking what science is. Before I respond to this it is important to analyse what kinds of questions are bothering you and the prince. All these questions are related to the world around us and arise out of a basic human curiosity to understand our surroundings. Your Majesty, science starts with this curiosity, which is generated by seeing, touching, smelling, tasting or listening. Curiosity catalyses questions and science tries to answer them. This way science helps us in making sense of our surroundings."

The king responded, "Dear Minister, this is all very fine, but tell me - how can science answer these questions?"

The minister said, "To understand this we will have to look at how scientists work. First of all they observe and compile information related to the problem area. They gather all this data together and hypothesize an answer to the question – forming a picture in their minds. Often it happens that they do not have enough data, so they do more experiments to test these theories. In the process more unanswered questions arise, and they again search for better mental pictures and more theories. This process continues until no theory can be thought of that will give a better answer to the problem."

The king said, "Dear minister, I did not understand your explanation. Can't you clarify yourself by giving a simple example?"

The minister replied, "Yes sir, why not? Let us take one of the prince's own questions. He had asked why do objects always fall down. This question is connected to our everyday experience that whenever we drop an object in the air, it falls down. Does this observation apply to all objects and all places? To find out, we need to do experiments with many different objects in different places. If we try this, we might find that all kinds of things like stones, coins, needles, clothes, and pieces of paper - whether they are heavy or light - generally come down, no matter where we drop them. Many years ago one scientist had experimented like this and had reported that this is what happens."

By now the king had really become interested in this question. He asked, "What was his answer?"

The minister said, "The answer is quite straight forward. Things fall down because the earth has a force that pulls everything towards itself."

The king jumped in delight and said, "Oh, it's so simple!. Why couldn't I have thought of that?"

The minister said, "Sir, it's true that generally many answers are simple in nature, but finding them is not always easy. A lot of observations, experiments, analyses etc. are needed in order to come to a concrete conclusion or establish a theory. Sometimes scientists keep on searching throughout their lives, but the answers to their questions are not found until long after their death."

Now the king had started understanding something about science and he was getting interested in finding out more and more.

The next day the king said to the minister, "I am very happy with what you explained about science. But things will be more clear to me if you can explain them through some experiment. I want to see an experiment for myself. You can take two or three days to design an experiment that will show me what science is all about."

Now the minister felt that he had got stuck in a complicated situation. How could he show the king a real science experiment? Certainly it was a serious problem. But actually, the minister was an intelligent person with an inquisitive mind. After a lot of thought he came up with a plan,

and he turned up in the palace the next day with an elephant and three blind people.

This attracted the king, the prince and all the people in the palace.

The minister said, "Your Majesty, may I now start the experiment as per your order?" The king thought the minister must be just having some fun. He said, "What kind of a joke is this? What does science have to do with three blind people?"

The minister replied, "Sir! I am not joking. The blind people cannot see what I have brought. Now you will see how they will find out through their curiosity."

Then the minister asked each blind person to go to the object (the elephant), touch it and say what it was.

The first blind person moved ahead. She picked up the tail of the animal and declared, "It's a rope". The second person caught hold of its trunk and shouted, "It 's a snake."

The third one touched the leg of the elephant and reported, "It's a tree."

The audience started laughing at their answers. The poor blind people felt embarrassed. The minister had to pacify them all. Everyone waited to see what his next move would be.

The minister said, "We saw that these three people gave three different answers about what is one single thing. Now we will tell them to work together and discover what it really is."

And he asked the blind people to work together. All of them were surprised to hear each other's statements. They wondered about what kind of object could appear to be a rope, a snake and a tree trunk all at once! They kept on discussing among themselves for a long time, but could not reach any conclusion. Defeated, they decided to make more observations. They also decided that this time they would not just feel one part, but would investigate more thoroughly. For a long time they all kept on feeling their own portions thoroughly and apprised each other of their own observations.

The first one said, "Now I can feel the snake-like part. Oh, sometimes it moves up and disappears into a big hole." Suddenly he took back his hand and said, "Oh, it seems to be a face! Thank God, I realised it just in time, otherwise it would have bitten me. Now I know! That thing I thought was a snake might actually be a very long nose!"

The second person groped around and said, "I am investigating your rope-like object. It is not too long and I feel it is securely attached to a very big heavy thing. See, I can't pull it off! I don't understand what is this rope-like object. . ."

The third one said, "While I've been listening to you, I've been

searching over here. This cannot be the trunk of a tree. Because at its top it has neither branches nor leaves. It grows into something very heavy and soft at the top. Oh, now this 'tree' rose up by itself and moved ahead also. Well I got it – it's just a big foot!"

All three of them discussed their observations with each other.

Then the minister asked them what they had concluded. One of them replied, "Sir, the thing we investigated might be a very large animal. It has quite a long nose that even touches the ground. It also has strong legs. Its body is very heavy. Even if we try all together we cannot even begin to lift up the animal. It is much taller than us. Hence we cannot investigate the upper part of it. It has a rope like object at its back. This might be its tail. So we hypothesize that it might be an elephant or some animal like that. Because we are blind, we can just say this much, based on what we now know from all of our observations put together."

The minister said, "Your Majesty, thus we come to the end of the experiment. I hope now you can understand something about what science is."

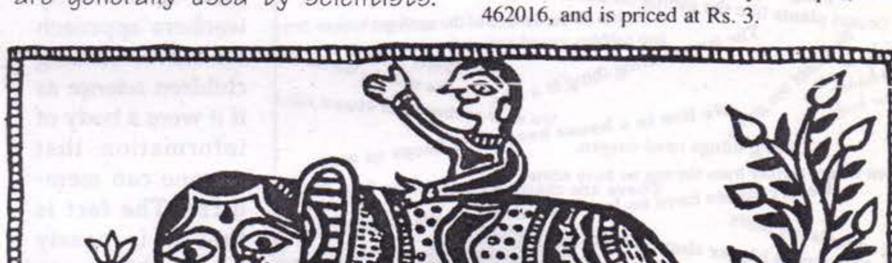
By now the king appeared satisfied and delighted with his new understanding. He told the minister, "Your attempt at explaining science to all of us in such a simple way is well appreciated. Still, could I request you on behalf of all of us to highlight the conclusions of this experiment?"

The minister said, "Dear sir, the conclusion of this experiment is this. These three blind people used the same techniques that are generally used by scientists.

Each blind person compiled the available data and based on that tried to develop a mental picture of the unknown thing. Because they are blind, they were able to gather rather limited data and hence in the beginning their mental picture based on this data was wrong."

"At this stage they tried to take their own theories ahead through further enquiry and experiments. They worked together to gather more information. Each of them observed a part of the animal in an organised way and asked good questions. Along with this they shared each step of their observations with others and discussed it. Only then could they draw a mental picture of the animal. This picture was drawn as per the long trunk, tail, leg, etc. The idea they had about an elephant from people's feedbacks in their mind was now confirmed. Validating an imagination through experiments is the approach of science. This is known as science."

This is a translation from Hindi of '*विज्ञान क्या है?*' written by Vinod Raina and D.P. Singh, and illustrated by Satyanarayan Lal Karn. The Hindi version is published as a booklet by *Eklavya*, E-7, HIG-453, Arera Colony, Bhopal, M.P. 462016, and is priced at Rs. 3.



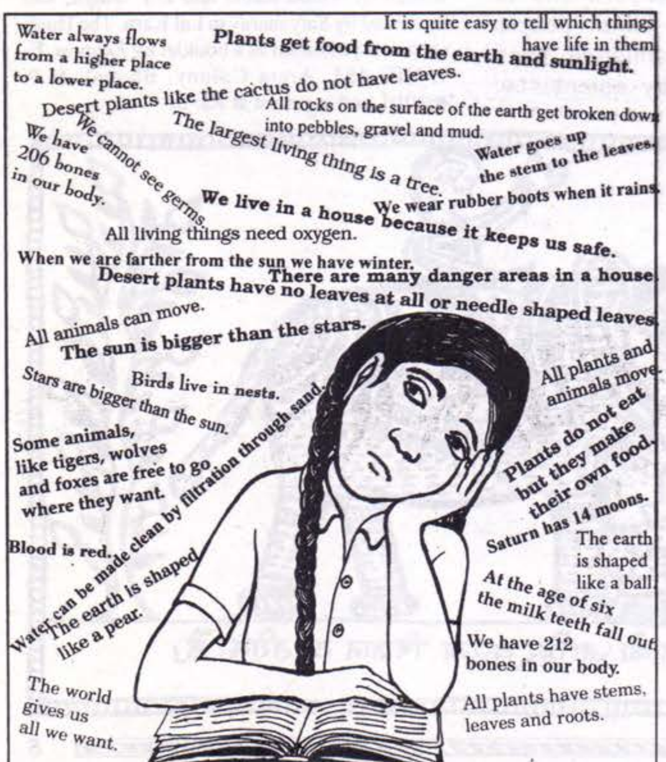
THE BASICS OF SCIENCE

Karen K. Lind

When people think of science they generally first think of the content of science. Science is often viewed as an encyclopedia of discoveries and technological achievements. Formal training in science classes also promotes this view by requiring memorization of seemingly endless science concepts. Science has been compiling literally millions of discoveries, facts, and data over thousands of years. But how much should a child require at the primary stage? What is important for her/him? Should school emphasize more on content or process? The present article focuses on the importance of the later one. It is extracted from a book entitled 'Exploring Science in Early Childhood: A Developmental Approach'.

Science and Why We Teach it to Young Children

We are now living in the age that is sometimes described as the "Knowledge Explosion." Consider the fact that the amount of scientific information created between the years 1900 and 1950 equals that which was learned from the beginning of recorded history until the year 1990.



Since 1950 the rate of production of scientific information has increased even further. Some scientists estimate that the total amount of scientific information produced now doubles every two to five years.

If you tried to teach all that has been learned in science in preschool and continued daily straight through high school, you would make only a small dent in the body of knowledge. It is simply impossible to learn everything. Despite this, however, far too many teachers approach the task of teaching children science as if it were a body of information that anyone can memorize. The fact is that it is nearly impossible to predict what specific information taught to primary age students today will be of use to them as they pursue a career through the next century.

It is entirely possible that today's body of science knowledge will change before a child graduates from high school. Scientists are constantly looking at data in different ways and coming to new conclusions. Thus, it cannot be predicted with any certainty which facts will be the most important for students to learn for life in the 21st century. What is known is that people in the next century will have to face new problems that they will attempt to solve. Life, in a sense, is a series of problems. The people who are most successful in future decades will be those who are best equipped to solve the problems they encounter.

This discussion is intended to put the nature of science in perspective. Science in preschool through college should be viewed more as a verb than a noun. It is not so much a body of knowledge as it is a way of thinking and acting. Science is a way of trying to discover the nature of things. The attitudes and thinking skills that have moved science forward through the centuries are the same attitudes and skills that enable individuals to solve the problems that they encounter in everyday life.

An approach to science teaching that emphasizes the development of thinking and the open-minded attitudes of science would seem to be most appropriate to the instruction of young children.

Science Process Skills

Knowledge and concepts are developed through the use of the processes used in inquiry. It is with these processes and skills that individuals think through and study problems and begin to develop an understanding about scientific inquiry.

Observing

The most fundamental of the scientific thinking process is observation. It is only through this process that we are able to receive information about the world around us. The senses of sight, smell, sound, touch, and taste are the means by which our brains receive information and give us the ability to describe something. As young children use their senses in a firsthand exploratory way, they are using the same skills that scientists extend to construct meaning and knowledge in the world.

Sometimes we observe, but we do not always see very much. Teaching strategies that reinforce observation skills require children to observe carefully to note specific phenomena that they might ordinarily overlook. For example, when a teacher's class observes an aquarium, s/he guides them by asking, "Which fish seems to spend the most time on the bottom of the tank? In what way do the fish seem to react to things like light or shadow or an object in their swimming path?" Storybooks and informational books can also encourage the use of process skills.

Observation is the first step in gathering information to solve a problem. Students will need opportunities to observe size, shape, color, texture, and other observable properties in objects. The following teacher statements and questions facilitate the use of this process: "Tell me what you see," "What do you hear?", "What does this feel like?", and "How would you describe the object?"

Comparing

As children develop skills in observation, they will naturally begin to compare and contrast and to identify similarities and differences. The comparing process, which sharpens their observation skills, is the first step toward classifying.

Teachers can encourage children to find likenesses and differences throughout the school day. A good example of this strategy can be seen when, after a walk through a field, the teacher asks her first graders. "Which seeds are sticking to your clothes?" and "How are these seeds alike?"

The comparing process builds upon the process of observing. In addition to observing the characteristics of an object such as a leaf, children learn more about the leaf by comparing it to other leaves. For example, a child finds a leaf and brings it to class to compare with other leaves in the leaf collection. Statements and questions that facilitate the comparing process include, "How are these alike?" "How are these different?", "Which of these is bigger, wetter, etc.?" and "Compare similarities and differences between these two animals."

Classifying

Classifying begins when children group and sort real objects. To group, children need to compare objects and develop subsets. A *subset* is a group that shares a common characteristic unique to that group. For example, the jar may be full of buttons, but children are likely to begin grouping by sorting the buttons into subgroups of red buttons, yellow buttons, blue buttons, and other colors.

A teacher encourages children collect many kinds of leaves. They place individual leaves between two squares of newspaper. The leaf is now sealed in and will remain preserved for the rest of the year.

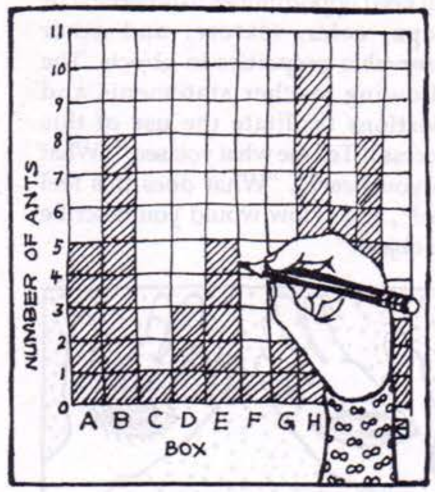
Once the leaves are prepared, the children choose a leaf to examine, draw, and describe. They carefully observe and compare leaves to discover each leaf's unique characteristics. Then, the children classify the leaves into subgroups of common characteristics.

Children initially group by one property, such as sorting a collection of leaves by color, size, shape, and so on. As children grow older and advance in the classification process, objects or ideas are put together on the basis of two or more characteristics that are inherent in the items. Brown-colored animals with four legs, for example, can be grouped with all brown colored animals, regardless of the number of legs, or they can be grouped with different colored animals with four legs, or they can be classified with brown-colored animals with four legs. Scientists from all disciplines use organization processes to group and classify their work whether that work involves leaves, flowers, animals, rocks, liquids, or rockets. Statements and questions that facilitate this process include "Put together all the animals that belong together, "Can you group them in another way?," "How are these animals organized?" and "Identify several ways that you used to classify these animals."

Measuring

Measuring is the skill of quantifying observations. This can involve numbers, distances, time, volumes, and temperature, which may or may not be quantified with standard units. Non-standard units are involved when children say that they have used two "shakes" of salt while cooking or a "handful" of rice and a "couple" of beans when creating their collage.

Measuring involves placing objects in order, such as an ordered sequence (*seriation*), or it can be ordering according to length or shade. Children can also invent units of measure. For example, when given beans to measure objects, a child may say, "The book is 12 beans long," but another child finds that the same book is 11 beans long. Activities such as this help children see a need for a standard unit of measure-like an inch. Questions that facilitate the measuring process include, "How might you measure this object?", "Which object do you think is heavier?" and "How could you find out?"



Communicating

All humans communicate in some way. Gestures, body postures and positions, facial expressions, vocal sounds, words, and pictures are some of the ways we communicate with each other and express feelings. It is through communication that scientists share their findings with the rest of the world.

In early childhood science explorations, communicating refers to the skill of describing a phenomenon. A child communicates ideas, directions, and descriptions orally or in written form, such as in pictures, dioramas, maps, graphs, journals, and reports. Communication requires that information be collected, arranged, and presented in a way that helps others understand your meaning.

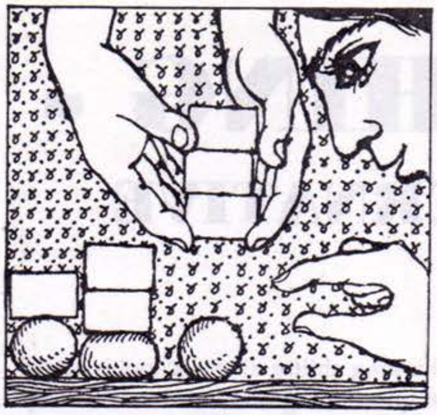
Teachers encourage communication when they ask children to keep logs, draw diagrams or graphs, or otherwise record an experience they have observed. Children respond well to tasks such as recording daily weather by writing down the date, time of day, and drawing pictures of the weather that day. They will enjoy answering questions about their observations such as, "What was the temperature on Tuesday?", "Was the sun out on Wednesday?", "What did you see?", and "Draw a picture of what you see."

Inferring

When children *infer*, they make a series of observations, categorize them, then try to give them some meaning. An inference is arrived at indirectly (not directly, like a simple observation). For example, you look out the window and see the leaves moving on the trees. You infer that the wind is blowing. You have not experienced the wind directly, but based on your observations and prior knowledge and experience, you know that the wind is blowing. In this case, your inference can be tested simply by walking outside.

The process skill of inferring requires that a reasonable assumption of prior knowledge be present. It requires that children infer something that they have not yet seen because it has happened or because it cannot be observed directly. For this reason, the inferring process is most appropriate for middle-level grades and the science content associated with those grades. However, science content and inferences associated with past experiences such as inferring what animals made a set of tracks, or the loss of water from plants, or the vapor in air can be appropriate for older primary children.

In another example, a teacher prepares four film canisters by filling them with different substances such as sand, chalk, stones, marbles, and paper clips. As the students observe the closed canisters, the teacher asks, "What do you think is inside of these canisters?", "What did you observe that makes you think that?", "Could there be anything else in the canister?", and "How could you find out?"



Predicting

When you predict, you are making a statement about what you expect to happen in the future. You make a reasonable guess or estimation based on observations of data. Keep in mind that this process is more than a simple guess. Children should have the prior knowledge necessary to make a reasonable prediction. Children enjoy simple prediction questions.

Children can count the number of seeds in a seed package and then predict how many of the seeds will grow into plants. As they prepare to keep a record of how two plants grow (one has been planted in topsoil : the other in subsoil), they are asked, "Which plant do you think will grow better?"

The ability and willingness to take a risk and form a prediction is of great importance in developing an awareness and understanding of cause and effect. This awareness can be developed and refined in many situations into the related skill of perceiving a pattern emerging and predicting accurately how it will continue. For example, if children are investigating changes in the shape of a piece of clay as more weight is added, they can be encouraged to look for patterns in their results, which can be recorded by drawing or measuring, and predict what each succeeding result will be.

Hypothesizing and Controlling Variables = Investigation

To be called an *experiment*, an investigation must contain a hypothesis and control variables. A hypothesis is a more formal operation than the investigative questions that young children explore in the preschool and primary grades. A hypothesis is a statement of a relationship that might exist between two variables. A typical form of a hypothesis is : if ______, then ______. With young children, a hypothesis can take the form of a question such as, "what happens if the magnet drops?"

In a formal experiment, variables are defined and controlled. Although experiments can be attempted with primary age children, experimental investigations are most appropriate in the middle and upper grades.

The question of "What is a hypothesis?" has probably caused more confusion than the other science processes. Hypotheses can be described as simply the tentative answers or untried solutions to the questions, puzzles, or problems that scientists are investigating. The major types of hypotheses are varied in character, but they correspond to the types of knowledge or understanding that the investigation aims to develop.

Science as inquiry

The *National Science Education Standards* emphasize Science as Inquiry, which is divided into abilities children need in order to do scientific inquiry and understandings they should have about scientific inquiry. Inquiry is presented as a step beyond process learning, such as observing, inferring, and predicting. In inquiry, the process skills are required, but students also must combine these skills with scientific knowledge as they use scientific reasoning and critical thinking to develop understanding. According to the standards, engaging students in inquiry serves five essential functions :

- It assists in the development of understanding of scientific concepts.
- It helps students "know how we know" in science.
- It develops an understanding of the nature of science.
- It develops the skills necessary to become independent inquirers about the natural world.
- It develops the dispositions to use the skills, abilities, and habits of mind associated with science.

Inquiry-oriented instruction, often contrasted with expository methods, reflects the constructivist model of learning and is often referred to as active learning. Osborne and Freyberg (1985) describe the constructivist model of learning as the result of ongoing changes in our mental frameworks as we attempt to make meaning out of our experiences. To develop scientific inquiry skills, kindergarten and primary age children should be able to do the following :

- Plan and conduct a simple investigation
- Employ simple equipment and tools to gather data
- Use data to construct reasonable explanations
- Communicate the results of the investigations and give explanation.

Dr. Karen K. Lind is a professor in the Department of Early and Middle Childhood Education, at the University of Louisville, Kentucky, where she is the recipient of the 1993 Distinguished Teaching Professor award. Her research publications and inservice programmes focus on integrating science into preschool and primary classroom settings.

SCIENCE TEACHING - CONSTRUCTING AN ALTERNATIVE

H.K. Dewan

Thinking about Science Education

If we look at some critical aspects of science education it is obvious that we need to ask ourselves the following questions:

1. What do we consider as learning science, what constitutes knowledge and understanding in science and what according to us is worth learning for a school child? What is the relationship of science learning to learning of other subjects?
2. The second aspect that we need to think about is children. We need to think what children are like and how should the classroom be constructed so as to best help them learn. In this is also hidden understanding of the learning process.
3. The third aspect that we need to consider relates to the development of teachers of science for the school.

These three questions form a part of whatever we do in the schools and determine it. What is needed in any development programme of Science Education is to think about these consciously and have a statement for each of them.

Before we go into these three factors I want to focus on one point that there seems to be a major gap in the discourse of education and also on science education. This is because of the lack of a clear articulation of why education and why science education.

