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A WORD FROM US. . .

You have before you, the revised edition of the Class 7 *Bal Vaigyanik*. We would like to draw your attention to some important aspects of this revision. However, before doing so, we would also like to point out some general features of the *Bal Vaigyanik* series of textbooks, in particular their overall framework and the way in which they are to be used in the classroom.

For most people, the textbook is more than just a base for instruction and information; it is synonymous with knowledge and education. *Bal Vaigyanik* is certainly a base for learning science but the edifice of learning can only be constructed through the combined efforts of the students and the teacher. So it is essential to see how they can use this book in a learning process.

Let us begin by looking at how the chapters are structured. Each chapter takes up a basic concept in science by first posing a problem that is usually related to the life experiences of the students. The problem is broken down and the students are expected to examine its different aspects in greater detail by performing a series of experiments. They then discuss their experimental results in class.

A series of leading questions are posed in the chapter to focus the discussion and guide the analysis to the required resolution. In some cases, the students are asked to conduct a few more experiments to test and verify their conclusions, with some additional logical questions being posed. Common sense and prior knowledge also contribute to the entire process.

Contrast this with the system of education that is generally followed in our schools in which the emphasis is largely on memorising "final results", without going through any procedure of experiment, discussion and analysis. No doubt, conclusions are important in science, but they are not the sole objective of "learning" science.

Bal Vaigyanik ensures that students go through a process of analysis to arrive at conclusions. It is not enough for them to just write answers in their exercise books to the questions posed. What is required is a written record of everything they do. That is what helps test their understanding later on. Scientific temper develops only if students reflect on these questions and discuss them.

The questions are of different kinds. Some relate to recording the observations of the experiments. Some require the students to give more details of their observations. Yet others help them to combine the observations and results of **several** experiments into a single general conclusion. Each type of question has its own **relevance**. So it is important for the teacher to identify and categorise them and **decide on a strategy** for posing them in the classroom.

But the teacher need not repeat the questions, word for word, **from the textbook**. The objective should be to help students undertake **meaningful discussions and analysis** and relate their conclusions to their everyday experiences **and knowledge**.

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MESSAGE

It is a matter of immense satisfaction that the revised edition of Class 7 *Bal Vaigyanik* is being published under the Hoshangabad Science Teaching Programme, which is currently running in 600 middle schools of the state.

It is desirable that educational programmes evolve and progress on the basis of their field experiences. The Hoshangabad Science Teaching Programme has placed a lot of emphasis on analysing its experiences in an organised manner. This new edition of *Bal Vaigyanik* is the collective effort of school teachers, college faculty, educational administrators, scientists and representatives from NGOs.

The *Bal Vaigyanik* workbooks are based on accepted principles of science learning. The strength of the Hoshangabad Science Teaching Programme is that it has successfully implemented these principles in the actual conditions pertaining to government schools. These educational principles are also being adopted by other states and Madhya Pradesh can now be regarded as a pioneer in this respect.

I sincerely hope this initiative in education will progress further.

27 June 2001

(Inderjeet Kumar)

When this happens, we can confidently say that they have internalised new information.

Bal Vaigyanik, thus, serves as a framework for the teaching-learning process in the classroom.

And now, a few words about important aspects of the present revision which, we feel, have enriched the *Bal Vaigyanik* syllabus. Several new elements have been incorporated to strengthen and reinforce the learning process. Study materials and narratives from the history of science have been included in some chapters. Additional scientific information has been given to help the students in the analytical process. Questions for revision have also been included.

The aim is to ensure that studying *Bal Vaigyanik* is both an educative and enjoyable experience. Only then will students be excited about learning science. Only then will they develop the curiosity and ability to learn about the world around them.

With all best wishes. . . .

The Eklavya Group

Two words

It is, indeed, a matter to rejoice that *Bal Vaigyanik* Class 7 is here to initiate a fruitful dialogue between teachers and students.

What exactly is science? It is a subject that was born and evolved through dialogue - a dialogue between humans and nature. Faced with the immense diversity in nature, humans began asking questions - how, when, where, why? Humans sought to unravel the mysteries hidden behind events occurring in nature - Why does the sun shine? Where does it hide between sunset and sunrise? Where does water come from when it rains? Why does lightning strike? Why do the tides in the seas ebb and flow? Why are leaves green? Why don't fish die when they are immersed in water? And so on.

Humans became scientists in the process of searching for answers to such questions. This process did not evolve in a few days. Information was gleaned, little by little, over years, over centuries. Sometimes scientists arrived at wrong answers, but they kept moving ahead in their quest till they found the correct path .

The beauty of science is that the subject keeps developing and adding to its storehouse of knowledge. It keeps fine-tuning and embellishing this knowledge. Earlier beliefs are discarded when they are proved wrong by newer information. This process of constant renewal is what brings a feeling of freshness to science.

This renewal is achieved in two ways - through theoretical discussions and mental churnings and through experimentation and testing.