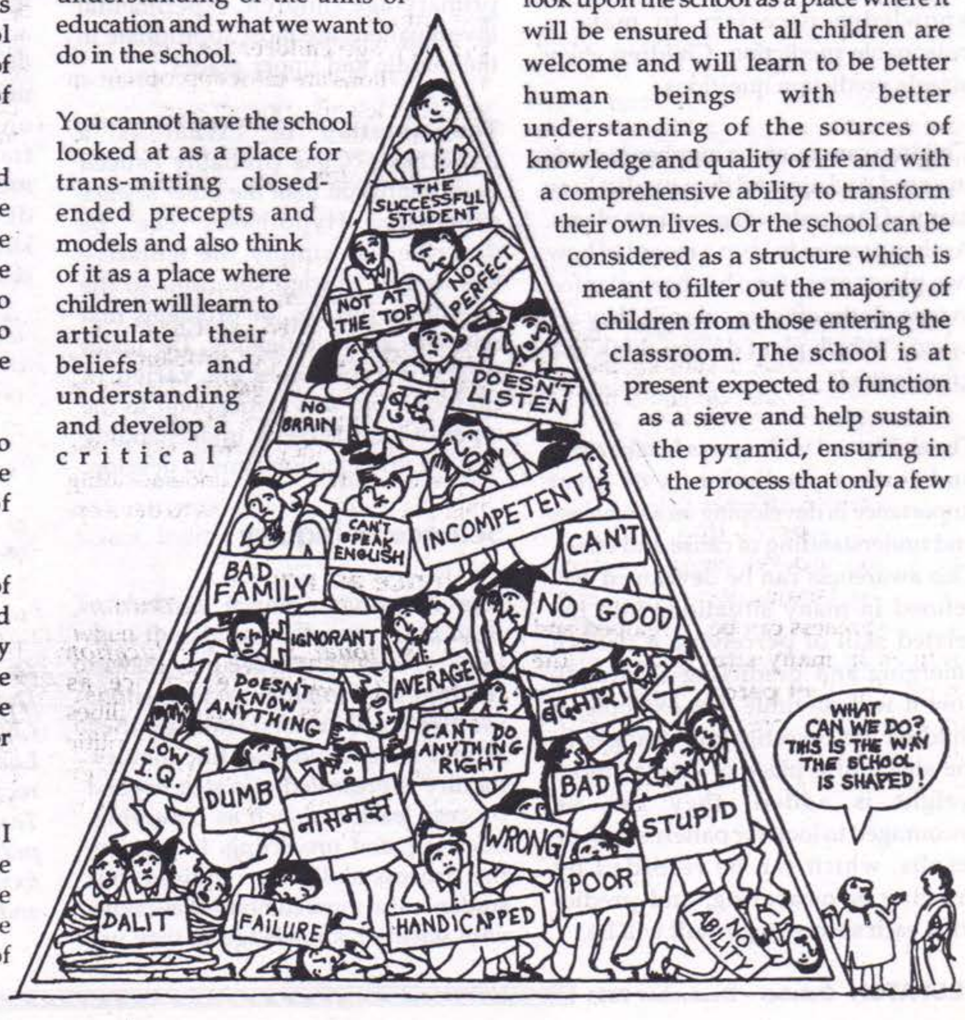
Why Education?

Science education would be defined in the context of what we understand from education and the component that we lay emphasis on in the classroom. We cannot talk about problems of science education without having some understanding of the aims of education and what we want to do in the school.

You cannot have the school looked at as a place for trans-mitting closed-ended precepts and models and also think of it as a place where children will learn to articulate their beliefs and understanding and develop a critical thinking ability. If the school is afraid of questioning known ideas and may be is only a place for transmitting synthesized knowledge to the children, then it cannot speak about developing observations, analysis and influential abilities.

What Should School Do?

One possible expectation could be to look upon the school as a place where it will be ensured that all children are welcome and will learn to be better human beings with better understanding of the sources of knowledge and quality of life and with a comprehensive ability to transform their own lives. Or the school can be considered as a structure which is meant to filter out the majority of children from those entering the classroom. The school is at present expected to function as a sieve and help sustain the pyramid, ensuring in the process that only a few



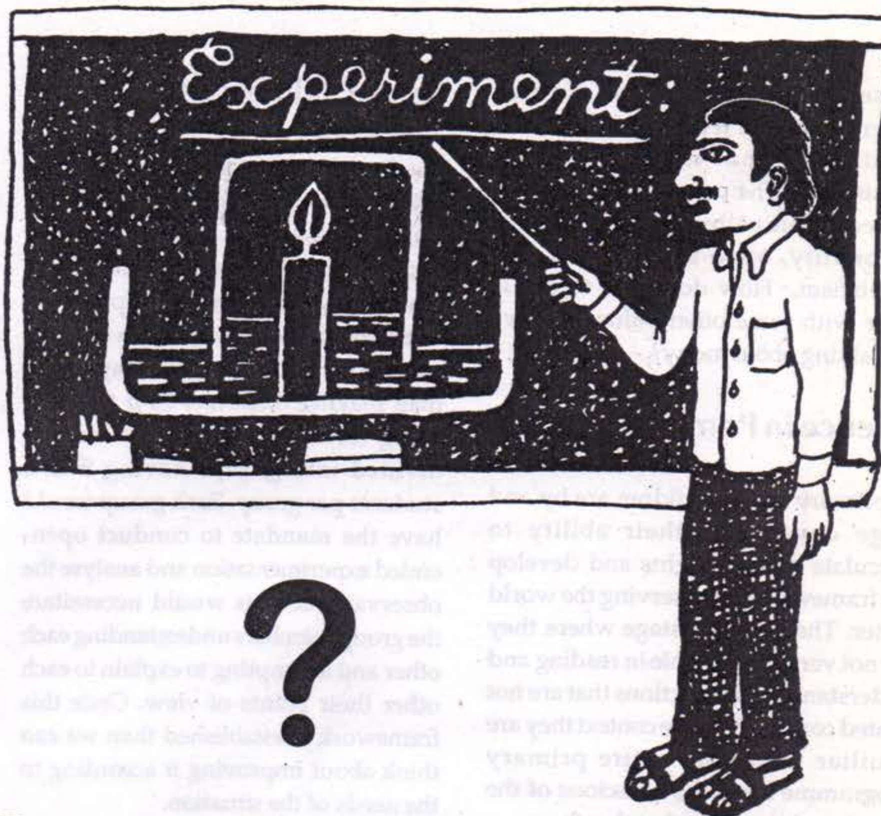
children are able to climb to the top of the pyramid while the majority of the children must fall by the wayside.

The other aspect is, if you want children who know a lot of facts and remember a lot of information and accept statements given to them because they come from elders or from those who are said to have looked at these issues without questioning them, we need a process of a certain kind. If the school is meant to share information, facts and known ways of living with children then there is no scope for children discovering new ideas and learning new things in the classroom. There is no knowledge that could be constructed in the classroom and the teacher cannot learn anything that she does not already know. The values to be shared are acceptance, obedience and maybe mysticism, all of which takes knowledge and knowing away from the realm of reason to different degrees.

If we compare this with the process of science there is an inherent contradiction. Science constantly builds on itself and encourages explanation and application of known principles to newer situations. It also demands more careful observation on known experiments to see whether they yield some other insights. The present teaching of science would require a radical shift, if this is to be accepted.

Science Experiments in Textbooks

Experiments in textbooks currently are repeats of experiments done much earlier and there is no imperative on the people doing the experiments to value or respect the result they get. The result is already known, often stated in the book and if the results of the students happen to be different, they need to adjust their observations and analysis to reach the answer already given.



There are numerous instances which can be picked up from text-books of experiments placed for the reason that they would tell the students certain 'facts', even though the experiments actually do not produce the same result, or even if the result is the same reason for the phenomena taking place, it is different from the one suggested in the book. The entire process of setting up the apparatus and doing the experiments is therefore meaningless because there is no value attached to the observations. Neither do the students have to construct concepts from the observations nor derive any new measurables from the observations. The whole purpose of the experiments seems to be to put before the learner a situation that seems to show what the text books want to tell.

The people who write the textbooks and the teacher pick up these experiments and simplifications as they see from other materials without exploring them and trying them out themselves. There is no attempt to build logical formulations and conduct discussions to see whether the experiments would actually give the suggested results in different situations.

Since the learner and the teacher are not supposed to observe and make some analysis of relations but to repeat the observations given in the book, these mythical experiments carry on in the materials from generation to generation. There is no motivation in doing the experiment, as it is not supposed to bring out anything new and the best result is obtained by not doing the experiment.

Values in Science Education?

I want also to make a statement about values in education at this point. In the context of science the primary value is of testing, validating or falsifying known ideas. Knowledge in science is constantly confronted with new observations, new conceptual formulations and forced to explain these new phenomena. Known experiments are repeated in different conditions and tested for their consistency. The only value in science forced upon us by its process is of rationality, open-mindedness and skepticism. How does one reconcile these with some other values that we are talking about today?

Science in Primary Schools

In primary school children are by and large developing their ability to articulate their thoughts and develop the framework for observing the world better. They are at a stage where they are not very comfortable in reading and understanding abstractions that are not related concretely to the context they are familiar with. The entire primary programme has to be conscious of the conceptual structure that they have.

Language, Abstraction and Science Teaching

There is a need in the primary classes to give the child a lot of opportunities to articulate her experiences, attempt to develop her own logical arguments and inferential ability. This would require, of course, many other capabilities which we must talk about, but a fundamental point that emerges from this relates to the content of the primary school science classroom. If the classroom needs to have an emphasis on articulation, organization, analysis and use of the experiences of the child then it has to be determined in an open-ended manner based on children's own work. This would imply the need for a loose and broad framework as the syllabus, in which the process in the classroom determines much. A teacher needs to be confident and positive about children in order to facilitate the classroom interaction involving space for children.

Using Children's Knowledge

The first thing that is required then, is bring into the classroom what the children know. This exercise has to be such that it helps them share and learn what they know and helps them understand life around them in their own terms and their own way rather than making them feel as if they are being tested. The classroom can be divided into groups having 5 to 6 students per group. Each group would have the mandate to conduct open-ended experimentation and analyse the observations. This would necessitate the group members understanding each other and attempting to explain to each other their points of view. Once this framework is established then we can think about improving it according to the needs of the situation.

At this point it may be asked, if children have to learn what they already know and classroom discussions are to be based on their experience then what are the new things children are getting in school? This is really the hub of issues related to science teaching. Science has developed as a result of human desire to explore the world and organise our interaction with it in a meaningful framework, to try and seek patterns in what we observe and then formulate reasons for them and to attempt to change these patterns and make them softer for the human beings. Any exercise of regurgitating the data experienced by children is therefore a meaningful aspect of doing science. The new things they would get are newer ways of organizing data, specific tasks that help them review their observations as well as new ways of recording data. They may also get questions that force them to rethink their analysis and get an opportunity to analyse data and formulate testable and deducible hypotheses.

Learning: Telling vs Giving Opportunities to Struggle with Ideas

To summarise, in the Primary School, keeping in mind the fact that learning is not by telling but by struggling with concepts through the learner's thought and discovery, the focus of what can be done can look like the following:

1. Make the classroom process as much like the natural social interaction of children as possible.
2. Keep the notion of the child as an active, exploring, thinking and creative mind.
3. Keep the basic abilities, the experience and the environment of the child in mind.
4. Bring to the classroom what the child knows.
5. Add to what the child has.
   a Help her learn more about her own experience.
   b Widen exposure through sharing of experience.
   c Give newer experiences that are not usually available.

Possible tasks for the classroom:

1. Get students to observe more closely.
2. Give students newer categories to organise data in.
3. Give students tabulation tasks of various kinds.
4. Give students opportunities to make generalisations, enunciate principles and articulate their inferences.
5. Read and understand other persons' generalisations and relate them to match with one's own observations.

6. Make and Falsify hypotheses.
7. Read and understand texts
   a Instructions
   b Logical arguments
   c Pictures
   d Pictures and texts
   e Tables
   f Process diagrams
8. Expose students to more ways of recording information.
   a Make pictures.
   b Make tables.
   c Make process diagrams.
9. Analyse and synthesize experiences.
   a Categorise into known categories.
   b Form new categories.
   c See and form relationships between categories.
   d Generalise, infer and form principles.

This detail is sufficient to indicate the direction. The basic principle in what has been presented may appear to be process based and many of us may feel that this is to science learning as there is no systematic sharing of information. We may also worry that the science, society interface has not been touched at all and thus the most important purpose of teaching general science, development of a scientific temper is ignored. The basic point I am making here is that this divide of process and product in science is artificial and is not the correct way of looking at the situation. What I am concerned about is the development of a conceptual framework in the child and an ability to build on that structure. To me the question is regarding the best strategy that would help the child develop concepts. The basic related point that I want to make is that having a lot of information and facts, knowing a lot of definitions and remembering a lot of formulae cannot be considered as the product in teaching and learning of science.

A Science Classroom Needs to be an Active Classroom

Thus the main point that we want to emphasize is that the science classroom should be an active classroom, with opportunity for and need for the child to think. The learning situations in the classroom should involve meaningful tasks that are challenging for the child. They must engage her and help her learn something new for herself. The book should be such that it has space for both the teacher and the child.

It may be that the main difficulty is in making some of these terms concrete. For example what does it mean to say that there should be space for the child and the teacher? What is the nature of the space? In all the textbooks even now, there is at the end of the book optional home task or suggested home experiments, which may be done or not done. The entire presentation of experiments is, do this do that and if you do this experiment, this is what you would observe, leaving it optional for the teacher to do the experiment. The space we are thinking about is different. It is a space for thinking and for determining classroom activity.

We require a syllabus that reflects the nature of learning and uses the environment of the child. It is not as if children need to be taught about their own environment and informed about local needs. The effort should be towards using what the child has in the environment, using local information and experiences and helping the child organise it in a conceptual framework. Even the development of a perspective in the children of environmental and health issues, cannot be done by loading them with information and prescriptions of do's and don'ts. In order for children to be able to develop a concern it is important to help them understand, through their own analyses and experiences what is happening and help them form their own conclusions about the pros and cons of different events and think about their possible role in them.

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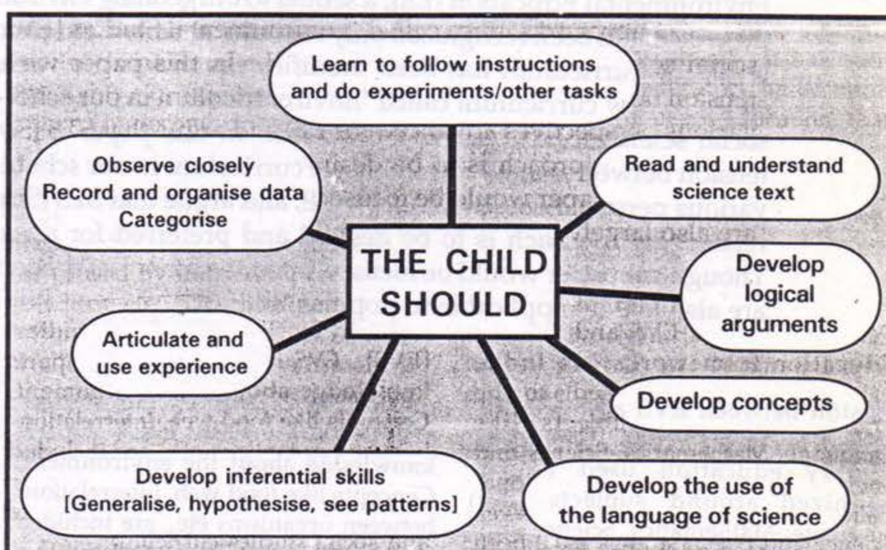
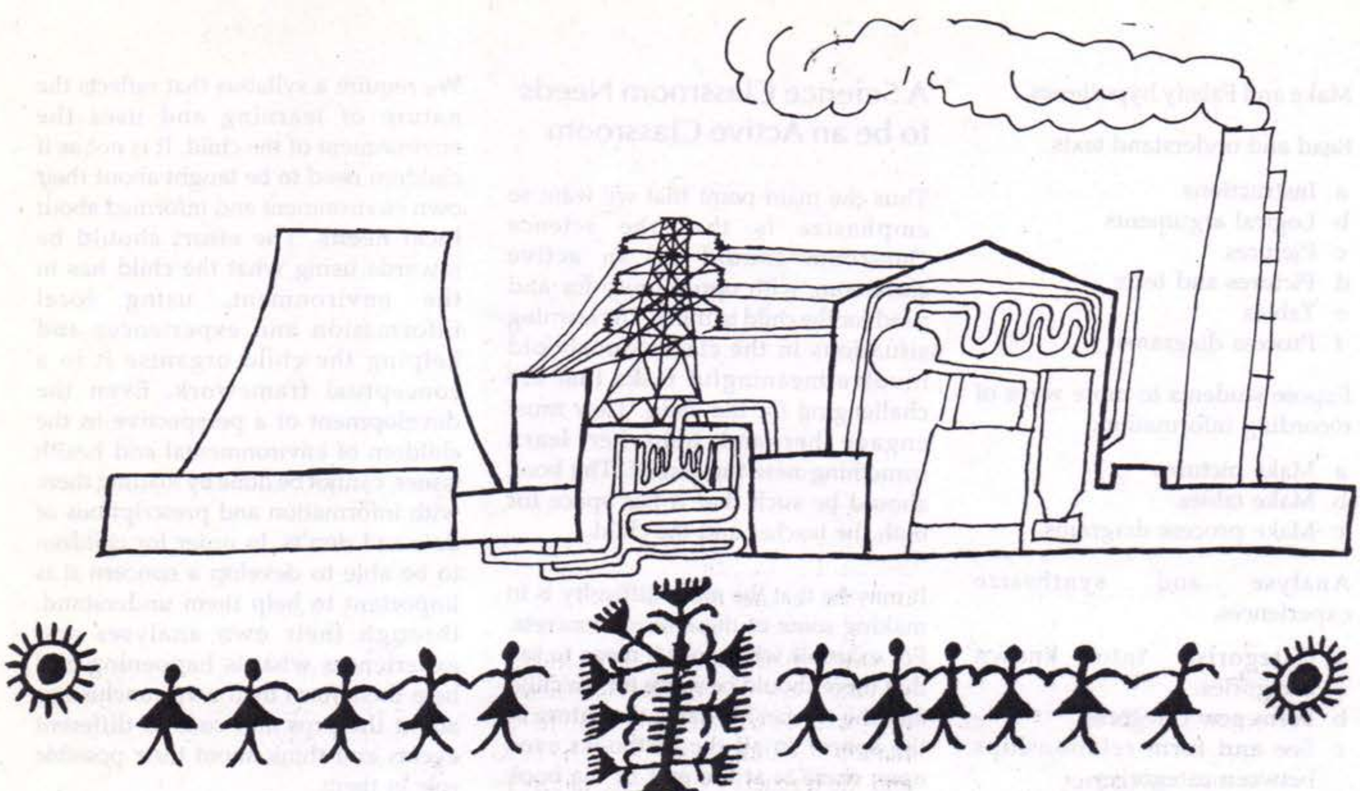




PERSPECTIVES FOR ENVIRONMENTAL EDUCATION - SOME REFLECTIONS

T.V. Venkateswaran

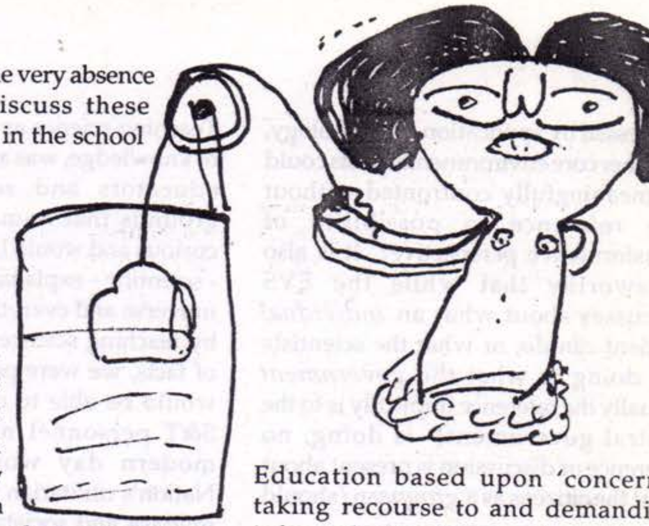
Environmental Education [EE], a sequel to burgeoning environmental concerns all over the world, has been recognized only recently in the Indian school system. At the primary level, the curriculum has been modified and instead of 'science, social sciences and civics', a new curriculum called 'Environmental Studies [EVS - with some rudimentary social sciences] has been incorporated. In this paper we would briefly look at the tension between the EVS and Science curriculum in our schools. We would also survey various perspectives advanced for EE, and argue that STS [Science Technology Society] related EE approach is to be desired and preferred for a transformative view of EE. Though the paper would be focused upon the school education, insights and arguments are also largely applicable to popular EE.

Tension between EVS and Science Education frameworks: In India, primary education used to be organized around subjects like Language, Mathematics, Science and Social Studies. After the National Policy on Education, at primary level, Science and Social studies have been replaced by 'Environmental studies' [EVS]. EVS in school firstly imparts knowledge about the environment. Concepts like food web, interrelations between organisms etc., are included in the syllabus. These topics were covered in the schools earlier in science and social studies curriculum.

But EVS has a second feature also - to arouse concern for the environment. EVS is differentiated essentially as a means of meeting the second objective. EVS by definition begins from concerns, hence considerations like pollution, degradation of life, environment, sustainability of life, disappearance of wild-life etc., became legitimate topics for study. The National Policy on Education 1986 on Environment discourse was about 'creating consciousness of environment'. On the other hand the same document while recommending the reorientation of the content and process of science education lays emphasis on *objectivity, inquiry, question, problem solving and decision making skills, its relation to health, agriculture, industry and other aspects of daily life'*, but no reference to 'concerns', 'value judgements' involved in production and use of science. This dualism setting in education leads to tension between the framework of EVS and Science Education in schools.

Science by attitude is portrayed in our schools as an 'objective, value neutral' system. There is no place for values, desires, personal judgements in the picture of 'pure' science in schools. It is predominantly positivistic in its conception. EVS in contrast, by definition is all about 'concerns'. EVS is replete with a large number of value judgements - pollution, degradation, sustainability etc. There is hardly any in-depth discussion on how these judgements can co-habit with 'pure' value-neutral science, or how one should understand science itself in a critical way.

Secondly, EVS discusses the values like concern for environment, co-habitation and adjustment with nature - not only with living organisms but also with non-living features like rivers, oceans etc. EVS also cautions that the earth's resources are limited and that there is a constraint for its exploitability. The dominant framework of science is markedly divergent to that of EVS - it is marked by metaphors like 'conquest of nature', 'control of nature'. It sees no limits for exploitation of resources. While discriminate control over the nature or critical conquest of nature (like say controlling floods, or conquering cholera) are not to be abhorred in itself, the very absence of attempts to discuss these tensions anywhere in the school is very striking.



Thirdly, there is contradiction between what is stated as 'scientific' recommendation in science textbooks and what is said in EVS text books. In EVS there is a very elaborate discussion on the dangers of 'indiscriminate' use of DDT. It discusses the 'bio-amplification' and cautions the readers that the concentration of residue DDT in our environment is ever increasing, whereas in science textbook, the students are advised to use 'DDT regularly to kill malaria carrying mosquitoes'. When one is advised to use DDT regularly, then does it not go against the caution to use 'DDT discriminately?' Such contradictions are aplenty.

The limitation of the present EVS is revealing, as one looks at the remedies for environmental problems prescribed in the text books. There are three classes of suggestions for 'what needs to be done'. One class of suggestions pertains to what *You [the students] Can Do* - garbage disposal, keeping the class tidy, reduce the waste of electricity by switching off the fans, lights etc., when not in use and so on. The second class of remedies that is talked of is *'What The Scientists Are Working on'* - for example, scientists are working on to find ways to repair soils where loss of organic life was caused by indiscriminate use of pesticides, etc. The third pertains to *'What the Government is Doing'*. Usually reference to government is only when already some technological solution to the identified problem exists - like river pollution due to dumping of municipal waste and the Government efforts like Ganga Action programme.

Education based upon 'concerns' taking recourse to and demanding informed value judgement, on the one hand requires information and skills. On the other hand it is also normative. UNESCO's Tbilisi conference on EE, held in 1977 stated that "(EE) should not confine itself to disseminating new knowledge but should help the public to question its misconception concerning the various problems of the environment and the value systems of which these ideas are part... All decisions regarding the development of society and the improvement of the lot of individuals are based on considerations, usually implicit, concerning what is useful, good, beautiful and such questions such as 'who took this decision? According to what criteria? With what immediate ends in mind? Have the long term consequences been calculated?' In short, he must know what choices have been made and what value systems have determined them". It has been pointed out by educators, based upon their studies on peace education, that there are essentially three approaches - reform approach, reconstructive approach or transformative approach.

The EVS in our schools is largely confined to 'reform approach' [keep things tidy, clean rivers etc.,], and in cases glance at reconstructive approach [use of bio-pesticides, organic manure etc.,], but hardly any transformative approach. While issues like 'keeping the school clean' etc., can be achieved as reform, some local industrial pollution could be addressed by application of technology, whether core environmental crisis could be meaningfully confronted without any reference to possibility of transformative perspective? It is also noteworthy that while the EVS discusses about what an *individual* student can do, or what the scientists are doing or what the *government* [usually the reference implicitly is to the central government] is doing, no reference or discussion is present about what the citizens as a *group* can/should do.

STS and EVS education

Educators have pointed out that there are basically three frameworks in which science education *in practice* can be organized.

1. Teaching science disciplines as *a structured body of knowledge*, to be learned as logically organized subject matter

2. Teaching science as a set of investigative processes - to promote *scientific way of thinking*

3. Teaching science as a human activity closely inter-connected with technological application and with the rest of society or referred to as STS [Science - Technology - Society] approach.

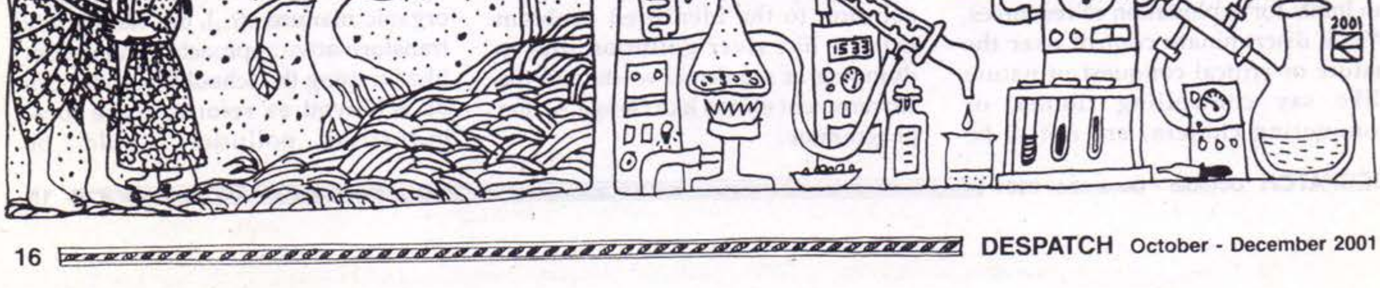
Teaching science as a structured body of knowledge, was advocated by many educators and scientists on the grounds that humans are naturally curious and would like to have the best - scientific - explanation to the world/universe and everything. Further only by teaching science as an ordered set of facts, we were persuaded, that one would be able to develop necessary S&T personnel necessary for the modern day world to meet the Nation's utilitarian needs of economy, military and society.

Teaching science primarily with an aim to promote a scientific way of thinking is premised upon arguments such as, that 'people are natural thinkers and rational thinking and developing intellectual power is naturally desired by them, or that 'scientific thinking' would be useful and effective in every day life. Further it is also posited that 'future' scientist must know to think like a scientist.

Socially relevant teaching, scientific literacy, and critical appreciation of S&T and its relationship with society on the other hand maintain that the 'popular' science education should be inspired and shaped by a vision of 'enlightened citizenry'. Teaching science in this case would have an emphasis on familiar daily experience, S&T issues that are discussed in newspapers, TV etc., - such as ozone, nuclear power, rain forest, recycling and so on. Rather than disciplines like chemistry, physics or themes like Newton's laws or heat, it would be the themes such as the above that would be the organizing principle of science education and popular science education would be organized around these social issues. Critics have pointed out that in this scenario while one would be able to familiarize the students with contemporary social issues, 'logic' of science would be almost missing from the picture.

It is not only that science education can be viewed from the above framework, EVS too can be viewed in the three framework referred to above. EVS can be seen as purveying of systematic, ordered information about ecology, man-nature relationship etc. EVS can also be seen as dissemination of skills and attitudes to understand complex environmental issues. Alternatively, EVS can be seen in the context of contemporary society, its culture, way of life, organization of social institutions and so on along with a transformative vision.

Current framework of science education in India is largely influenced by the first view and at times having aspects of the second. But the third framework is totally absent. As we have discussed earlier, there is a tension between EVS - viewed



paramountly as 'creating consciousness of the environment' - and science education - viewed as positivistic, 'pure' science. This emanates from the incompatible approach/framework of education that our educational system advocates. If our aim at primary level is to educate for an enlightened citizenry, then it is obvious that STS approach to science education would aptly harmonize EVS and Science education in schools.

STS approach to EVS

When one focuses on the *pedagogic* goals of EVS for adult population or general public, the difference in approach required between them and elementary school children is imperceptible. Hence what we state in this section would be by and large applicable to *popular* EVS education for both elementary education and general public. STS approach to EVS would essentially have following characteristics:

- Consider the environment in its totality - natural and built; biological and physical phenomena and their interrelations with social, economic, political, technological, cultural, historical, moral, and aesthetic aspects

- Integrate knowledge from the disciplines across the natural sciences, social sciences and humanities

- Examine the scope and complexity of environmental problems and thus the need to develop critical thinking and problem solving skills and ability to synthesize data from many fields

- Develop awareness and understanding of global problems, issues, and interdependence helping people to think globally and act locally

- Consider both short and long term futures on matters of local, national, regional, and international importance

- Relate environmental knowledge, problem solving, values, and sensitivity at every level

- Emphasize the role of values, morality, and ethics in shaping attitudes and actions affecting environment

- Stress the need for active citizen participation in solving environmental problems and preventing new ones

- Enable learners to play a role in planning their learning experiences and providing opportunities for making decisions and accepting their consequences

- Be a lifelong process - should begin at pre-school level continue through formal elementary, secondary and post secondary levels and utilize non-formal modes for all age and education levels.

In short it would have to be education *about, in,* and *for environment.* Further, it can not be Definitions plus Information garnished with Moral messages but as Awareness plus Critical thinking with appropriate in-depth discussions about EVS concepts.

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THE ROLE OF ART IN LEARNING SCIENCE

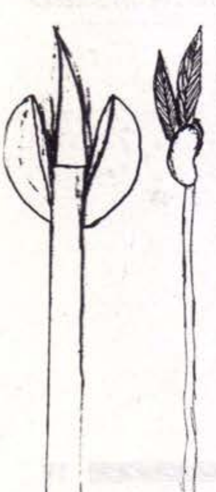
Karen Haydock

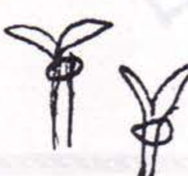
Drawing pictures, and realising one's capabilities in drawing are effective means towards self-empowerment. Being able to draw, as a means of communication and self-expression, is in this sense similar to being able to read and write. In as much as it increases one's ability to observe, understand, compare, analyse, communicate, and be creative, drawing can also increase one's scientific literacy. A few ideas on how student drawing can be used (and misused) in science teaching will be discussed. I will also discuss ways in which graphic arts can be used and misused in science teaching materials. In particular I will discuss examples of the use of art to increase enjoyment, to identify organisms and objects, to explain mechanisms and processes, and to communicate social and political points of view.

What are the uses of art in science teaching and learning? How can art be used in positive ways? And how is art often misused in science teaching? I will discuss these questions, and give examples of the way art is and can be used in teaching science.

ART FOR ENJOYMENT, APPRECIATION, AND WIDENING PERSPECTIVES

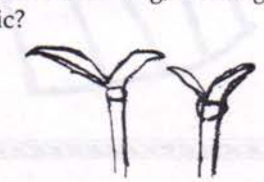
One obvious use of art in science teaching is simply to add beauty to science textbooks, worksheets, charts, and other educational aids. Art is used as decoration, and to make the material more interesting and enjoyable for students. This is certainly a worthwhile aim. For example, visual art in the form of drawings, paintings, and photographs can encourage students to appreciate





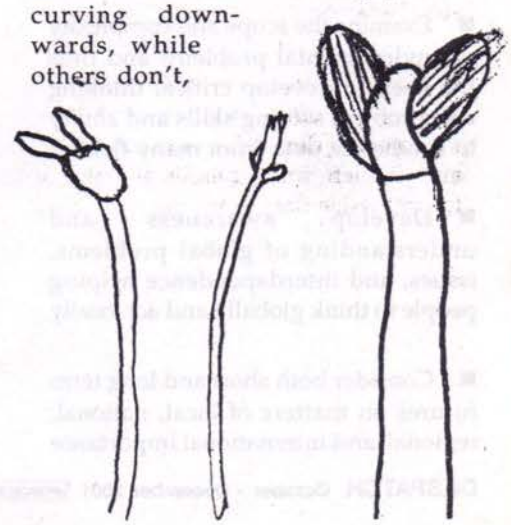
However, it is not possible for art to be just a pretty picture. Art always communicates a lot more than just beauty. Moreover, there is no one picture that everyone will find beautiful or that will succeed in interesting every student. It may not even be best to try to please the majority – perhaps the majority should also be exposed to unusual forms and examples of art. Illustration in science can also widen cultural perspectives and aesthetic sensibilities. This kind of multiple underlying meanings, uses, and misuses of art in science will be further discussed below.

Students' interest in science can also be enhanced if they draw pictures as part of learning science. When they are drawing they are necessarily more involved than when they are just listening and/or looking. Drawing is an important part of an activity-based science classroom. Art is an enjoyable mode of self-expression and communication, as well as a skill useful in science and other areas. So why not consider drawing to be just as essential as reading, writing and arithmetic?



DRAWING TO ENHANCE OBSERVATION

When students draw pictures of things they see, it enhances their observation of these things. This can be demonstrated by looking at an object, say a potted plant that is sitting in front of you. If you look closely at the plant, and try to draw what you see, as you see it, you will find that the act of drawing forces you to make many observations, comparisons, and analyses that you would not make if you were simply looking without drawing. You may notice that the leaves are more rounded at the bottom, that some leaves have sharp points curving downwards, while others don't,



that every leaf has another leaf on the opposite side of the stem, etc.

In order to use drawing as a tool to enhance observation, it is important for students to look at actual objects that they can clearly see in front of them while they are drawing. They will learn much more than if they are just asked to copy a picture from the board or from a book. Of course the teacher could simply tell the class that the leaves on a certain plant have opposite leaves, and ask them to copy a picture of opposite leaves that she has drawn on the board. But the lesson will be much more meaningful if the students themselves discover that the leaves are opposite while they are in the process of drawing.

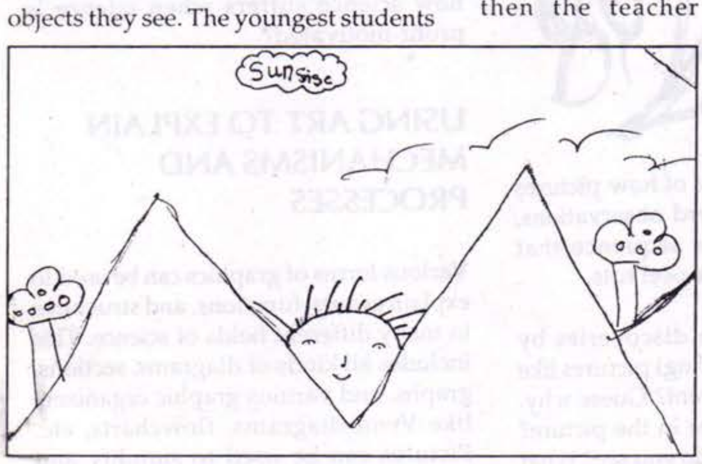
Consider a case where, for example, students are asked to draw pictures of green vegetables. Rather than drawing from memory, it would be much more meaningful if students have an assortment of green (and non-green) vegetables in front of them so that they can observe and draw what they see. In addition to demonstrating that they can remember that spinach, methi, cabbage, and chilli are green vegetables, they can also learn new things about the shapes, sizes, variations in colour and texture of these vegetables if they can observe while drawing.

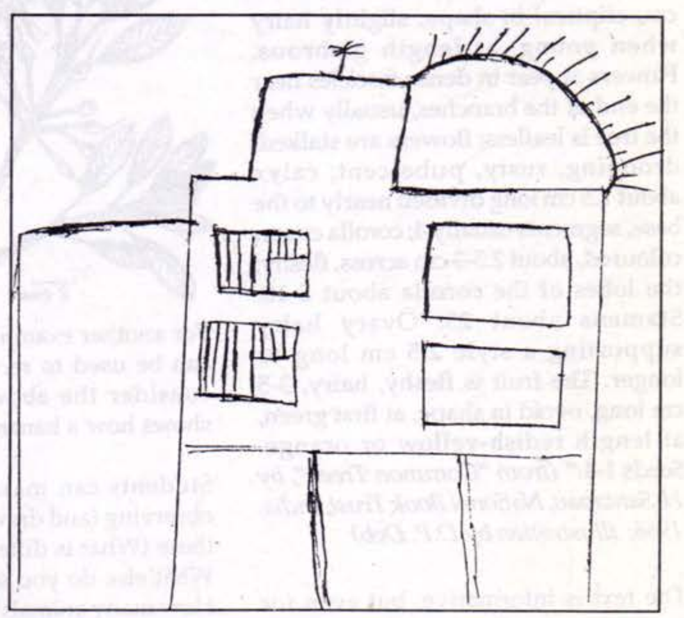
Teachers should not be afraid that the students will not be able to draw objects they see. The youngest students are always eager to take up a crayon and try to see what they can do with it. It is only after having been exposed to some "education" that some students start saying, "I can't draw." In my own experience, I have found that even those who are the most stubborn in this belief can draw good pictures. The only rule I follow in encouraging them to overcome their fear is that I never draw for them, or even make any mark on their paper. I simply tell them that I know they can draw. I ask the student to look at the object and tell me what they see. After some time, they might say that they see a branch. "And what shape is the branch? Is it straight, or does it curve to the left or to the right?" I ask as I stand next to them, pointing and trying to see what they might see. "It curves this way," the student might say. "So make a line on your paper that curves that way," I say. After a few minutes, and with some positive feedback, and plenty of reminders to "Keep looking!" the student will be intently drawing away. It may also help to take away a very hesitant student's eraser, so that the picture is not erased before you see it. I also find it easier to let the students draw in pencil or pen, without colouring, since details usually appear more clear in black and white.

If the teacher has a preconceived idea about what the students' pictures should look like, then the teacher may be disappointed, and the students may in turn become disillusioned about their abilities to draw. But if the teacher has faith in the children and expects them to see and draw things in their own ways, no one will be disappointed. The children will come up with drawings that will each be amazing and wonderful.

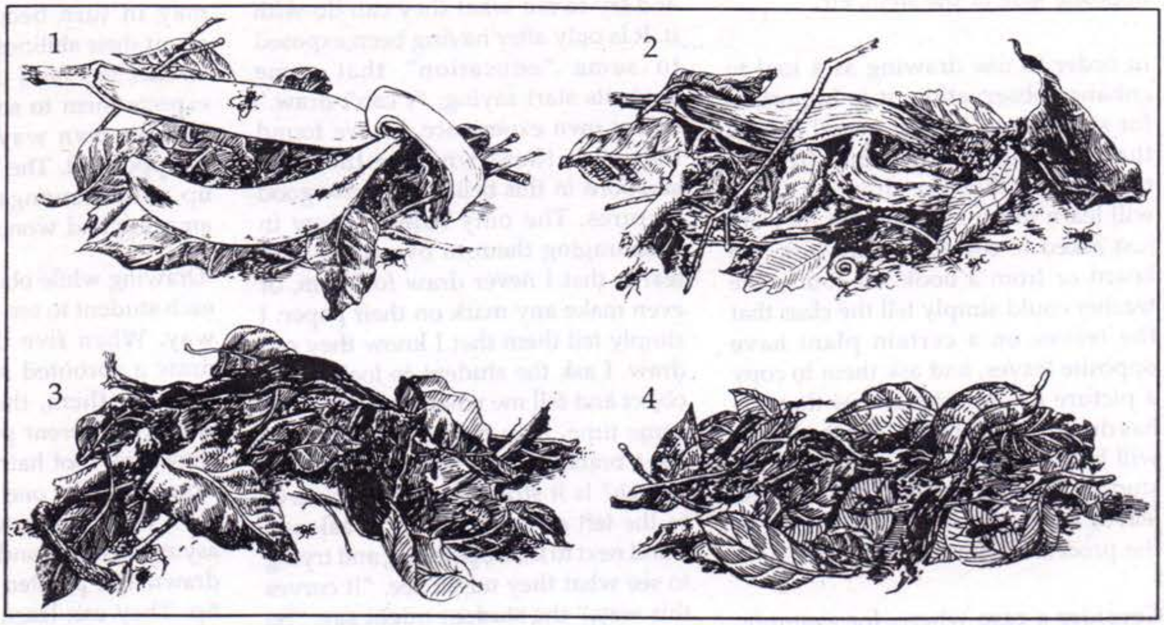
Drawing while observing encourages each student to see things in their own way. When five different students draw a sprouted seed that is placed between them, they will draw five entirely different pictures – one may show tiny root hairs that were visible from one side, one may have noticed that the seed cover was cracked asymmetrically, and another may have drawn how pointed the root was at the tip. They can learn from each other. And at the same time they can also learn that there is not just one way of looking at something and that there is not just one correct answer in science.

It is usually easy to assess whether a student has drawn what they have observed or not. The student who drew the picture on the left obviously did not go out to draw a sunrise as they saw it. In contrast, clearly the picture on the right was drawn while looking at a sunrise.





These pictures of a rotting banana peel were drawn on September 10, September 14, November 10, and February 2.



USING ART TO RECORD OBSERVATIONS AND TO IDENTIFY ORGANISMS AND OBJECTS

Pictures can be more informative and useful than words.

For example, consider this description of the leaves, flowers, and fruit of the Mahua: "Leaves are clustered near the ends of the branches, each 7-20 x 3-7 cm, eliptical in shape, slightly hairy when young, at length glabrous. Flowers appear in dense fascicles near the end of the branches, usually when the tree is leafless; flowers are stalked, drooping, rusty, pubescent; calyx about 1.5 cm long divided nearly to the base, segments usually 4; corolla cream coloured, about 2.5-3 cm across, fleshy; the lobes of the corolla about 8-10. Stamens about 25. Ovary hairy supporting a style 2.5 cm long or longer. The fruit is fleshy, hairy, 3-5 cm long, ovoid in shape, at first green, at length redish-yellow or orange. Seeds 1-4." *(from "Common Trees", by H. Santapau, National Book Trust, India, 1966; illustration by D.P. Deb)*

The text is informative, but even for someone familiar with all the terminology, it is much easier to get an idea of the leaves and flowers by a glance at the drawing.

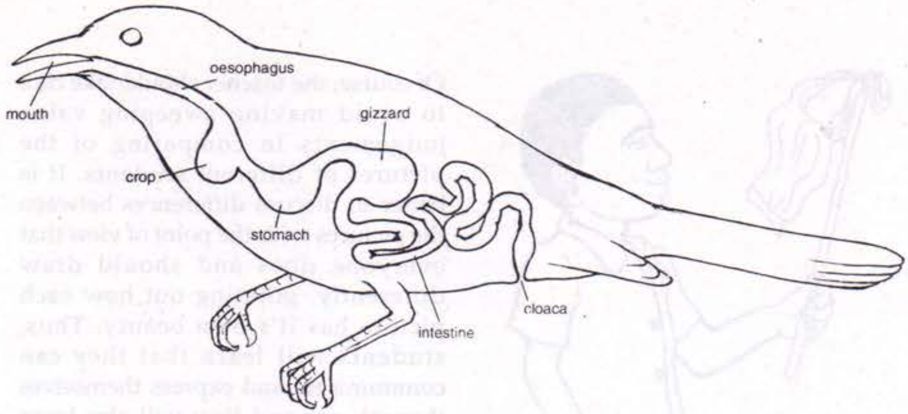
For another example of how pictures can be used to record observations, consider the above sequence that shows how a banana peel rots.

Students can make discoveries by observing (and drawing) pictures like these (What is different? Guess why. What else do you see in the picture? How many animals do you see? What is the snail doing?).

Notice that the type and style of each picture is important, and different kinds of pictures are suitable for different purposes. In the case of the banana peel, the above black and white line drawings are probably more informative than the usual quality of colour photographs would have been. Similarly the line drawing of the mahua is more useful than the colour photographs found in any modern CD encyclopaedia. The colour photographs are probably used because the publishing company is more concerned about attracting buyers with colour pictures than with being useful. Or perhaps they would have to pay more for a drawing than for a photograph? Is this another example of how science suffers when science is profit-motivated?

USING ART TO EXPLAIN MECHANISMS AND PROCESSES

Various forms of graphics can be used to explain events, functions, and structures in many different fields of science. This includes all kinds of diagrams, sections, graphs, and various graphic organizers like Venn diagrams, flowcharts, etc. Pictures can be used to simplify and generalise complex structures and



processes, for example in this diagram of a bird's digestive system.

Pictures (even photographs) in science textbooks can also be misleading. There is often a communication gap between writers and illustrators, and illustrators often do not take the time to observe and/or do adequate research before drawing. To be fair, the publishers are often the ones at fault, expecting illustrations to be quickly done and pasted on to a manuscript just before a deadline. For example, consider the following illustration of the moon phases that is found in many Indian science textbooks. It seems the illustrator did not look at the moon.

COPYING PICTURES AS A MEMORY TOOL

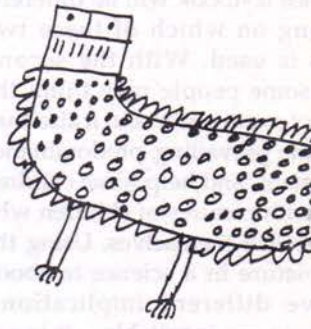
Students are often asked to copy pictures and diagrams, memorise them, and then reproduce them for examinations. While at times this may be useful, it is often overused and misused as a method of learning. It would be more meaningful if students went beyond memory, to do something that is more interesting and involves higher levels of critical thinking. It is possible to memorise and reproduce a diagram without even understanding much of what the diagram represents.