For example, Aristotle (384-322 BCE) believed the earth was stationary and the planets and stars revolved around it. Five centuries ago, Copernicus put forward a new theory in which he stated that the sun was stationary at the centre of the solar system, which included the planet earth. It was through a process of actual observations that the Copernican theory was eventually accepted as a better interpretation of the reality than the Aristotlean theory. Galileo furthered this tradition of experiment and verification in science, while Newton gave an impetus to the theorising aspect. Both scientists lived and worked during the 17th century.

During Galileo's time, people indulged in verbal debates only, to settle contentious scientific issues. Galileo questioned this approach, saying, "What can we discover by discourse alone ... come, let us do an experiment and find out."

So science is a subject that arises from an inherent curiosity; asks questions about contentious issues; and then finds answers to these questions through a process of hypothesising, experimentation and observation.

It is, indeed, a matter of great appreciation that the *Bal Vaigyanik* textbooks have adopted this path of science. However, the *Bal Vaigyanik* experiment can be considered successful only when the teacher encourages the student to ask questions and look for answers. It doesn't matter whether the questions appear strange, or if their answers cannot be found in the textbook. It is the duty of the teacher to ensure that the doubts of the students are resolved, even if it means referring to books from outside the syllabus.

I sincerely hope that this project of the Madhya Pradesh government and Eklavya is successful in bringing science closer to children.

जयंत नारलीकर

Jayant Narlikar

June 2001
Inter-University Centre for
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Pune

Jayant Narlikar was the director of the Inter-University Centre for Astronomy and Astrophysics (IUCAA) and played a key role in setting up the centre. His research interests include working on a hypothesis related to the birth and evolution of the universe. He has written popular articles on astronomy in Marathi and Hindi and written several science stories, including a collection titled *Comets*. He has also written *Aagantuk*, a science novel.



Dear friends,

Congratulations on reaching Class 7!

You must have conducted a lot of experiments in Class 6 and continued that process during your summer vacation in your home laboratory, fields and playgrounds. You also must have gone on several field trips in the course of the past year. Were you able to complete all the experiments in Class 6? If you haven't, try and find the time to do them this year.

Before embarking on the experiments in Class 7, take a second look at your Class 6 *Bal Vaigyanik* and exercise book. We hope you haven't thrown them both in the dustbin. That would cause a real problem because the chapters you will be taught in Class 7, are based on what you learned in Class 6. In the same way, what you learn in Class 7, will form the basis of what you learn in Class 8. So preserve your Class 6 textbook and workbook and also your Class 7 textbook and workbook.

After having performed all those experiments in Class 6, you must be quite familiar with the items in your science kit. By now, you also must have realised the importance of maintaining your kit. Continue that process this year and look after your kit well.

The chapters in this textbook have been arranged in a particular sequence. We spent a lot of time in discussing this issue in depth before arriving at the final sequence. What you learn in one chapter will help you to understand subsequent chapters better. For example, you will find it difficult to understand the chapter "Reproduction in plants" if you haven't first gone through the chapter

"Recognising flowers". Similarly, it is essential to not only do the chapter "Gases" before attempting to understand the chapter "Respiration", but also to first complete the chapters "Some games with air" and "Volume". They are all linked, so try and do the chapters in the given sequence.

You must be aware that your *Bal Vaigyanik* is constantly going through a process of revision. Have you ever wondered what the basis of each revision is? The revisions are mainly based on the experience of teaching each chapter in the classroom. We learn about this experience in many different ways. For example, while you are doing a chapter, your teacher notes down where you are experiencing problems, which experiments are difficult to do, what improvements need to be made in the experiments, etc. All the teachers then discuss their observations at the regular monthly feedback meetings they attend. Apart from this, you must be familiar with the person who visits your school regularly to follow-up and observe what is being done in the classroom. S(He) also helps you and your teacher in many ways, by explaining your doubts and giving new information. Also, there are the questions you ask Sawaliram, to help you prepare for your examinations.

We learn about the problems you face in studying *Bal Vaigyanik* through all these different methods - where it is necessary to make changes and revise the chapters, what additional information needs to be given, what unnecessary information needs to be removed, what information needs to be further simplified, etc. It is on this basis that we revise the book from time to time. Just think about it. Would we be able to improve this book if you did not perform the experiments and did not ask questions?

There is one more thing you need to bear in mind. Your book has several long-duration experiments that have to be conducted over several days. Take special care while performing these experiments. You will need

to make detailed observations at specific intervals, so you must have the patience to wait till the end of the experiment before reaching the desired conclusions. You shouldn't fall into a situation where you begin the experiment and lose track of what you had done earlier.

The number of letters I receive from you and your teachers, makes it obvious that you have a lot of questions to ask. Probably, your list of questions will get longer in Class 7. Don't ask only those questions related to your problems in the classroom. Ask questions about things that puzzle you outside your classroom as well. After all, science means inculcating the habit of looking attentively at things, observing them carefully, asking questions about whatever puzzles you and finding answers to these questions. Also remember - no question is stupid or useless. If anything comes to your mind, ask your teacher. You may not receive an answer immediately. If you can't get an immediate answer, don't lose heart. Just keep searching. And send your question to me as well. Write me a letter. I shall also try and help out in your search for an answer. My address is:

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Yours,
Sawaliram