USING ART FOR EMPOWERMENT AND TO COMMUNICATE SOCIAL AND POLITICAL POINTS OF VIEW

One of the main blockages to learning and achieving is a student's lack of faith in their own ability. Particularly when dealing with the underprivileged, teachers must address problems of the 'psychology of the oppressed'. Such students feel that science is something foreign, which is done by people that are not like themselves. Students find relatively few pictures of girls in their science textbooks, and they therefore get the impression that science is mainly for and about boys and men. In fact, it is very difficult to find a science textbook in India that does not have a far greater number of pictures of males than females. Furthermore, males are more often shown in active roles, while females are in the background, just looking on.

The people shown in Indian science textbooks usually appear to be quite European looking, almost never having even moderately dark skin. An Indian girl has nothing to identify with. Imagine the difference if she could see a picture of someone who looks like herself, actively engaged in doing a science experiment –it would make her feel more important and self-confident.

Even the style of the illustrations is important in this regard. Imagine the empowering effect if the usual western style of illustrations in a science textbook is accompanied by pictures like the following. The children who draw like this themselves would feel a sense of 'ownership' of their science book.



Pictures, even those that are used for teaching and learning science, always have a point of view. For example, consider the picture on the left, that could be used in a science textbook to show a student experimenting with the way air blows a plastic bag that is tied to a stick. Many people look at this picture and see a cute little boy.

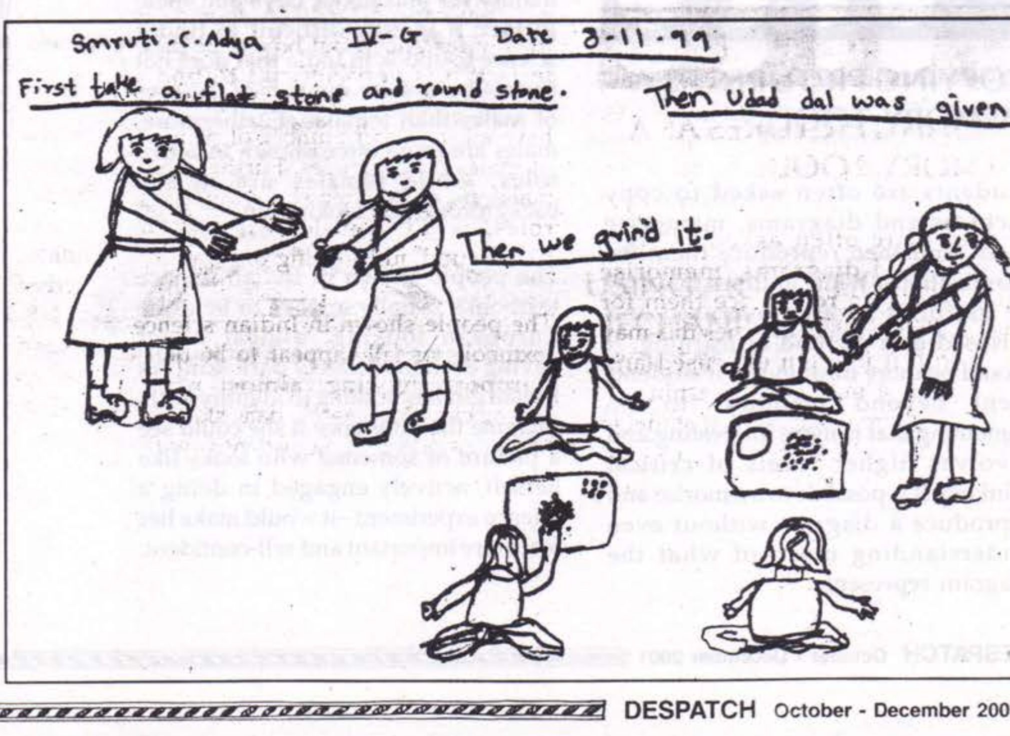
But when the same people look at the picture on the right, they do not think the boy is so cute. The only difference is in the hair, which makes the first boy look more Caucasian. People have been conditioned to think that children are cuter when they have blond hair. The science textbook will be different, depending on which of these two pictures is used. With the second picture, some people may think the book is not as attractive. But it also may counter the prevailing predominance of Caucasians, and help some children identify with pictures of children who look more like themselves. Using the second picture in a science textbook will have different implications. Implications are inevitable – it is not possible to design a socially neutral book. However it is possible to be aware of one's point of view and analyse the possible outcomes of alternative designs.

When students observe and draw what they see as part of their science learning they also find out that they can do something that they may have thought they could not do. They become empowered. In my own teaching whenever I have taken a student's picture, pointed out a few of its interesting characteristics, and posted it on the board, I have found that the drawer beams with pride. Any lingering feelings of inferiority get washed away.

Of course, the teacher should take care to avoid making sweeping value judgements in comparing of the pictures of different students. It is better to discuss differences between the pictures with the point of view that everyone does and should draw differently, pointing out how each picture has it's own beauty. Thus, students will learn that they can communicate and express themselves through art, and they will also learn to appreciate aspects of each other's art.

In conclusion, I would like to stress the importance of art in teaching and learning science. The use of art is in doing art as well as in seeing art. By doing art, students can be creative and communicate new ideas. By seeing art, students can be inspired by new directions and new ideas.

Karen Haydock (PhD) is a freelance activist, artist, and a biophysicist by training. She has worked in the field of education with Eklavya and other organisations and illustrates and writes textbooks and other books for children. She can be contacted at T.F. 10, Sector 14, Chandigarh 160014 (or haydock@i91.net.in).

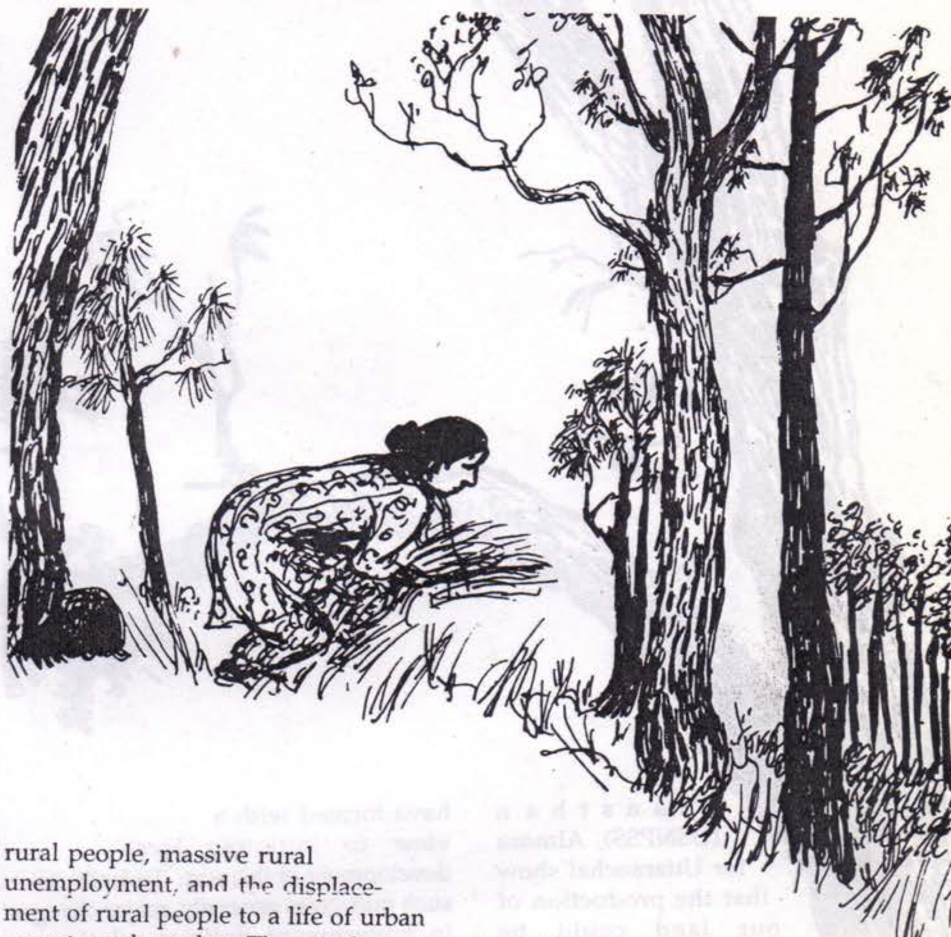


Here is a nice example of how one student used pictures to illustrate the process she went through to grind dal, as part of a lesson on agriculture and food.

RELEVANT SCHOOL EDUCATION FOR LOCAL ECOLOGICALLY-SOUND RURAL DEVELOPMENT

M. G. Jackson

In our drive for industrialisation we have created serious environ-mental problems and generally marginalised rural people. It is now generally agreed that the school curriculum needs to be modified to bring in elements of environmental awareness and the concepts, knowledge and skills students will need to solve these problems in the future. However, there is as yet no clarity about how this can be accomplished. This paper suggests an alternative curriculum structure designed to meet this challenge — an alternative formulated on the basis of the author's experience of designing and testing environmental education programmes over the past 15 years in rural Uttaranchal.



One of the functions of school education is to prepare young people to earn a living. At the same time it contributes to development of the country, preparing trained people for the expanding and diversifying national economy. Since independence our national development policy has been industrialisation and the chemicalisation of agriculture. School education was designed to support these efforts. This policy is now seen as having paid off, in so far as it is enabling us to fit into the global economy. However, the costs of this development are becoming painfully evident: environmental degradation, social disruption, ill health, an increasing income disparity between the urban middle and upper classes and rural people, massive rural unemployment, and the displacement of rural people to a life of urban poverty and squalor. There is thus an urgent need to redirect national policy towards sustainable local development. School education, suitably reoriented, would be a vital component of such a policy.

Our ideas on this subject have grown out of our experience of some 15 years of designing and testing environmental education (EE) programmes for rural schools and communities in Uttaranchal. However, we see these ideas as broadly relevant to all rural areas of the country, and to urban areas as well.

Briefly stated, we see sustainable local development as a community-based effort to manage local resources for sustainable production in ways that involve all members of the community, and benefit all equally. In our setting here in Uttaranchal, and indeed over all of rural India, the chief local resource is land — both farm land and forest land. This is a rich endowment, and, managed wisely, can give rural people reasonably comfortable and secure lives. Estimates made by the Uttarakhand Seva Nidhi Paryavaran Shiksha

Sansthan (USNPSS), Almora for Uttaranchal show that the production of our land could be doubled or more, so that we could provide ourselves with food, fuelwood, water and have a saleable surplus in the form of timber, resin, milk, fruit, vegetables etc. This would be possible using traditional land management practices updated with modern ecological understanding. Given a surplus of agricultural produce, small-scale, local processing industries could be developed. Individual villages at various places throughout the country have shown that this can be achieved. In Uttaranchal, in the last two decades hundreds of village women's groups have formed with a view to initiating local development of this sort. To facilitate such initiatives generally, major changes in government policies relating to agriculture, forest, industrial production, trade and education would be necessary. The guiding principle for these changes would be the empowerment of local communities to take control of local resources and manage them effectively and equitably.

Background

In what way could school education contribute to sustainable local development? Let us first consider the nature of the task before us. Rural students need to learn how to manage land in an ecologically-sound manner; that is, they need to understand the causes of land deterioration and how to arrest it. Village forest land is a vital part of the village economy, providing water, fuelwood and fodder (which in turn gives compost for the growing of crops). Rehabilitating village forest land is therefore the place to begin. As it is a community resource, community action alone can accomplish the job of restoring it and then managing it for high and sustainable production for the benefit of all families of the village. Similarly for village water resources. Children therefore need to learn the forms and functioning of community organisation in addition to the theory and practice of ecologically-sound land and water management. These things need to be learned by doing them practically.

In general, in the 'green revolution' areas of the country, the same approach would appear valid. The green revolution has also brought about land and social deterioration, although of different types. These include groundwater depletion, salinisation of the land, pollution of soil and ground water by toxic agricultural chemicals, indebtedness and suicide. There is a need to introduce sustainable natural methods of farming, to diversify production, as well as to begin community rebuilding to enable the community to manage village forest and water resources effectively and equitably, and, we might add, in order to provide the social security that has always been a feature of village life until now. Again, enterprising individuals and communities all over the country are already experimenting along these lines.

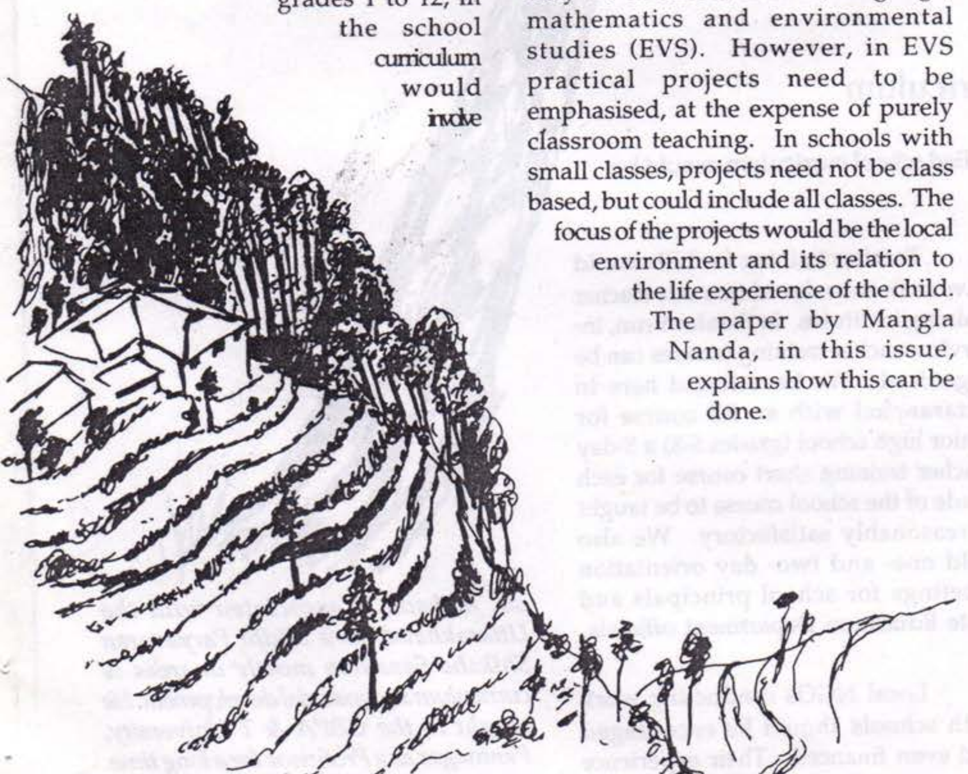
This argument can, we suggest, also be extended to urban school children. They need to learn analogous concepts, knowledge and skills to deal with the many serious problems of the deteriorating urban environment. Further, here too, the local community (the town as a whole, the ward or *mohalla*) is the basic social unit for rehabilitating the local environment (e.g., water harvesting, sewage disposal, recycling of waste, town planning) as well as fostering ecologically-sound local economic development (such as small-scale industry with low energy requirements, and services to the surrounding rural areas). And as everywhere else in the country, community building, or rather rebuilding, must be undertaken concurrently.

Suggested curricular framework

A key element in the revised school curriculum we have in mind would be courses of EE. The focus of these courses would be the local community, its environmental and livelihood concerns. The introduction of such courses at all levels, from grades 1 to 12, in the school curriculum would involve a certain amount of redesigning of the curriculum. On the one hand, all courses in the curriculum need to be given an environmental and community orientation. This is already being done by the so-called infusion process, but not entirely satisfactorily since the infused subject matter/discussions sometimes contradict the existing subject matter. This is particularly evident in science courses, where the environmental perspective clashes with the development perspective derived from modern science and technology. On the other hand, the EE courses need to draw together concepts, knowledge and skills learned in other courses and focus them on local environmental and livelihood issues and tasks.

The main features of this proposal can be summarised as follows.

1. At the primary level (classes 1-5) the existing three-subject approach may be retained; that is, language, mathematics and environmental studies (EVS). However, in EVS practical projects need to be emphasised, at the expense of purely classroom teaching. In schools with small classes, projects need not be class based, but could include all classes. The focus of the projects would be the local environment and its relation to the life experience of the child. The paper by Mangla Nanda, in this issue, explains how this can be done.



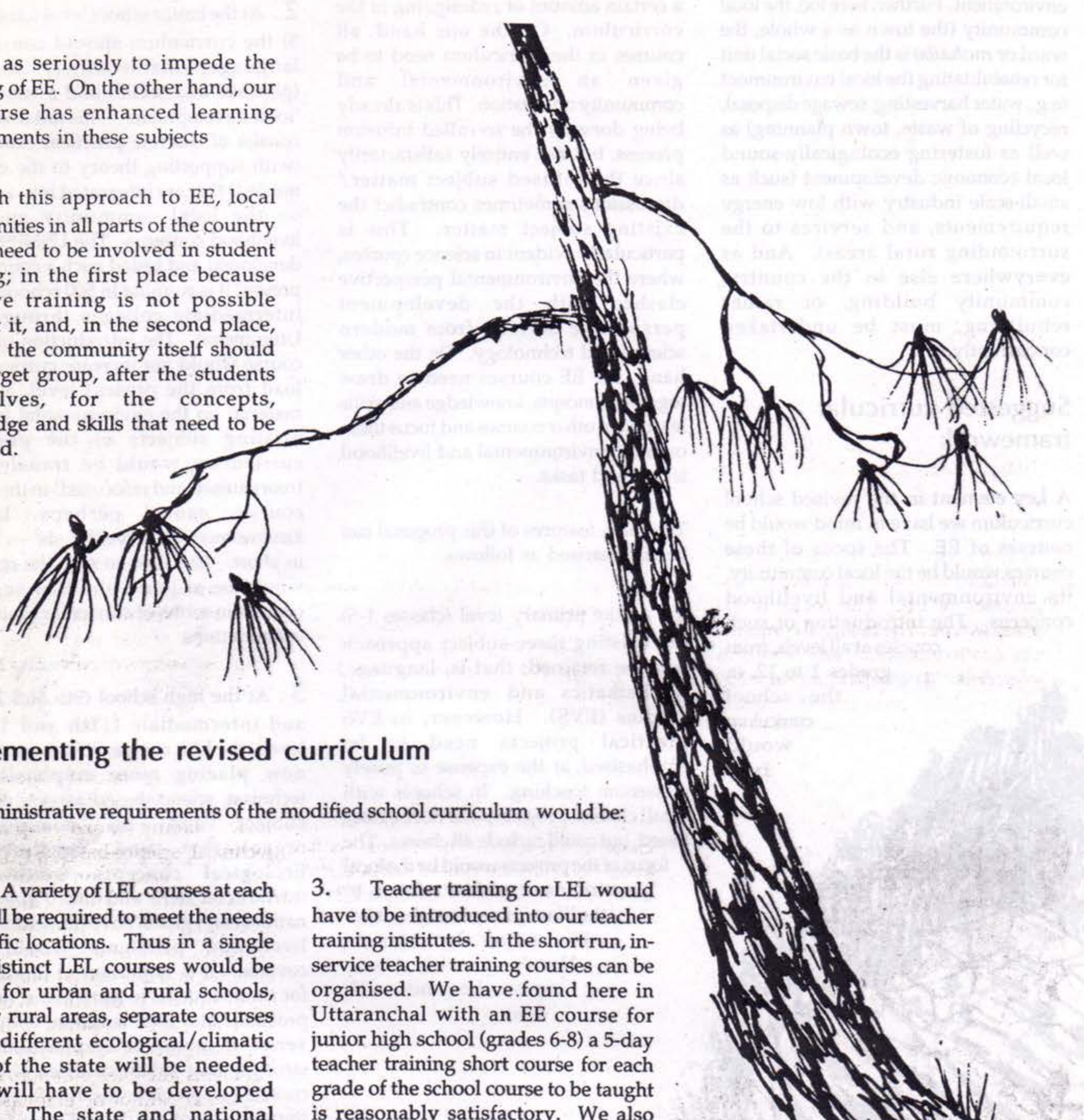
2. At the junior school level (classes 6-8) the curriculum should consist of language, mathematics, science (physical and social) and a course of 'local development'. This latter would consist of discrete practical exercises (with supporting theory to the extent needed) that are integrated into a focus on the local community and its livelihood concerns. The USNPSS has developed and tested such a course; at present it is running in 500 schools and intermediate colleges throughout Uttaranchal. The introduction of this course would not increase curriculum load from the present level, as the material on the environmental in the existing subjects of the present curriculum would be transferred (reorganised and refocused) to the new course, named perhaps 'Local Environment and Livelihoods' — 'LEL' in short. Needless to say, the course would be at par with other subject courses in terms of curricular time and examinations.

3. At the high school (9th and 10th) and intermediate (11th and 12th) levels, the LEL course would continue, now placing more emphasis on technical, science-based aspects of the subject and on community organisation and functioning. Ecological concepts would be introduced here and more abstract national and global environmental and livelihood problems would be covered. It is important at this stage for rural students to learn about urban problems and their solution, and *vice versa*. It cannot be emphasised too strongly that urban children should come to appreciate the fundamental importance of land, and its proper management, to the nation.

4. No dilution of language, mathematics and science subjects would be allowed. Indeed, there is much scope for improvement in quality here. It is our experience that children's levels of proficiency in language, mathematics and science are

› low as seriously to impede the aching of EE. On the other hand, our E course has enhanced learning :hievements in these subjects

. With this approach to EE, local ›mmunities in all parts of the country 'ould need to be involved in student 'aining; in the first place because ffective training is not possible 'ithout it, and, in the second place, ecause the community itself should e a target group, after the students nemselves, for the concepts, nowledge and skills that need to be nparted.



mplementing the revised curriculum

'he administrative requirements of the modified school curriculum would be:

. A variety of LEL courses at each evel will be required to meet the needs ›f specific locations. Thus in a single tate, distinct LEL courses would be ıeeded for urban and rural schools, ınd, for rural areas, separate courses or the different ecological/climatic :ones of the state will be needed. 'hese will have to be developed ocally. The state and national ›xamination boards will need to :oordinate their work to ensure similar :ourses for each setting (i.e., rural or ırban) and zone.

2. Increased allocation of funds to government schools will be needed to ensure adequate buildings, equipment, supplies and numbers of teachers. Incidentally, the costs of running LEL courses is far lower than for conventional science courses.)

3. Teacher training for LEL would have to be introduced into our teacher training institutes. In the short run, in-service teacher training courses can be organised. We have found here in Uttaranchal with an EE course for junior high school (grades 6-8) a 5-day teacher training short course for each grade of the school course to be taught is reasonably satisfactory. We also hold one- and two- day orientation meetings for school principals and state Education Department officials.

4. Local NGOs conducting work with schools should be encouraged and even financed. Their experience can be drawn upon for designing LEL courses and conducting short-course teacher training.

Dr. Jackson is associated with the Uttarakhand Seva Nidhi Paryavaran Shiksha Sansthan mostly in areas of curriculum and material development. He taught in the GBPA & T University, Pantnagar as a Professor for a long time. The present article is a reflection of his thoughts and activities in education for rural development. Dr. Jackson can be contacted at USNPSS, Jakhan Devi, Mall Road, Almora, Uttaranchal, 263601.

a few japanese haiku

Old pond:
frog jump-in
water sound.

[Matsuo Basho (1644-1694)]

Won't you come and see
loneliness? Just one leaf
from the kiri tree

[Basho]

The winds that blow-
ask them, which leaf of the tree
will be next to go!

[Soseki]

The falling leaves
fall and pile up; the rain
beats on the rain.

[Gyodai (1732-93)]

Clouds come from time to time
and bring people a chance to rest
from looking at the moon.

[Basho]

A storm-wind blows-
out from among the grasses
the full moon grows.

[Chora]

A fluttering swarm
of cherry petals; - and there comes,
pursuing them, the storm!

[Sadaiye]

Townsfolk, it is plain-
carrying red maple leaves
in the homebound train.

[Meisetsu]

Poverty's child –
he starts to grind the rice,
and gazes at the moon.

[Basho]

A lovely thing to see:
through the paper window's hole,
the flowing Milkyway

[Issa]

Fallen petals rise
back to the branch – I watch:
oh . . . butterflies!

[Moritake (1452-1540)]

Hearing insects –
and hearing people talking –
with different ears.

[Wafu]

Right at my feet –
and when did you get here,
snail?

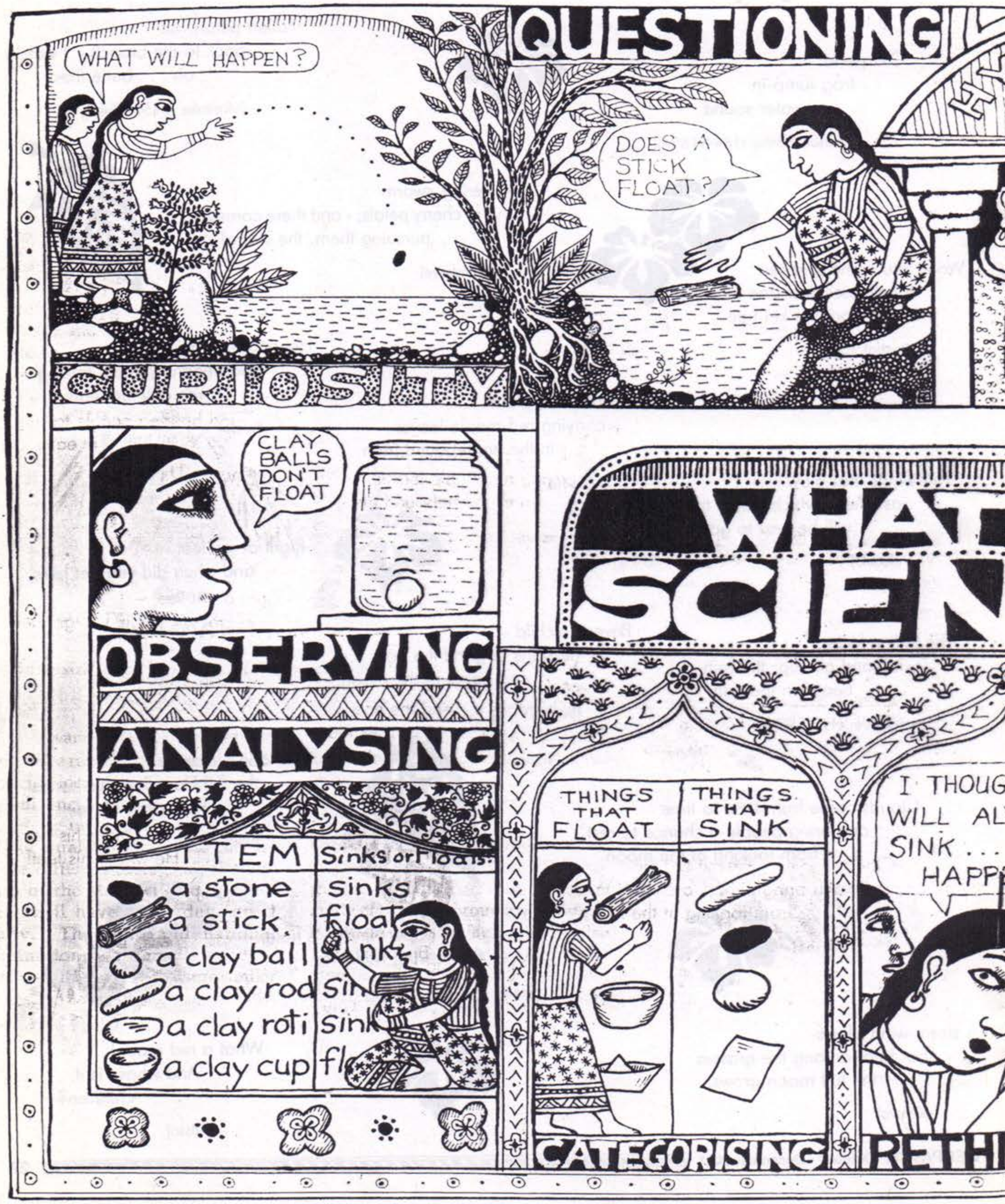
[Issa, (1762-1826)]

Oh, don't mistreat
the fly! He wrings his hands!
He wrings his feet!

[Issa]

What a red moon!
And whose is it,
children?

[Issa]



WHAT WILL HAPPEN?
QUESTIONING
DOES A STICK FLOAT?
CURIOSITY
CLAY BALLS DON'T FLOAT
OBSERVING
ANALYSING
ITEM
Sinks or Floats:
a stone sinks
a stick float
a clay ball
a clay rod
a clay roti sink
a clay cup
WHA
SCEN
THINGS THAT FLOAT
THINGS THAT SINK
I THOUG
WILL AL
SINK . . .
HAPP
CATEGORISING
RETHI


HYPOTHESISING
THIS CLAY BALL LOOKS LIKE STONE ... SO I THINK IT WON'T FLOAT...
TESTING
RECORDING
DESIGNING
WHAT IF I MAKE A CLAY BOAT AND PUT A CLAY BALL IN IT?
...S
...CE?
...UGHT CLAY ...ALWAYS ... WHAT ...PPENED?
...HINKING
CLAY FLOATS ONLY IF IT IS SHAPED LIKE A BOAT.
MAKING CONCLUSIONS

How to Reach the Sun . . . on a Piece of Paper

a poem by WES MAGEE

Take a sheet of paper
and fold it,
and fold it again.
and again, and again.
By the 6th fold
it is 1 centimetre thick.

By the 11th fold
it will be 32 centimetres thick,
and by the 15th fold
- 5 metres.

At the 20th fold
it measures 160 metres.
At the 24th fold,
- 2.5 kilometres
and by fold 30
is 160 kilometres high.

At the 35th fold
- 5000 kilometres.
At the 43rd fold
it will reach to the moon.

And by fold 52
will stretch from here
to the sun!
Take a sheet of paper.
Go on.

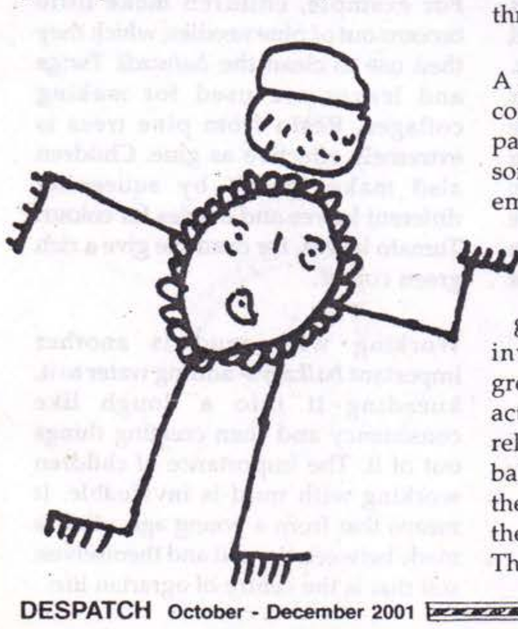
Try it!

RELEVANT ENVIRONMENTAL EDUCATION IN EARLY SCHOOLING IN A RURAL SETTING

Mangala Nanda

The Uttarakhand Seva Nidhi Paryavaran Shiksha Sansthan (USNPSS) is an NGO that has been working for the past 15 years to promote environmental under-standing in the villages of Uttaranchal. An important means of doing this is through the 'balwadi' (pre-school centre) programme. Environmental education (EE) plays a prominent role in the balwadi, and helps children relate and interact with their environment from a very young age. The USNPSS supports 28 local NGOs who are responsible for running 355 balwadis throughout Uttaranchal. About 7000 children are involved in this programme. The age of balwadi-going children ranges from age 2-8.

The 'balwadi' is an informal setting where children learn through play. As the value of learning through play is now widely recognised, a number of primary schools have adopted or are planning to adopt the play-way methods system in Classes 1 and 2. In this regard, there are many aspects of the balwadi programme that may be of interest to primary school teachers throughout the country.



A powerful environmental message is conveyed to children through every part of the curriculum: games, stories, songs etc. In addition, there is a special emphasis on using locally available and relevant materials. Another important facet of the balwadi is that it involves village women's groups in its management. This involvement leads the women's groups to undertake other community activities as well, particularly those related to the environment. Thus the balwadi facilitates EE on two levels: the first is with the children, to enable them to relate to their surroundings. The second is building understanding in village communities to take steps to improve their environment.

The very term 'Environmental Education' suggests the facilitation of awareness and understanding of the different facets of one's surroundings. Modern schooling in general, and particularly the present EVS course, however, has little connection with the rural child's reality. Children are not given the knowledge and skills needed for life in their village. By focusing on aspects of the environment that young children can grasp and learn from, a solid foundation is laid out for them; in future they can use this local knowledge for their own livelihood and survival. The importance of the inclusion of locale specific environmental education is therefore apparent. This paper describes a locally relevant EE programme for young rural children in Uttaranchal.

The *balwadi* is essentially a pre-school centre. However, there are a sizeable number of children of the primary school age group who also attend the *balwadi.* The route to the school from the village is the main reason for this. While the distance to the school would not normally be more than 1 km, ravines and streams may need to be crossed. In addition, the path itself (owing to the mountainous terrain) may be difficult for young children to use. Thus, particularly in far off villages, many children are prepared in the *balwadi* to enter the primary school directly into Class 3, when they are able to walk to the primary school. As primary-aged children attend the *balwadi,* there is some overlap between the *balwadi* and the primary school. Every part of the curriculum aims to link the children to their environment. In this regard, there are many aspects that primary schools might adopt to promote environmental understanding in their own set-up.

The *balwadi* is firmly founded on the idea of learning through play, which is recognised to be the most efficient way of promoting eagerness and interest in learning in young children. Learning through play has also proved to be the best way of communicating a message to children. Learning by rote and memorising facts about the environment does not further a child's understanding. However, games, songs and stories are a powerful medium for conveying a message to a child. In the *balwadi,* it is through these that environmental issues are dealt with. The principle elements of the curriculum are:

◆ *Bhavgeets*: *Bhavgeets* (songs with expressions) are entirely related to the child's immediate surroundings. The topics are varied; not simply songs about trees, but animals, the seasons, the growth and cycle of crops amongst other things. In addition to this environmental education, the child's knowledge and vocabulary is also much improved through learning new *bhavgeets.*

◆ Stories: The content of these relate to the child's own environment. After the story has been told, the children often act out the story. This element of drama and being able to perform is vital in eliminating children's inhibitions. In addition, often village elders are invited to the Balwadi to tell stories to the children. These stories are based on the traditional culture of the region. This is a vital point. Today's education system is a universalised one. Education is divorced from knowledge of one's locality and community. Providing the children with a background to their lives is important in allowing them to feel secure, and to feel pride in themselves. One of the biggest problems today is the diminishing respect of rural people for their own culture and life; believing the city world to be ahead of them.

◆ Games: The underlying theme in most games is the environment. At the same time these games provide children with different stimuli. Many games help the children to understand concepts of numeracy, others improve their memory, active games promote their physical fitness and all games require the children to listen carefully and respond quickly and appropriately. This is vital for increasing the receptiveness of the children. Thus, environmental awareness in the children goes alongside their mental and physical growth.

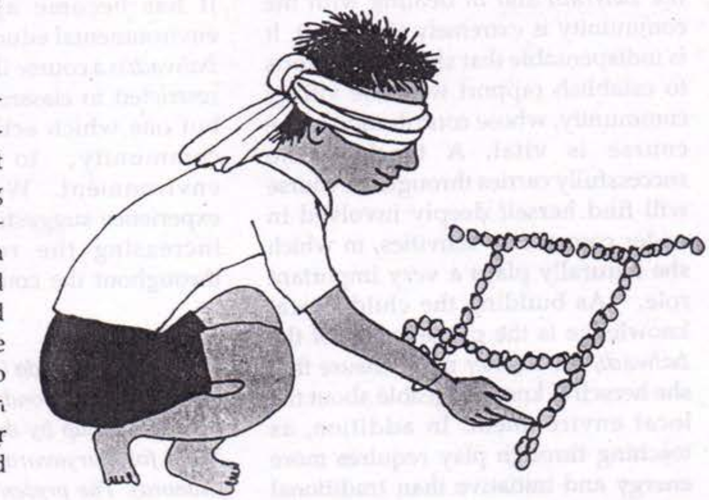
◆ *Balkaryas*: Another important aspect of the curriculum is the *balkarya*: practical work that increases the hand-eye co-ordination of the child. The inclusion of these tasks is vital to advance the motor skills of the child, skills that are central to overall growth and development. Locally available materials are used abundantly for the different *balkaryas.*

For example, children make little brooms out of pine needles, which they then use to clean the *balwadi.* Twigs and leaves are used for making collages. Resin from pine trees is extremely effective as glue. Children also make 'paint' by squeezing different leaves and berries for colour. Tomato leaves, for example give a rich green colour.

Working with mud is another important *balkarya*- adding water to it, kneading it into a dough like consistency and then creating things out of it. The importance of children working with mud is invaluable. It means that from a young age a link is made between the soil and themselves: soil that is the centre of agrarian life.

◆ Numeracy: Numerical concepts are also taught through locally available materials. For example, children arrange different sized pebbles in ascending/ descending order, and use *'mitti ki golis'* (little balls made from mud) for counting.

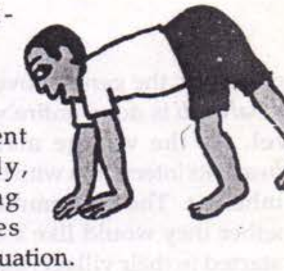
◆ Language development: Language development with very young children is primarily through *bhavgeets* and stories. Talking and conversing with the children is also invaluable in increasing their knowledge and vocabulary.



Therefore, the 'daily chat,' is another important aspect of the curriculum. This is also environmentally based. The *balwadi* teacher chooses a topic that is relevant. If it is raining heavily, the discussion is about the rain: what happens when it rains, how we can tell it is going to rain etc. The children themselves come up with statements like, 'it becomes cold when it rains' and 'it becomes dark before it rains.' By keeping the discussion at a level where children can grasp it and contribute to it, their interest in it is ensured. The topics of the 'daily chat' are varied: whether it is about a calf that has been born in the village or whether about monkeys who have been attempting to eat the crops. Very young children are not burdened with writing.

Older children learn how to write through play. For example, the teacher writes a letter of the alphabet on a piece of card-paper. Children then stick pebbles along the lines. It has been noted that since children enjoy this so immensely, they effortlessly learn to write. When they are fairly familiar with the alphabet, the teacher blindfolds a child. The child guesses the letter by feeling the layout of the pebbles. As learning is entirely through play, the children's eagerness to learn increases. At the same time they are implicitly shown the many facets of their surroundings. They see their environment in a new light: leaves that give colour, soil that is used for making mud birds and bananas, pine trees that give resin for making collages. Through their interaction with it, children learn to respect their environment.

◆ *Paryavaran bhraman*: Although environmental education is present in every aspect of the course, there is a certain time in the week that is devoted especially to it, when the teacher and children go outdoors. However, this is not just nature study; not just passively observing the environment. Rather, it addresses the issue: how does the environment relate to me? How do I relate to it? Thus the children do not just observe a dry leaf; they recognise the valuable use of that dry leaf for bedding for the cow at home. This type of environmental education involves the children interacting with and understanding their surroundings. They do not view their environment detachedly, but bring themselves into the equation.



In contrast, children who have not received locale-specific environmental education are unable to do this. When asked what the use of a green leaf is, they are unable to give the answer that is foremost in their life. Although they help their mother everyday to collect leaves for fodder, and consequently *know* the relevance of leaves in their daily life, they are expected to recite: 'leaves give us oxygen'. Local environmental knowledge is thus repressed. The textbook says that leaves give oxygen, so that must be the only right answer. Contradictions and confusion prevail in the children's minds. They are distanced from their world. The inclusion of locale-specific education is thus indispensable.

One of the most important facets of the *balwadi* is that it involves the

community; the general overseeing of the *balwadi* is done entirely at a local level. As the village manages the *balwadi*, its interaction with the *balwadi* is inherent. The community decides whether they would like a *balwadi* to be started in their village, they appoint the *balwadi* teacher themselves, and they decide and organise the place where the *balwadi* will run. The village women also determine the *balwadi* timings in accordance with their seasonal workload. Thus, in most cases the setting up of the *balwadi* is the beginning of community spirit, as many decisions need to be made, and the village has to be drawn together to make them and execute them. It is through this community spirit that *Mahila Mangal Dals* or Women's groups have formed in *balwadi* villages. With community participation, the possibilities for actual work to improve the local environment open up. The *balwadi* teacher plays an important facilitating role in this.

The *balwadi* teacher's role, both within the *balwadi* and in dealing with the community is extremely important. It is indispensable that she makes efforts to establish rapport with the village community, whose contribution to the course is vital. A teacher who successfully carries through the course will find herself deeply involved in wider community activities, in which she naturally plays a very important role. As building the child's local knowledge is the primary aim of the *balwadi*, the teacher must ensure that she herself is knowledgeable about the local environment. In addition, as teaching through play requires more energy and initiative than traditional schooling, the teacher must also plan extensively for each session. It is vital that the teacher carries out these tasks in order to ensure that the environmental education is complete and holistic.

It has become apparent that the environmental education course in the *balwadi* is a course that does not remain restricted to classrooms or textbooks, but one which actively involves the community to improve the environment. We feel that our experience suggests opportunities for increasing the relevance of EVS throughout the country.

Ms. Mangala Nanda is a researcher based in UK. She had conducted a study on the balwadis set up by the Uttarakhand Seva Nidhi for Paryavaran Shiksha Sansthan (Almora). The present paper is based on that study. For more details the readers can contact the USNPSS, Jakhan Devi, Mall Road, Almora, Uttaranchal 263601.

Exploring the Environment in its True Spirit

Binaya Krushna Pattanayak

In our country there are two types of groups who work for the qualitative improvement of school science education. Groups like Eklavya (MP), HBCSE (Mumbai), CEE (Ahmedabad), Uttarakhand Seva Nidhi Paryavaran Shiksha Sansthan (Almora), etc. work with schools formally. But there are other groups like Kerala Shashtra Sahitya Parishad, Tamil Nadu Science Forum, Pondicherry Science Forum, Srujanika, Manavik (Orissa) etc. who work for the same cause in a different way by conducting supportive camps, workshops, seminars atc., and through publications to provide alternative ideas to teachers and teacher educators. Narrated here are the activities of one such programme conducted for DPEP in Assam.

A state level camp was organized at Guwahati (Assam) for a week in mid-June. This was one of the science camps organised in the state through external resource support since the inception of DPEP in the state. The basic aim of this camp was to create interest in science among the participants, to develop an understanding about the process of science, to develop a sense of appreciation and care for the environment, and to project this short-duration camp as an alternative to better science teaching. The participants of included 60 primary school children (of class IV and V) and 15 primary teachers from different districts of Assam.

This camp was conducted by *Manavik* (An educational research centre in Orissa) in collaboration with local experts in different fields. After briefings about the philosophy and approach of the camp the participants were divided into 15 groups. The different groups were to work on *plants* (leaves, flowers, fruits, seeds, roots), *animals, birds, insects, water, air, soil, weather, sky, society, artificial materials, energy, environmental problems* and *remedies* etc.

Grouping, Preparation & Exploration: Each group was guided as to its responsibilities during an *exploratory nature walk*. Each group consisting of 4 children, 1 teacher and one expert was to explore the environment for one and a half hours focussing on their own area as per the group name. They all went prepared with a kit bag, specific equipment and reference material. They observed their own subject area in detail, carefully collected samples and recorded information generated through observation, group discussions and debates. After the enjoyable walk in the nearby open area each group returned to the venue with heavy carry bags containing as many specimens, illustrations and other data as possible.

Analysis: Now it was time for *sorting* the collections out and *classifying*. Each group sat in different corners of the room and worked on their own samples. The *plant* group occupied a full room to classify their collection of 102 types of leaves, 67 types of flowers, 47 types of fruits and vegetables, 56 types of seeds and 96 types of roots. They classified their plants into trees, shrubs, herbs, creepers, mushrooms, moulds, orchids, cacti, insectivorous plants and aquatic plants on a big chart with supporting illustrations. They put small labels in front of each exhibit on the floor. The other groups worked in similar ways on their collections, systematically and in collaboration with the guides.

Exhibition: Each area now took on the shape of a colourful educative *exhibition corner*. After deciding on a good design, each group went around to the other corners observing and discussing the different aspects of each collection. It was interesting to see the classification of the *animals* into terrestrial, aquatic, amphibians, pet and domestic, etc. along with the exhibitions of bottled lizards, snails, fishes, a chained puppy and a sheep! The *bird* group had drawn the picture of 22 birds they had observed. The *insect* group had collected more than 40 types of butterflies, moths, grasshoppers, cockroaches, spiders, flies etc., using nets, pooters and other safe methods.

They all were exhibited in transparent bottles with mosquito nets at the mouths. The *soil* group displayed 24(!) types of soil. The *water* group put 12 types of water in bottles. Along with that they made an attractive aquarium to carefully display aquatic plants, animals etc. in a big bottle. The *weather* group put up all its observations through charts and models. The group on *artificial materials* displayed more than a hundred items that they had collected during the trip. The group on *society* compiled an enormous amount of data relating to the past, the present and the culture of the people living in the visited areas.

Preservation: Then each group narrated its *experience* before the others and clarified points and questions raised by curious members of other groups. After this the resource people guided them all on simple techniques for *preserving* all the collections. The plant products were mostly preserved inside pressed newspaper notebooks. Preservations of insects and animals in *formaline* solution were exhibited for reference only.

Fun with Plants: Besides these activities, the groups also explored

plants, did tree mapping, drew plant profiles, took a close look at the plant world and studied the inter-dependencies between plants and animals.

They also conducted simple experiments on plant germination, sensitivity, respiration, transpiration, propagation, osmosis etc. and learnt processes like taking leaf rubbings, bark rubbings, etc. to keep records. The making of a herbarium and a green house enabled them to study plants systematically.

Soil Experiments: For exploring *soil* the collected samples were dissolved in water in transparent glasses to see how they settle in distinct layers at the bottom. The fertile soils showed high amount of humus and bio-ingredients whereas the sandy ones proved lifeless. The participants also practised simple tests to study the acidity, hardness, water holding capacity and fertility of the different soil samples.

Water: The *water* tests touched upon the different characteristics of water like its shapelessness and how it maintains surface regularity, participates in the water cycle, evaporates, condenses, flows downwards, exists in different forms, helps in growth of plants, performs osmosis, maintains a 'skin', climbs upward, creates waves etc. There were tests for knowing turbidity, pH, conductivity, hardness, alkalinity, chloride, magnesium, calcium, phosphate, sulphate, iron, colour and smell of the different samples and also for studying different types of aquatic life through *observation tubes*.

Air, Weather and Energy: Exploring *air* was also fun, with tests for making bubbles, evaluating the power of air jacks and simple experiments related to air pressure. The *weather* tests included keeping regular records of the different components of weather through tables, and safe techniques. The *energy* tests were related to measuring time through a handmade sun dial, using solar energy by a solar cooker, a green house, a solar oven etc. There were also simple experiments related to plants as solar collectors, energy change, food chain etc.

Small animals: To find *small animals* and *insects* the participants searched in different places where they live. They looked under rocks, on tree branches, and in soil, tree bark, decomposed wood, garbage, straw heaps, decomposed cow dung, compost and moist locations. Small animals were carefully collected using nets and pooters. Then they were observed minutely, keeping them in a wormery, terrarium or aquarium. Equipment like a viewing tube, an ordinary hand lens, magnifiers, simple microscopes etc. were very useful for the finer observation of these collections. Besides these the study of *micro organisms* like aquatic micro organisms, and others in compost soil etc. were very fascinating for all the participants. They drew sketches of the animals they observed in this way and exhibited them on the final day.

Out of the eggs: To study the life cycles of different animals, eggs of chickens, frogs, butterflies, lizards etc. were collected and kept under proper conditions for hatching. The participants not only enjoyed seeing the cute offsprings hatch, but also got direct experience of their life-cycles. Along with these several *observation houses* such as a simple terrarium, aquarium, formicarium (ant house), vermicarium (earthworm house), minipond, green house etc. were constructed in the camp to familiarise the learners with the various exciting worlds of animals, plants and other forms of life in the environment.

Sky Watching: Every night the participants were acquainted with the night sky first through briefings about the history and development of astronomy as a science, orientation about celestial coordinates and finally observation of stars, planets and constellations through the naked eye and the telescope.

Nature, Society & Science: Participants were also apprised of the genesis and social implications of science through a series of slide shows titled '*Nature, Society and Science*'. The themes included *Our place in the universe, The evolution of the animal and plant world, How apes became humans, Science from yesterday to today* and *The future of the environment.* These slide shows opened up long discussions each time and focussed on the 'true spirit' of science.

Green Games : Besides this, each day the participants took part in various educational green games each afternoon which included games like *'The web of life'* (the well-known game on biodiversity), *Who am I, Seasonal signs, Tree conversation* etc.

Studying the Zoo: On the last day they all visited the Assam state zoo with a detailed plan to study its various aspects. They also identified problems in the local environment and discussed possible solutions, taking lessons from various individual initiatives and people's movements.

The Open Exhibition at the end of the camp was visited by a good number of people. There were altogether about 1800 exhibits in the six rooms which were mostly developed by the young participants and teachers touching upon all aspects of their environment.

In Conclusion: At the end of the seven day long camp the direct experience and information gathered in the process were much more lively, exciting and enriching than the typical textbook and school education. After this, similar camps were independently organized in different parts of Assam. Glimpses of the impact of such experiments are now visible in Assam classrooms and reading materials.

Mr. B.K. Pattanayak is presently a consultant (pedogogy) for the Technical Support Group (DPEP). He has been working on qualitative improvement of science education through various types of workshops, writing, editing, songs, science camps, talks, illustrations and other methods. He is closely associated with NCSTC (DST), Vigyan Prasar, NBT, CIAA, AIPSN, and other organisations.

Dear Reader, Are you interested in organising similar camps for your teachers/children? State level orientation camps of longer duration are being conducted in near future in UP and Rajasthan. You can contact us at: Pedagogical Improvement Unit, TSG (DPEP), 10-B, I.P. Estate, New Delhi – 2, or MANA VIK, Tota Sahi, Masterpada, Phulbani, Orissa – 762001.

EKLAVYA - HOSHANGABAD SCIENCE TEACHING PROGRAMME - A NOTE

Kamal Mahendroo

Perspective

An effective intervention in the way science is taught in our schools has been perceived as an essential step towards achieving a society more capable of creatively developing and absorbing technology as well as giving a more scientific foundation to our cultural, political and economic fabric. The directive perspective of the Hoshangabad Science Teaching Programme (HSTP) has been formulated to overcome the gap between these expectations and the reality in our schools.

To remould school science education to fulfil universally accepted national goals and educational objectives, HSTP has attempted to base science education on the principles of 'learning by discovery', 'learning through activity' and 'learning from the environment' in contrast to the prevailing textbook centred 'learning by rote' method. The processes of science needs to be emphasized if we have to fulfil the constitutional goal of promoting scientific temper and make the child a confident self-learner for the rest of his or her life. In addition science curriculum must relate closely to science and technology experiences of everyday life.

Perceiving Innovation as an integrated whole: HSTP recognized that an effective innovation must take into account all the factors that affect the teaching process in the classroom – curricular innovation, teacher training, kit for doing experiments, examination system, school administration, extra curricular inputs, etc. Examination reform has been seen as a crucial factor which really influences how the curriculum is transacted in classroom.

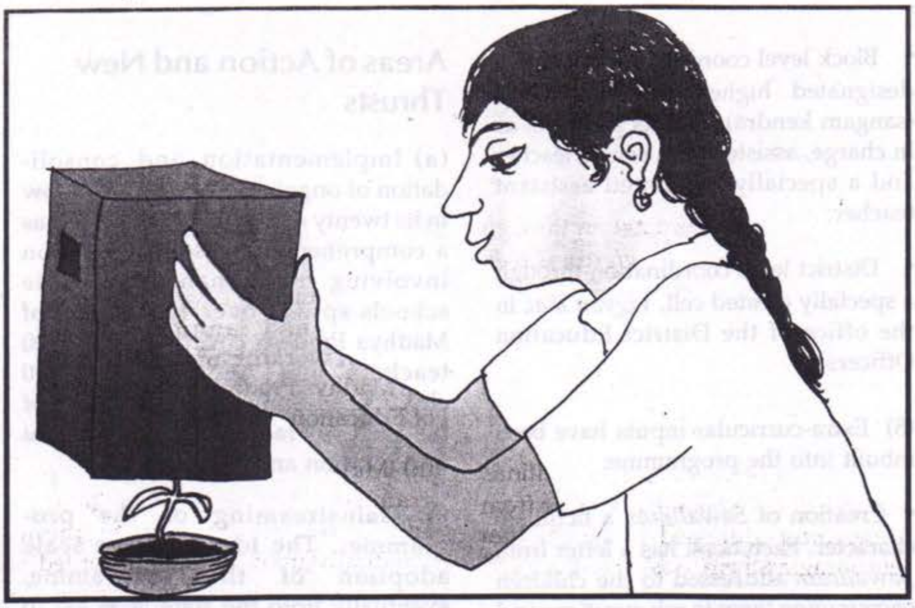
Innovating in the Mainstream System: The HSTP model has been evolved in Government schools in rural and semi-urban areas in close collaboration with and involvement of the district and state level education department.

Empowering the Teachers: The HSTP innovation has involved the teachers themselves in evolving the innovative package. Empowering teachers – academically, administratively and intellectually is an essential requisite for effective reforms at the classroom level.

Administrative decentralization: Utilising and equipping the block level higher secondary school to administratively and academically coordinate the programme has effectively decentralized the field level implementation of the programme. A limitation has been the inability to decentralize financial powers.

Participation of Institutions of Higher Education and Research: HSTP group strongly believes that the effort to improve our school education system needs the involvement and commitment of the best scientists, researchers and academicians of our country.

Role of Non-governmental Voluntary Groups: HSTP is an ideal example of close and complementary working of the State Education Department and Non-governmental Voluntary groups. With the district level expansion of the programme, the day-to-day administrative and academic responsibilities were taken over by the State Education Department. Eklavya



now has a coordinating role in further development of HSTP in collaboration with the SCERT and the State Education Department.

The Innovative Package

The package consists of:

(1) The 'Bal Vaigyanik' books, one book each for classes 6,7 and 8:

- Based on the discovery principle, the books are in a combined format of work-cum-textbooks.
- The books layout has been specially designed to make it attractive, easy to read and follow for the children;
- The books have been prepared after intensive field testing incorporating feedback from the teachers and children.
- The books are being published by the MP textbook corporation since 1978.

(2) Teacher training: Each teacher undergoes three trainings, each of a three week duration for classes 6, 7 and 8 each. The training consists of:

- Doing all the experiments and activities of the Bal Vaigyanik, analysing, discussing, reaching conclusions and conceptual understanding expected;
- Discussions about the educational and academic understandings, underpinnings, and the administrative structure of the programme;
- Training in evaluation methods and making new questions for open book examinations.

(3) Resource Group: The quality, motivation and commitment of the resource group has been crucial to the achievements of the HSTP in these areas:

- Development and improvement of Bal Vaigyanik books and teachers' guides; training of teachers and resource teachers;
- Conducting follow-up and monthly meetings;
- Preparing test papers – both written and practical for annual evaluations; preparing evaluation guidelines;
- Answering questions asked by children through letters to 'Sawaliram';
- Conducting trainings, exposure workshops, etc. in other states.

The resource group consists of about 200 trained and motivated school teachers, backed and supported by a group of scientists and academicians from leading centres of research and education like Delhi University, Tata Institute of Fundamental Research, Indian Institute of Technology, National Institute of Immunology, and Colleges and Universities of Madhya Pradesh.

(4) Kit: The activity kit is designed for children to do their own experiments in groups of four. It contains materials like magnets, test tubes, valve tubes, easily available chemicals etc. Presently, a kit for an average school with 40 children in each class costs about Rs. 4,000. About 20% of the kit needs to be replaced every year to make up the loss of consumable and breakable items. An annual replacement cost of Rs. 800 needs to be provided, which works out to less than one rupee per child per month.

(5) Monthly meetings and follow-up: This is a system that was worked out to assist the teacher in the school

situation and to encourage peer group interaction. At the monthly meeting they share their experiences, discuss their problems and are also given a refresher or enrichment lesson by resource teachers. The resource teachers from all the sangam kendras come together with the Eklavya team on a fixed day to prepare for that month's meeting. For follow-up visits, resource teachers are assigned schools to visit and guide the teacher in the classroom.

(6) Examination and evaluation: An evaluation system designed according to the objectives of the programme consists of:

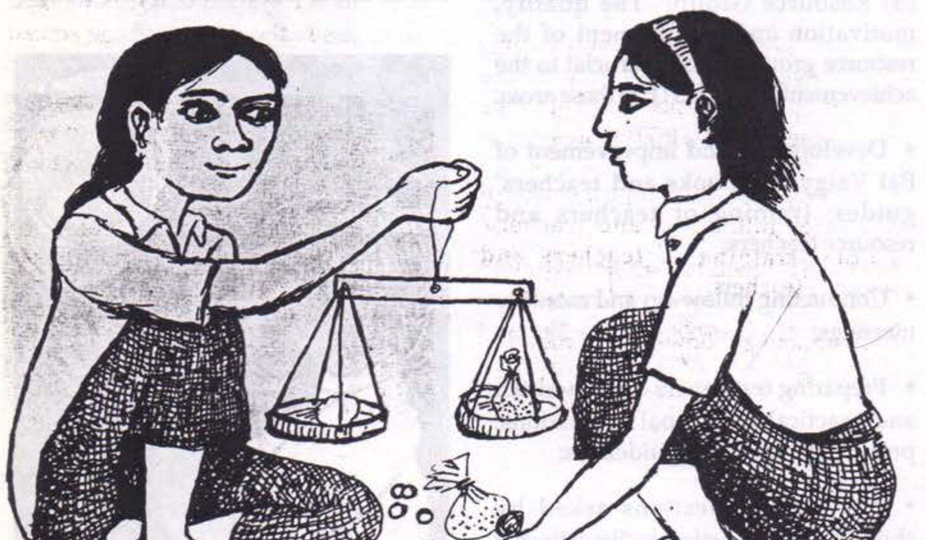
- A written as well as a practical examination;
- The written examination is an open book exam;
- This exam is designed to test analytical skills, de-emphasising learning by rote.

(7) Administrative structure: The programme has a decentralized administrative structure. Its main features are:

- Block level coordination through a designated higher secondary school (sangam kendra) with its principal as in charge, assisted by a senior teacher and a specially appointed assistant teacher;
- District level coordination through a specially created cell, *vigyan ikai*, in the office of the District Education Officers;

(8) Extra-curricular inputs have been inbuilt into the programme:

- Creation of *Sawaliram*, a fictitious character. Each book has a letter from *Sawaliram* addressed to the children encouraging them to ask questions and much more. An arrangement has been made to reply to their letters;
- Publishing of *'Chakmak'*, a monthly magazine for children, as well as small booklets containing interesting activities to do;
- Publishing magazine *'Hoshangabad Vigyan'* and journal of resource material *'Sandarbh'* for teachers;
- Encouraging teachers and children to participate in various science popularisation activities like jathas, bal melas etc.



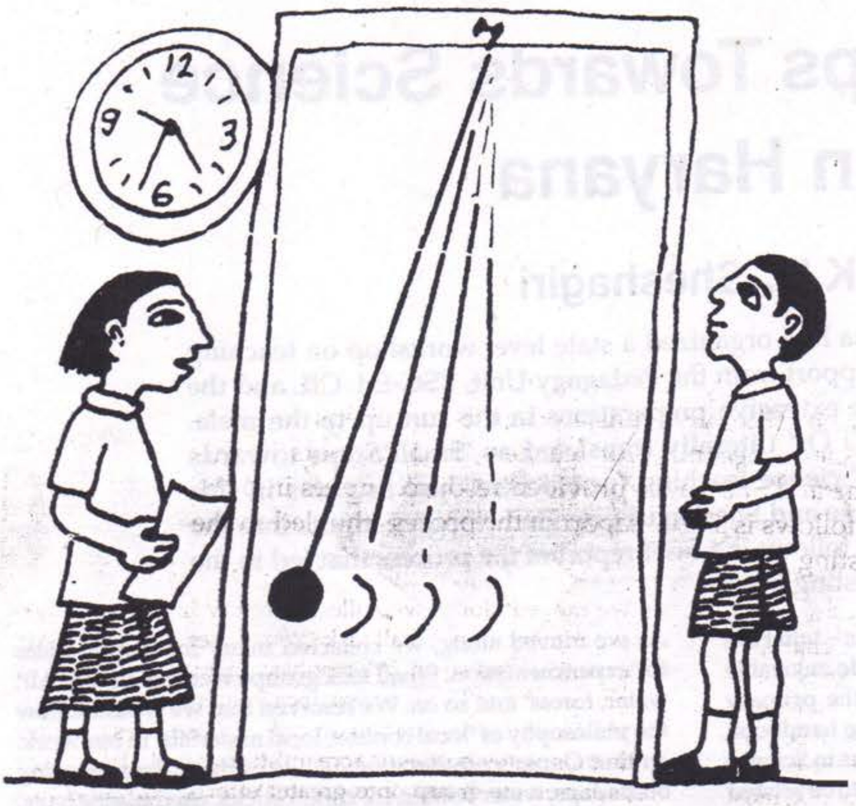
Areas of Action and New Thrusts

(a) Implementation and consolidation of ongoing programmes: Now in its twenty eighth year, the HSTP has a comprehensive base of operation involving more than 500 middle schools spread over 15 districts of Madhya Pradesh covering over 2,000 teachers and annually 1,00,000 children working under the aegis of the Madhya Pradesh State Department of Education and the SCERT.

(b) Mainstreaming of the programme: The idea of large scale adoption of the programme, eventually upto the state level led to exercises to plan the logistics and the financial implications of such a programme. A large expansion would be possible only with decision at the political level and active backing of the education bureaucracy. The Eklavya group hopes to actively participate in any such process to innovate science education over the entire state.

(c) Spreading the Innovative Spirit – our role as a Resource Agency: The people's science movement has effectively been spreading the ideas and sharing the HSTP experiences. Our resource persons participate in meetings and workshops of teachers and people's science activists in various states from time to time. Contingents of participants from various states are a regular feature of our training programmes. Interaction with other groups continues to be important to our attempt for idea-level expansion of the HSTP.

HSTP is providing close and extensive collaboration to groups attempting to develop innovative programmes in their states with the primary objective of establishing an independent resource group. Examples are the *Adhyaita Kendri* (Learner Centred) Science Teaching Programme in Gujarat and the Upper Primary Programme of the Lok Jumbish Parishad in Rajasthan.



d) Academic innovations in the curriculum material: Continuous innovation is an accepted norm in the HSTP group. The central concerns of the present round of innovations are two fold :

• That curricular material needs to be presented in a still more attractive and child-friendly form as feedback indicates.

• The efficacy of conceptual development in children and the ability to articulate it directly or through use in problem solving tasks.

• 'The HSTP curriculum emphasises the 'process' aspect of science, the 'product' aspect or content, however, is underplayed.' To address this common criticism, an attempt is being made to develop new areas of content through innovative methods combining activity with narration that emphasises understanding rather than rote learning.

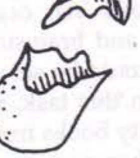
The material prepared is first being tried with teachers and children at various levels to establish its effectiveness and appropriateness. We are involving persons concerned with curricula design and development as well as teachers in this process through a series of workshops. We have sought collaboration with creative artists and designers for layout, design and illustrations.

e) Moving towards High School – Classes IX and X: With the implementation of 10+2 system, the years of general education were specified up to class X instead of class VIII and we have been under pressure to extend the HSTP approach to cover High School. Some tentative steps taken in this direction were to organise interactions with high school teachers to understand their problems with the present curricula, etc. and to prepare a critique of the present curricula and curricula materials which will be shared with a larger group to evolve a framework of intervention at this level.

f) Comprehensive Evaluative Studies and Documentation: HSTP has already attracted many researchers and there are already over a dozen thesis and dissertations studying its impact in a comparative framework. An expert Committee constituted by the Ministry of Human Resource Development, Government of India after review described the HSTP as being based on sound pedagogical principle.

The nature and expanse of the HSTP offer an ideal situation for a comprehensive comparative evaluation of the academic, administrative and social impact of such an innovative effort. Such an evaluation requires a complex exercise of selection and development of evaluation tools and their standardization before the actual evaluation and analysis. We are looking for a suitable group or agency which can take the major responsibility of organising such an exercise in collaboration. This would have to be undertaken as a separate project with independent funding.

Mr. Kamal Mahendroo is a Fellow with Eklavya. He has a long experience in Hoshangabad Science Teaching Programme. He can be located at Eklavya, Sandia Road, Pipariya (M.P.) – 461775.



Small Steps Towards Science in Haryana

K.M. Sheshagiri

In April'99, DPEP Haryana had organized a state level workshop on teaching learning materials with support from the Pedagogy Unit, TSG-Ed. CIL and the DPEP bureau. There were extensive preparations in the run up to the mela. 'Nanhe Kadam Vigyan Ki Or' (literally translated as 'Small Steps towards Science'), a handbook of Science teaching for teachers, had its roots in this experience. Tushar Tamhane and Sheshagiri provided resource inputs into the making of this book. What follows is a brief report of the process that led to the development of this interesting book

In the beginning, we asked some basic questions – what are the various ways by which Science can be made enjoyable and meaningful for teachers and children in the primary years? Where should we begin? How should the handbook be written? Quickly, we realized that if new ideas in Science teaching had to be introduced, they would have to be related to that 'Bible', the textbook. Whether one likes it or not, most primary school teachers in our country still swear by the textbook. Any idea that cannot be linked with what the textbook is saying is considered 'extra'; the usual refrain is that "We have to 'cover' the syllabus!" Therefore, the more specific the linkage with the text, the greater the degree of acceptance by the teachers, a maxim we realized in the early days itself. Not a very pleasant way to begin, but there was no choice! Ideally, however, we would have liked to rethink the Science curriculum, but there was no space and time for this to happen.

So, we began with a 'core' group of teachers and resource persons from Block Resource Centres, Cluster Resource Centres, District Project Offices and District Institutes of Education and Training. Like hawks, we studied the existing science textbooks of each of the primary grades, looking for statements that provided even vague possibilities for experiments and demonstration. You see, we had to 'equip' ourselves with these ideas to provoke the teachers into thinking that they could do these things in the classroom. Our textbook search rewarded us with cryptic statements like 'Hot air will rise', or 'Air exerts pressure', or the ubiquitous 'Air occupies space'. We grabbed these possibilities and brainstormed the possible range of experiments that could be set up to explore these 'facts'. To help ourselves in this task, we had collected a wide range of science activity books from here and there – why reinvent the wheel when so many ideas exist? They had only to be adapted to our needs.

As we moved along, we collected many interesting ideas for experimentation. Small task groups were set up on 'Air, water, forces' and so on. We resolved that we would follow the philosophy of 'local context, local materials' in our work. Arvind Gupta's presentation on one of those days on using bottle caps, water bottles, ice cream sticks, used plastic bags, etc., spurred the group onto greater efforts. For the group, the dream of writing a book for thousands of teachers across the state was itself awe inspiring, and it kept them going. Another slogan that we established in the early days in the name of enquiry and exploration, was, *'Karo! Vichaar Karo! Dubara Karo!' (Try! Think! Try again!)*

As the workshop dates approached nearer, we shifted base from the Technical Support Group (TSG) to SCERT, Gurgaon, Haryana. The conference room was soon littered with materials which otherwise would have been termed as 'junk'. Slowly, this junk was being converted into exciting experiments. Water bottles with balloons showed that air indeed occupies space. Plastic milk bags showed that pressurized air could even lift a person.

Dry pieces of cloth could act as siphons, camera film containers acted as pumps, balloons could be stuck to the walls, marbles were used like bearings, matchboxes jumped up like frogs...each of these activities had a wealth of fascinating science to be explored and understood. We managed to link all of these to those cryptic textbook statements!

Two incidents can never be erased from my mind – the first had to do with a curious professor of mathematics education at the SCERT who had walked in to see what we were up to. He was given a mineral water bottle, with a balloon fixed across its opening, hanging inside the bottle. When asked to blow the balloon inside the bottle, he found to his consternation that it wouldn't expand. He went away, muttering that there was some 'problem' with the bottle or the balloon! He came back later to realize with a shock that the balloon could not be blown inside the bottle because there was something inside the bottle that occupied space – air! Despite their best efforts, some members of the group who were trying to 'prove that 20% of the atmospheric air is made up of oxygen', failed. In the classic experiment of the burning candle in the water container with an upturned glass tumbler, the water always rose to occupy *much more* than a fifth of the glass tumbler much to everybody's frustration, thereby violating the 'facts' as presented in most textbooks! So, there was a great deal of discovery, learning, and more importantly, *unlearning* for many of us.

The process of writing the handbook was equally interesting and challenging. There was a debate on including the 'explanation' for each experiment. Some favoured the easy way, suggesting that we write the explanation at the end of each experiment. How would the teachers know otherwise? Others, who were a bit more adventurous, felt that the teachers and children should themselves discover the meaning behind each experiment. We would only write about the materials required and indicate the basic instructions to be followed. Eventually, the latter view prevailed. So we left an empty box on each page for the teacher to fill. Similarly, another box was left empty for the teachers and children to write about phenomena that they saw or experienced in their environment that illustrated an interesting principle. It would not be an exaggeration to state that this is perhaps the only Govt. primary school handbook with spaces for the teachers to fill! We chose catchy names for each experiment like *"Are, Ye Pani kahan se!" (Hey! Where has this water come from?")* We even gave a list of references at the end of the book. There was another list of locally available materials that could be used for the experiments. All in all, we gave our imagination the best shot in the making of this book. Last, but not the least, the naming of the book – Tushar suggested *Nanhe kadam Vigyan Ke* (Small steps *of* Science), but the group felt that *Nanhe Kadam Vigyan Ki Or* (Small steps towards science) was better. So we left it there, enriched by all the small steps that we had taken towards that effort.

The mela itself was lively; there were hundreds of participants from all over the state. The science group did a commendable job.

As I write this, I wonder – how far has this book reached? Has it made the life of the child and her teacher in DPEP Haryana more exciting and filled with a joy of discovery? It is one thing to write an interesting book, but quite another to make that book work in the harsh and complex reality of our schooling system. We can only hope that it has made some difference. We do realize however that many more *Nanhe Kadams* will have to be taken...

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Readers, if interested, can obtain copies of the handbook from the State Project Director, Haryana Prathmik Shiksha Pariyojna Parishad, SCO 170-72, Sector 17C, Chandigarh - 160001

EVS Intervention in DPEP Assam

Uttam Bordoloi

In DPEP, different states have initiated their pedagogical renewal process based on their pedagogical vision and needs. Accordingly their approach to EVS teaching varies. DPEP, Assam has tried to design its EVS teaching basically to encourage children to observe their own surroundings, collect information, analyse the data, arrive at conclusions and apply the experience in real life situations. Nature camps, Shishu Melas, school development initiatives of Mother's groups and Self Help groups, Maa-beti Mela, plantation exercises, community museums, community library, contribution of community teachers, etc. are some of the significant activities in Assam. Simple science experiments like collection of seeds, seed germination, soil test, etc. are being done as a part of normal day-to-day activity in nearly every school. Let us have a look at some of their significant initiatives.

Textbooks : The state has developed textbooks of a different type in the name of *Samal Sambhar* (meaning resource material). These have been further improvised in the form of *Karma poothi* (Work book) and *Shikan poothi* (Learning book). These books carry several symbols and simple instructions which children understand comfortably. As per the instructions, they collect the materials, read the lessons, experiment, collect data, discuss and draw inferences. The teacher on all occasions keeps on catalyzing the process steadily.

The following aspects are taken care of in *Samal Sambhar*.

- Linkage with learner's experience
- Discussion in groups followed by individual tasks.
- Children are gradually led to explore, anticipate, verify, analyse and infer.
- Discussion of learning experience with family members / neighbours etc.
- Supplementary reading material developed with the help of the community.
- Additional information to teachers to explore further EVS issues.
- Extensive use of locally available TLMs.
- Extensive use of low-cost material like maps, slates etc.

Some Samples

EVS activities in 'Samal Sambhar'.

1. Collect some popular stories from your grand mother and other elderly persons. Write the stories in your own words and put in the library.

2. Look at the picture and relate it with what you see in the sky; discuss with your friends.

3. Discuss with the mother's group about the disease chart and think about the precautions that need to be taken to prevent common diseases.

4. Discuss with fisherman about the variety of fish available in the locality, and find out about the fishes that are now extinct.

5. Discuss with the Student Government about the absentees in the school; discuss with parents about the agricultural calendar.

6. Collect from the village old coins; tickets; materials etc and write a note on each giving the date of collection; the nature of the collected material and the name of the donor, and keep them in the 'Learning Centre'.

Field level innovations

1. Community Museum – Some Cluster Resource Centres have been converted into a Community Museum where entire socio-cultural and economic background of the locality has been reflected in the Museum. Old coins, very old hand written books; materials used by people 2 to 3 hundred years ago, and other historic materials are all collected from the community. These centres are used by the nearby schools to discuss, reflect and analyse the materials. Some good examples of such museums are seen at Hanumanaghat CRC, Bhurbendha Block in Morigaon district.

2. Nature Camp – The children of the school along with the teachers move around the locality on holidays to collect different types of specimens from the locality. Then they organise them by classifying, naming and labelling them. These are then discussed with the community members.

3. Documentation of different aspects of the village and use as the supplementary book in the school library.

4. Community teachers – community resource persons, such as craftsman, farmers, singers, actors, players etc. are encouraged to come to schools and take classes.

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SCHOOL SCIENCE

FOR INDIA OF TOMORROW

In April 2000 a two day symposium on 'School science for India of tomorrow' was organised by the National Academy of Sciences at Allahabad. About 60 scientists, university teachers and educators attended this symposium. Extracted here are some of the views and recommendations of the symposium.

Content and Methodology of Science Education

1. To be effective, science education must be appropriate to and be based on the environment in which the child lives. Especially at the earlier phases of school education, the child must learn science, using examples that s/he is familiar with. S/he must be encouraged to carry out the processes of science at her/his own level, by developing the faculties of observation, measurement, logical thinking and hypothesis formation and testing. School science must enable a child to appreciate beauty of nature; it must evoke in her/him a sense of joy and wonder and must provide a way to provoke and satisfy natural curiosity.

2. To be sure, science education must be based on exploratory activities and experiments. (It must be emphasized here that the word "experiments" should not be interpreted in the narrow sense of laboratory experiments, with Aims, Apparatus, Procedures, Observations and Conclusions). These activities should be so designed as to ensure that they can be easily carried out, using locally available materials.

3. A compendium must be made of such activities and experiments. Such a compendium may be prepared at the national level, but it would be the task of the school teacher, the DIET and resource persons from other similar institutions and NGOs in a particular region, district or locality to adopt and adapt these activities. The activities must be open-ended and must not be aimed merely at verifying a known law of science.

Throughout the school system, every attempt must be made to link activities undertaken at various stages with each other and with the environment. Thus, for example, the child could study the same phenomenon in different ways appropriate to her/his capabilities. Relating activities to the local environment would result in the production of a work force that is in empathy with the needs and requirements of the community and could actually be encouraged to get involved in dealing with the various environmental problems or problems faced by the community. This would emphasize the beneficial face of science, help create scientific temper and encourage leadership.

4. While, as has been stated above, science learning must be based on the child's experiences in primary schools, at higher levels, it is necessary to draw upon other people's experiments and experiences. This is made even more necessary today due to the explosion of unrefereed information through sources like the Internet. The student must be enabled to comprehend such experiences, to analyse them, to arrive at conclusions based on them and to judge the reliability of the conclusions drawn by others. Such activities would also make the child realize that science is an ongoing activity, not a completed one and would instil a healthy disregard for Authority and a questioning attitude in the student.

5. In addition to performing activities of the kind outlined above, the student should be encouraged to articulate her/his experiences, observations and conclusions. Needless to say, such articulation should not be in the "Lab Notebook" form, with prescribed formats, but should be as much an act of creativity for the child as performing the activity itself is.

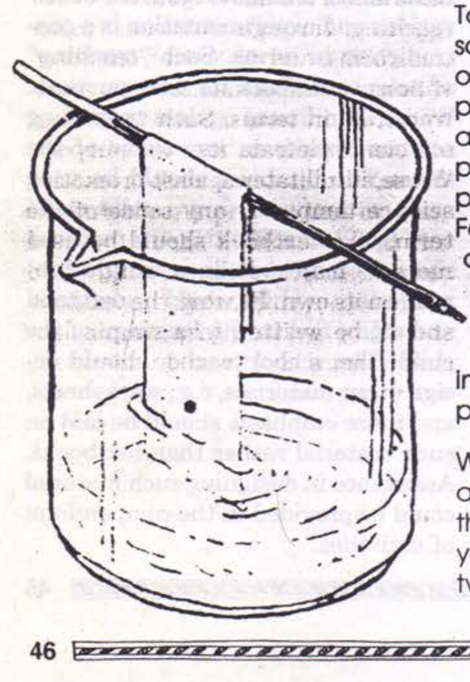
6. It is needless to emphasize that a dependence on textbooks, especially those written or approved by a central authority, would go against the basic aim of the above system. Science teaching, through textbooks, inside classrooms, and divorced from observations and experimentation is a contradiction in terms. Such "teaching" of science defeats its own purpose. Worse, it militates against promoting science temper in any sense of the term. The textbook should be used more as material that a child could read on its own. For this, the textbook should be written in a simple language that a child would understand and enjoy, and in the language of the child. The school teacher should design other materials, e.g., worksheets, and more emphasis should be laid on such material rather than textbooks. Assistance in designing such material could be provided in the compendium of activities.

ACTIVITY POOL

This time we attempt to expose our readers to several simple experiments in science teaching by extracting a few interesting activities from various publications.

Bal Vaigyanik

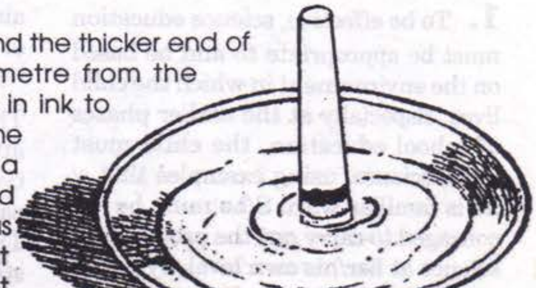
(Eklavya, MP): *Children are curious and inquisitive by their very nature. Inside each child lies a scientist eager to explore and discover the world around her/him. Teaching of science must help this trait in each child to develop, grow and flower to her/his full potential. The teacher has to act as a guide to help the children to discover the hidden phenomena, experiences, laws of nature and scientific principles around them.*



Separation by Chromatography

Experiment 1:

Paint a heavy ring of black ink around the thicker end of a stick of chalk about one centimetre from the bottom (you can dip a matchstick in ink to paint with). Let it dry. Then pour some water in a saucer or bottle cap to a height of about half a centimetre and stand the chalk erect in the water (as shown in the picture). Just ensure that the stained end of the chalk is not completely immersed in water.



Does water rise up the chalk? Does anything else happen? Remove the chalk before the water rises to the top of the chalk. How many different colours can you see on the chalk? Make a diagram to show the sequence of colours.

Where did these colours come from?

Experiment 2:

Take a beaker and a used refill. Pour some water into the beaker to a height of about one centimetre. Now cut a piece of filter paper 4 cm wide and about 12 cm long. Using the tip of a pin, place a tiny drop of ink on the filter paper about 2 cm away from one end. Fold the other end of the filter paper and place it on a refill in such a way that the inked end dips in water in the beaker (see the picture). Ensure that the drop of ink is not immersed in water. Nor should the strip of filter paper touch the beaker at any spot.

When the water rises on the filter paper and ascends to near the refill, remove the filter paper and let it dry. (Note: if you cannot get a refill, use a straight twig.)

How many colours can you see on the filter paper strip? Depict them with a diagram.

Repeat this experiment with inks of different colours.

Answer the following questions after discussing with your teacher:

- How many different coloured substances are found in blue ink?
- How many different coloured substances are found in red ink?
- If you mix red and blue ink, do the coloured substances they contain remain as they are or do they react with each other to create new substances?

Small Science

(Homi Bhabha Centre for Science Education, Mumbai): *Primary school students, particularly in rural areas, have rich interactive experiences of natural world. But lacking systematisation and clear expression, their observations and skills do not contribute to school learning. Urban students from literate homes, on the other hand, are often encouraged to ignore their natural surroundings and to concentrate on meaningless bookish learning. As a result, most students miss out on the concrete experiences of systematic observation and self expression, which are so vital to science, learning through the rest of their lives.*

Example: How long, how high, how far?

1. Growing taller

On a wall at home, mark how tall you are. Every few months, check if you have become taller.

2. Tall and short

a. Stand next to a friend and check who is taller. Write the name of one student in the class who is taller than you and one who is shorter than you.

Will the tallest and the shortest students be able to write these names? Say why.

b. Think and do!

Before you start counting, *think* about how you will do this:

Count the number of students in your class who are taller than you.

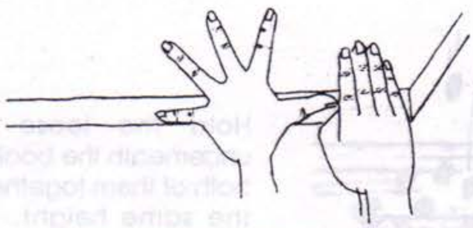
Count the number of students in your class who are the same height as you. (Do not forget to count yourself!)

Count the number of students in the class who are shorter than you. Add the three numbers that you got.

3. Measure with your body

a. Which is longer, your finger or your nose?

b. How long is the table? Use your hand span to measure it. See what other things you can measure with your hand span.



Do the next four activities at home:

c. How long is your arm-span? How many hand spans fit into your arm-span?

d. Use your arm span to measure the length of a wall in your house.

e. Lie down on the ground and ask a friend to mark your arm span with a piece of chalk. Now check if you are taller than your arm span or shorter.

f. Walk across the room like this.

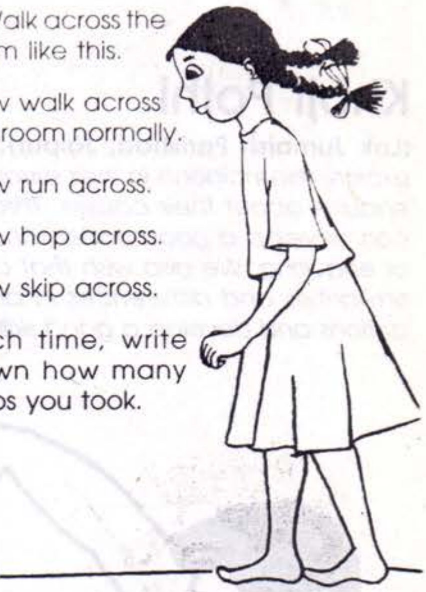
Now walk across the room normally.

Now run across.

Now hop across.

Now skip across.

Each time, write down how many steps you took.



4. Measure with other things

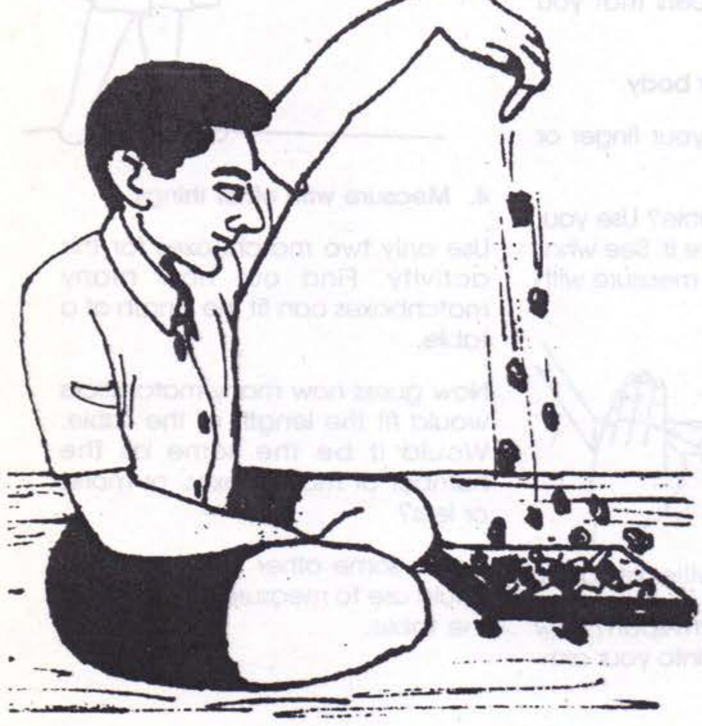
Use only two matchboxes for this activity. Find out how many matchboxes can fit the length of a table.

Now guess how many matchsticks would fit the length of the table. Would it be the same as the number of matchboxes, or more, or less?

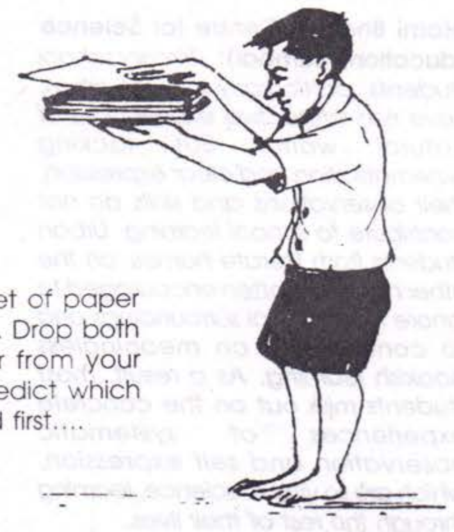
Name some other things that you could use to measure the length of the table.

Khoji Pothi

(Lok Jumbish Parishad, Jaipur): *We wish children explore the incidents in their surroundings in detail and enquire about their causes. Through these children can develop a good understanding of their process of enquiring. We also wish that children discover the similarities and differences in different objects and actions and develop a good skill of making patterns.*



Hold a loose sheet of paper on top of a book. Drop both of them together from your head's height. Predict which will hit the ground first...



Hold the loose sheet underneath the book. Drop both of them together from the same height. Guess which one will hit the ground first?....

Hold both the book and sheet separately. Drop them together from the same height. Which one will reach the ground first?

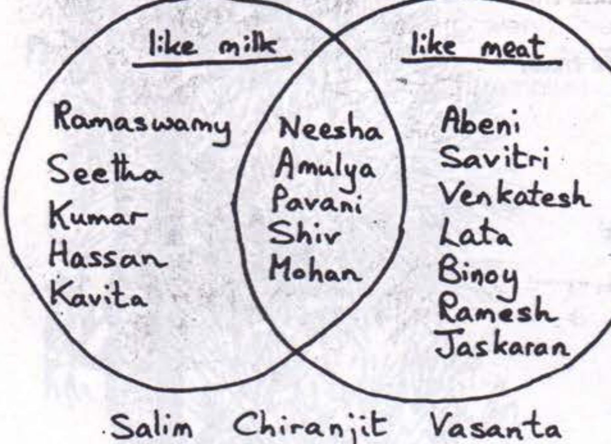
Example: Think and say

Many times you might have dropped paper, feather, stone etc. from a height on the floor. Can you say which object takes the maximum time to touch the ground? Which object reaches fast?

Take 5-6 such objects and drop all them from a good height at the same time. Tell which object reaches ground first? Which object hits the ground last?

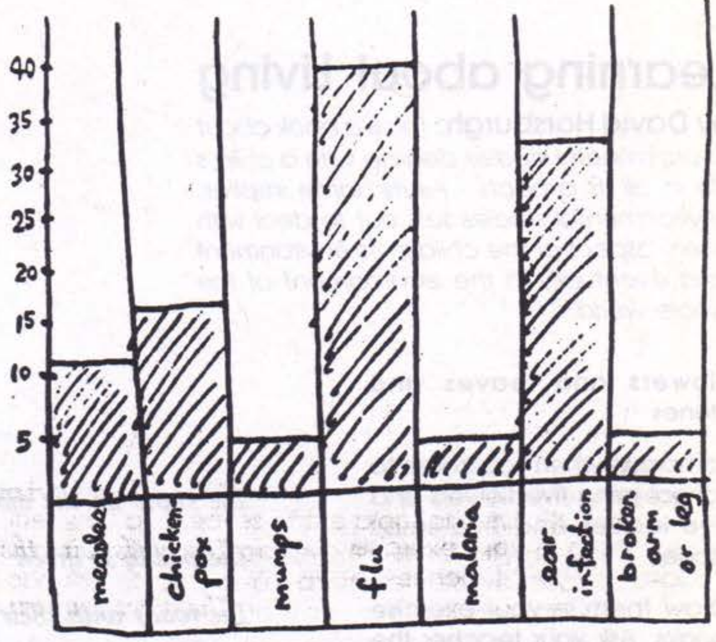
The Blackboard Book

by Eleanor Watts (Sangam books, Orient Longman, 1993): *A textbook cannot provide material about the immediate surroundings of the school. It is now widely agreed that learning should start from the familiar environment, from the experiences of children. A visit to the zoo, a survey of the area round the school, a graph about children in the class – each of these is an important learning activity. However, no accompanying written work can be given in a textbook because it is designed for a general public. The board enables you to devise work around the experience of your own pupils. Use the board to teach about your environment.*



Venn diagrams

Venn diagrams help to establish the important concept that some things can belong to two or more sets at once. Using data from your own class, you can build up Venn diagrams on the board like this one.



The Human Body

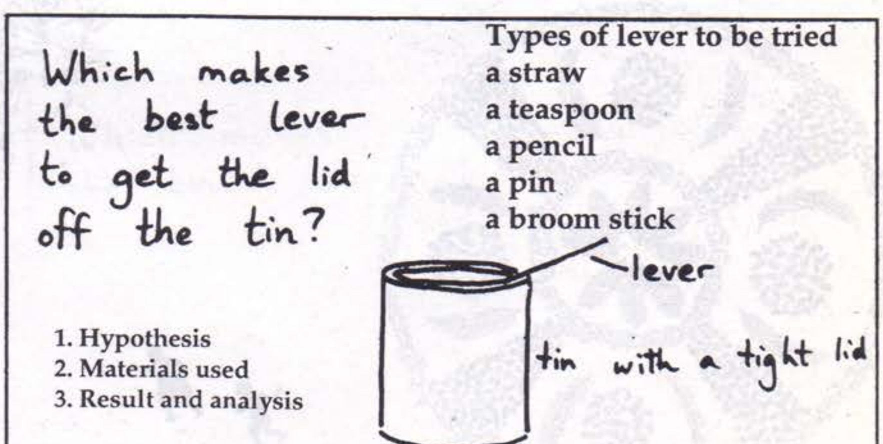
Do a class survey of the illnesses and injuries the children have had. For example, ask the children who have had measles to put up their hands. Count them and fill in the block graph. Do the same for the other illnesses listed. It might look like this:

After you have finished the graph, ask the children to analyse the results. For example, more people have had chicken pox than measles. Malaria is not common in our area.

N.B. You may wish to get the children to copy the list and ask their parents before you complete the graph.

Levers

Give different groups in the class the materials you have listed on the board. Get them to discuss what makes a good lever of this kind. For example, the straw may be too bendy, the broom stick too brittle, the pin too short, the pencil too thick. Get them to write up the experiment in three paragraphs under the headings shown. Do not discuss other types of lever yet as the children may be confused by them.



Learning about Living

by David Horsburgh: *This is a book about Environmental studies dealing with a child's life in all its aspects. As its name implies, Environmental studies sets out to deal with every aspect of the child in its environment and eventually in the environment of the whole world.*

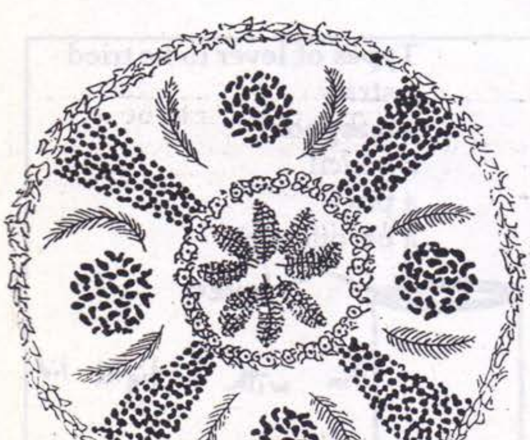
Flowers and leaves and stones

Tomorrow when you come to school bring five flowers and five leaves and five small stones.

Draw them in your exercise books. Ask your teacher the names of the flowers.

Ask your teacher the names of the trees.

Take all the leaves and flowers and stones to the playground. Ask your friends to bring their leaves and flowers and stones too. Put all the things in a circle and make a pattern, like this :



The snow on the mountains

The paddy so green

The roads with their shade trees,

The quiet country scene

The ghats and the cities

The towns and the plains

The birds and the forests

The earth when it rains

My friends in the village

My parents at home

My country is India

And I'll never roam

- David Horsburgh

General Science
for Primary Schools (3 Volumes)

NCERT, New Delhi: *Why teach science to children ? The effective way to approach the answer to this question is to analyze what is the nature of science and what is it that scientists do? Unfortunately there are wide misunderstandings about these things. There are many who believe that science is simply a collection of theories and principles, facts and formulas, special methods and scientific names. They believe that a scientist is one who has learnt all such things and is prepared to draw upon his memory in his scientific work. This description is far from accurate. Science is more than a collection of knowledge; it is also the intellectual activity in which scientists are engaged. That is, science is not just a subject – it is also a pattern of methods for solving real problems, large and small, scientific and otherwise.*

Investigation: How are cocoons formed by larvae ?

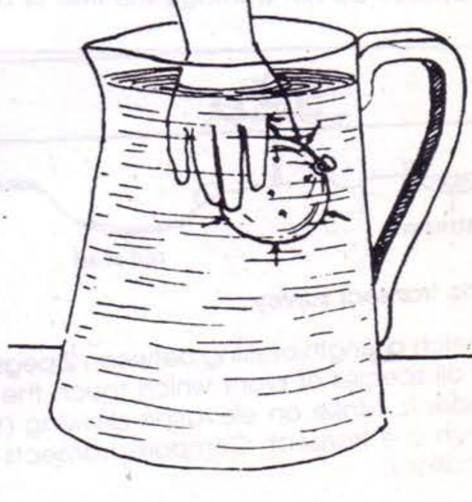
Materials required: moth larva, twigs, leaves, shoe-box, cellophane.

Make a transparent window in a shoe-box by replacing part of its wall with cellophane. Put a caterpillar (larva of a moth or butterfly) inside this box along with the twigs and leaves of the plant on which it is found, as shown in Figure . Invite children to observe it periodically for about three weeks. They will observe that the larva is at first very active in eating leaves, etc. After about a fortnight the larva starts spinning the cocoon. Then it remains inactive inside the cocoon. After some days the adult insect comes out of the cocoon as a completely changed animal.

Ask children to discuss with their parents which is better for making cloth – natural silk (from the silkworm) or artificial silk and other synthetic fibres.

Investigation: In what direction is under water force exerted?
Materials required: large jar (preferably of glass), round balloon

Inflate a small round balloon. Now lower it as deep as possible into a container of water while the students observe. Point out that if the pressure beneath the water is exerted downward only, the balloon will become flatter. But if the pressure is exerted in all directions, the balloon will become slightly smaller, but will retain its original shape as shown in the picture. Students' own observations will readily verify that the balloon is not flattened. Hence, pressure beneath the water must be exerted in all directions.

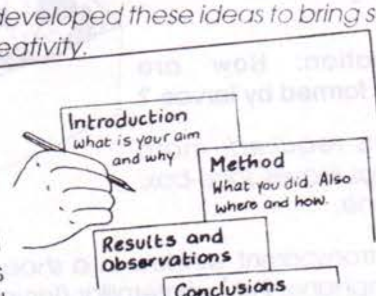


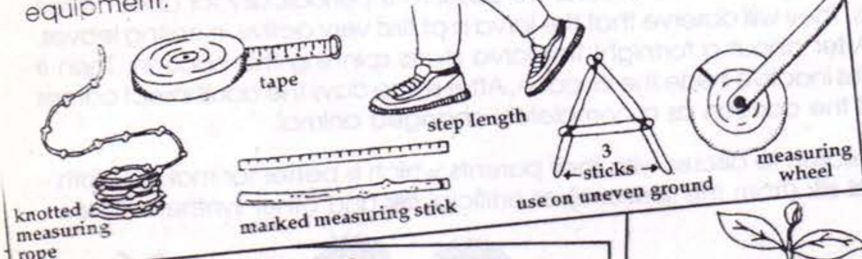
The Science Teachers' Handbook

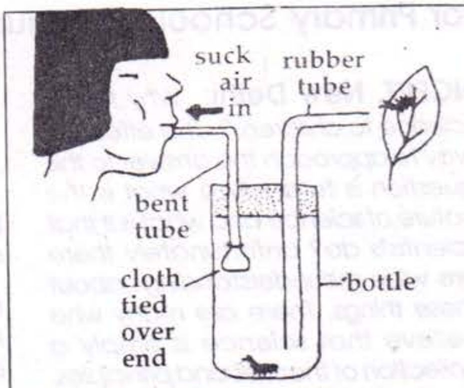
VSO (Voluntary Service Overseas) book: *The Science Teachers' Handbook is full of exciting and practical ideas for demonstrating science in even the lowest - resourced classroom. VSO teachers and their colleagues in over 50 countries (since 1958) have developed these ideas to bring science to life using local resources and creativity.*

Recording and Measuring

When you visit a natural ecosystem try not to disturb the animals and plants too much. Write clear records of what you discover on the spot. One recording method is shown here together with useful equipment.







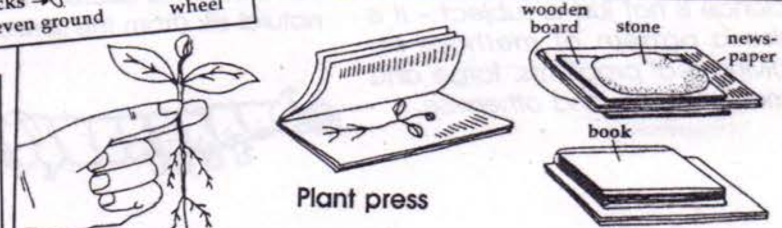
Collecting small insects

Place the tube near the insect. Suck in air through the bent tube and the insect near the mouth of the rubber tube will be drawn into the bottle. The tubes can be made from bendable straws or from a ballpoint casing bent in heat.

Beating a tree

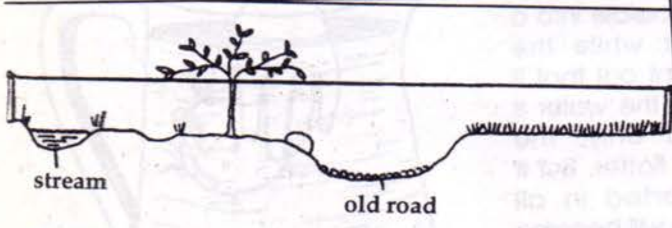
Put a newspaper or large white cloth under a tree or bush. Beat the branches with a long stick being careful not to cause any damage. The creatures fall onto the paper. Examine and record what you find. If you take creatures away from study return them to where you found them afterwards.

Check nothing dangerous is living in the tree before you beat it or there may be a few surprises! Do not damage the tree or bush.



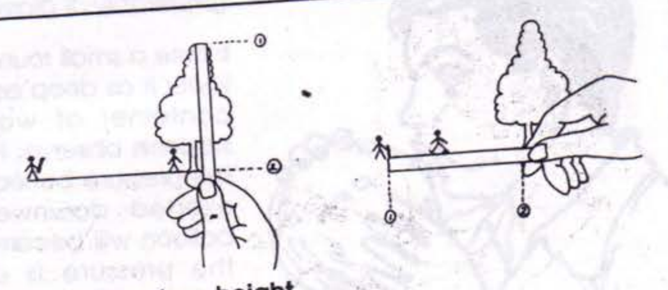
Plant press

Collect samples of local plants. Find out the local and scientific names and label the specimens. Place each specimen between pages of newspaper. Place the boards on either side of the newspaper stack and put a heavy weight on top.



Line transect survey

Stretch a length of string between 2 pegs. Make a list of all species of plant which touch the string or lie under it. Make an elevation drawing (to scale) of each line transect. Compare transects in different locations.



Measuring tree height

Line up the top of the tree with the top of the stick (point 1). Move the fingers to the bottom of the tree (point 2). Turn the stick, keeping the finger in exactly the same place on the stick. Ask a student to walk from the base of the tree until you shout 'stop'. Measure the distance of the student from the base of the tree.

UNESCO Sourcebook for Science in the Primary School

Wynne Harlen and Jos Elstgeest (NBT India, 1992): *The environment of every school is full of information and full of illustrations. It is also rich in materials to work with, almost all for free. As a rule, the school environment is very close (and appropriate) to the daily experiences of the children in their own familiar world. The familiarity of the environment might be a drawback in so far as it can lead to taking things for granted. Some effort is therefore required to delve into the unknown parts of this well known place.*

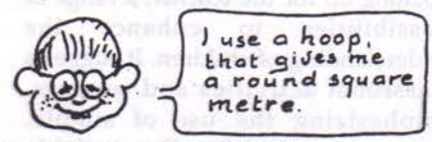
Help the children to approach their environment, or aspects of it, with a new, scientific look, so they learn to view it as a whole, in all its complexity. Some activities suggested here do just that: working on a minifield, or a transect, means observing it as a community in which we try to unravel relationships and interdependence and other influences.

Working on a minifield

Choose a piece of ground which, for some reason or another, looks interesting.

It need not be of uniform appearance.

Use sticks, slats or string to mark or peg out a square of, say, 1x1 metre.



Now study this minifield carefully and map it :

- What lies there?
- What sits there?
- What moves there?
- What crawls there?
- What creeps there?
- What grows there?
- What digs or dug there?
- What lives there?
- What made a home there?
- What lives there?
- What made a home there?

If you take a convenient shape and measurement, then it is very easy to map things accurately:

Various kinds of plants, objects, stones, holes, seeds, fruits, seedlings, animals, droppings, peels, throw-aways, and other bits and pieces:

Try and see if you can find relationships between any of those things you find in your minifield:

Relationships ....

...between individuals of one kind,

...between different kinds,

...between plants and animals,

...between plants and things,

...between animals and people,

...between animals and things,

...between things and people.

Could you write down what you find or think?

You may draw,
or sketch, or paint to make it clear.

Better: talk about it first.

Look also for relationships between (things within) the minifield and (those in) the larger world without.

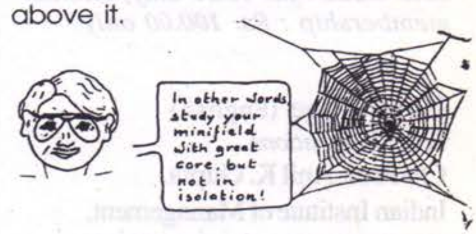
Perhaps somebody passes through your minifield.

- Where from?
- Where to?

Seedlings come from seeds... From where come the seeds? Can you find parent plants around? Where? Many? Far away?

Leaves lying about...were blown from where?
Can you find trees somewhere near? Do they have similar leaves?

Look carefully, too, at what sits and lives underneath, and at the bottom of your minifield.... And do not forget to look at what hangs above it.



If the children compare their findings recorded on their minifield maps it would add meaning to their conception of the character of a larger area.

Useful Publications and Reference Materials

Chakmak (Hindi) *Eklavya,* E-7/HIG-453, First floor, Arera Colony, Bhopal, MP - 16

Chakmak is a monthly magazine for children, focussing on science and other areas. It seeks to demystify science and provide an entry point for children to explore its varied and exciting areas without being overawed. It caters to their curiosity by urging them to make, build and do things. It encourages them to look at their society, environment and themselves from different stand points, and enter into lively debate with each other.

Each issue : Rs. 10.00 only; Annual membership : Rs. 100.00 only.

Honey Bee (English)
Sristi Innovations
C/o Prof. Anil K. Gupta,
Indian Institute of Management,
Vastrapur, Ahmedabad 380 015

Supporters Rs. 500
***Farmers/NGOs** (without foreign aid)*
Large : 150/- Small : 50/-
Student : 100/-

Hoshangabad Vigyan (Hindi), *Eklavya,* Sandiya Road, Pipariya, Madhya Pradesh - 461775

Touches upon different aspects of science teaching and the experience of the innovators in the field.

Each issue : Rs. 3.00 only; Annual membership : Rs. 30.00 only.

Sandarbh (Hindi), *Eklavya,* Kothi bazar, Hoshangabad, Madhya Pradesh - 461001

It provides supplementary reading material on various themes and discusses developments in pedagogy, opening up for the teacher, a range of possibilities to enhance the understanding of children. It suggests classroom activities and projects, emphasizing the use of simple, inexpensive and locally available materials.

Each issue : Rs. 15.00 only; Annual membership : Rs. 75.00 only.

Srote (Hindi), *Eklavya,* E-7/HIG-453, First floor, Arera Colony, Bhopal, Madhya Pradesh - 16

Srote places science in today's context. It has been launched to enhance the quality and quantity of S & T coverage and understanding. It also provides reference materials for teachers, students and various institutions. Its three key components are a resource centre, a weekly feature service and a monthly compilation.

Each issue : Rs. 12.00 only; Annual membership : Rs. 150.00 only.

Gyan Vigyan (Hindi) *Prativesh,* East and West Centre for Environmental Education, Patna.

The magazine meant for teachers and others interested in science and education tries to initiate dialogues and debates on issues related to science, mathematics, environment and people's science.

Each issue : Rs. 12.00 only; Annual membership : Rs. 150.00 only.

Aviskar (Hindi) *National Research Development Corporation,* 20-22, Jamrudpur Community Centre, Kailash Colony Extension, New Delhi - 110048

A popular monthly science magazine.

Each issue : Rs. 80.00 for individuals, Rs. 100.00 for institutions.

Resonance (English) *Indian Academy of Sciences,* C. V.Raman Avenue, PB No. 8005, Bangalore - 560080

This magazine focuses on the research issues on Science education and is pitched at high school and higher secondary level. But can be useful to DIETs, BRCs, SRG and SCERT level as a resource magazine.

Single copy: Rs. 15:00 only; Annual membership Rs. 180:00 only

Science Reporter (English) and **Vigyan Pragati** (Hindi), *CSIR, Dr. K.S. Krishnan Marg, Near Pusa Gate,* New Delhi-110012

This monthly magazine highlights the various aspects of scientific developments. Some of its issues and articles are based on science teaching.

Jhilmil Jugnoo (Hindi), *Prativesh,* East and West Centre for Environmental education, Patna.

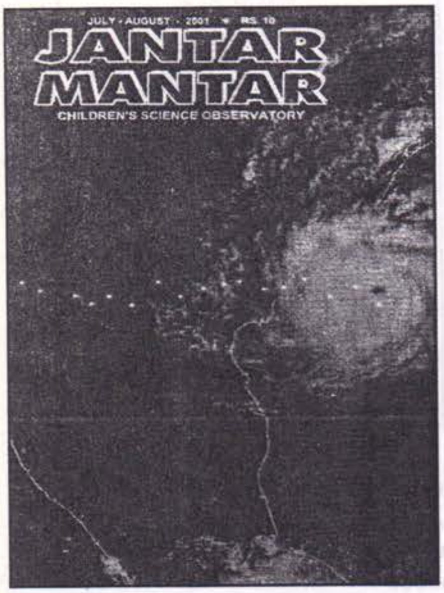
It aims at encouraging children to explore the surroundings with open mind and eye, discover the beauty of diversity in living and non-living world and share the excitements with others through creative expressions.

Single copy: Rs. 15.00 only; annual membership Rs. 160.00 only

Vigyan Alok (Hindi) Lucknow

This monthly journal brings into light the different aspects of science and technology in lucid language.

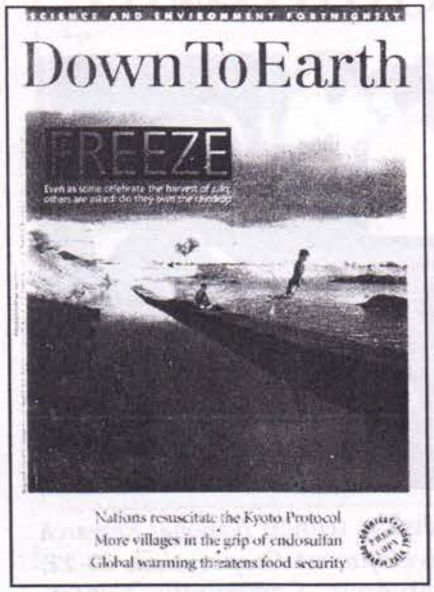
Single copy: Rs. 10.00 only; annual membership Rs. 110.00 only



Jantar Mantar (English)
Children's Science Observatory,
130/3, Avvai Shanmugam Salai,
Gopalapuram, Chennai 600 086.
Published by Tamil Nadu Science Forum, Chennai and *All India People's Science Network*, New Delhi

It serves as a regular observatory for sensitizing children, teachers and general readers about history and development of science, social implications of Science and interesting events in scientific development.

Single copy: Rs. 10.00 only; annual membership Rs. 60.00 only



Down to Earth (English)
Centre for Science and Environment,
41, Tughlakabad Institutional Area,
New Delhi - 110062.

This magazine touches upon various issues related to environment and development across the world. It can be useful to teachers for updating their understanding on environment on a continuous basis.

Each issue : Rs. 20.00 only.

Gobar Times (English)
Centre for Science and Environment,
41, Tughlakabad Institutional Area,
New Delhi - 110062.

This is a colourful supplement for children that comes free with a subscription to Down to Earth.

Besides these, journals of the following type can prove useful for apprising teachers and educators about the latest developments in science and pedagogy. Some of them are Dream 2047 (Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi – 16), VIPNET news (Vigyan Prasar), Gyan Vigyan Varta (BGVS, C-18, Saket, New Delhi-16), monthly newsletters like News EE and CEENARIO of Centre for Environment Education, Thaltej Tekra, Ahmedabad - 380054. Also there are magazines published by various organisations and newspaper science supplements in local languages which can aware us about various aspects of science and science education regularly.

Collect your copy on an EVS Seminar Bulletin (if interested)

A Seminar was organised at Vidya Bhawan Society, Udaipur in collaboration with Lok Jumbish Parishad and Sandhan of Jaipur between 23rd and 25th November 1995 to discuss about the issues relating to What is EVS, Curriculum Development, Teachers' Training, Materials and methods in EVS, Integration of Curriculum, EVS in non-formal system etc. The report of the workshop can be useful to pedagogues working on different aspects of EVS. Interested persons can collect copies of the report by writing to :

VIDYA BHAWAN SOCIETY
Fatehpur,
Udaipur -313004
Rajasthan

RUN A SCIENCE CLUB......and get help from VIPNET

A weekly or fortnightly Science Club in a school is always a great way to inculcate scientific temper and develop interest in science among children and teachers. Here the children and teacher can get together to read science magazines/books, practise activities related to science and maths fun, study nature, do origami (paper folding), puppetry, sky watching, and bird watching, play games, sing songs, and go for many other creative activities.

The Broad Objectives of VIPNET are :

1. Dissemination of information on science & technology (S&T), which is an essential tool for development.
2. Evolution of a holistic approach towards problem solving through awareness, concern, involvement, and application of the scientific methodology.
3. Stimulation of the spirit of curiosity, enquiry, innovation and creativity through activities that supplement conventional education and make science a very enjoyable and interesting pursuit. Members can also participate in the National Children's Science Congress.

The Department of Science & Technology, Govt. of India is promoting such Science clubs through Vigyan Prasar (VP), its autonomous organisation. The venture to weave together all science clubs, societies, etc. to strengthen the popular science movement in the country is done by its network – VIPNET, i.e., Vigyan Prasar NETwork. Presently VIPNET has about 3500 clubs all across the country.

FACILITIES AVAILABLE THROUGH VIPNET MEMBERSHIP:

a) Get a free subscription to Vigyan Prasar's monthly newsletter "Dream 2047", and access to vast information on S & T through Vigyan Prasar Information System (VIPRIS) and all other communication materials of Vigyan Prasar.

b) Exchange views and ideas, express opinions and gain insights into a vast array of activities taking place in other VIPNET clubs through the monthly VIPNET newsletter.

c) Participate in programmes including trainings and campaigns launched by Vigyan Prasar and/or the National Council for Science & Technology Communication (NCSTC), DST, or their associated agencies.

d) Take on an active role in the National Children's Science Congress (NCSC) as a participant, a motivator, or in any other capacity which would lead to wider participation and deeper penetration of this unique activity.

e) Become eligible to receive kits, posters, books and software free of cost (on first-cum-first-served basis, depending on availability), and rest of the VP publications and other materials at very attractive discount rates.

And much more.......

Contact Address : Coordinator (VIPNET), Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi – 110016.

or,

Mr. B.K. Pattanayak, TSG (DPEP), 10-B, I.P. Estate, New Delhi-110002

SCIENCE RESOURCE CENTRES

the readers can be in touch with:

Eklavya
E-7, H-453, Ist Floor
Arera Colony
Bhopal, M. P- 46201

Homi Bhaba Centre for Science Education
Tata Institute of Fundamental Research,
V.N. Purav Marg,
Mankhurd, Mumbai – 400088.

Uttarakhand Seva Nidhi Paryavaran Shiksha Sansthan
Jakhan Devi, Mall Road
Almora, Uttaranchal – 263601

Digantar Shiksha Evam Khelkood Samiti
Todi Ramjanipura,
Jagatpura,
Jaipur, Rajasthan – 302 017

Bharat Gyan Vigyan Samithi
C-18, DDA Flats, Saket
New Delhi –16

Centre for Environment Education
Thaltej Tekra
Ahmedabad – 380054

(CEE also has Regional Cells in Bangalore, Guwahati, Lucknow, Pune, Coordinating office at Delhi and EE Bank facilities at Ahmedabad, Bangalore, Guwahati, Pune and Tiruppur.)

Centre for Science Education and Communication
10 Cavalry Lane
University of Delhi, Delhi-110007

National Council of Educational Research and Training
Sri Aurobindo Marg
New Delhi-16

All India People's Science Network
New Delhi and its member organisations like KSSP (Kerala), TNSF (Tamil Nadu), PSF (Pondicherry), PBVM (West Bengal), Srujanika (Orissa), etc.

Manavik
Tota Sahi, Masterpada
Phulbani, Orissa - 762001

Jodo Gyan
39/13, Ground Floor
Old Rajendra Nagar
New Delhi – 110060

National Council of Science Museums
Kolkata
and
Regional Science Centres in different states.

Navanirmiti
Discover it
Ravi Nivas, Ganesh Nagar
Querry Road, Bhandoop (West)
Mumbai – 400078.