

Science Modules

High School Science Education Group, 2008

The need for modules

In an environment where textbooks are considered the sole repositories of knowledge and rote learning is encouraged, teaching and learning of science is a difficult and frustrating process. The present school science curriculum in India is too extensive and both students and teachers experience a lot of stress in attempting to complete the syllabus within the allotted time frame. Most of the topics in school science are not dealt with in a manner that would generate interest in children. Few activities are done, there is no open-ended discussion and there is little space to include children's experiences of daily life. Students, therefore, gradually lose interest in the subject.

It is thus necessary to provide teachers and schools with alternative possibilities. Though there are plenty of activity books and project books, there are few that tie them up as a theme and seek to explain the underlying concepts. Therefore there is a pressing need to develop resource materials that are related to the curriculum, are contextual or related to life, activity based and make the teaching and learning process a more lively engagement.

Developing alternatives modules

Our objective is thus to develop theme based modules on science and technology. These may be linked to the present school curriculum or to an alternative view of this curriculum. These modules could be used in the classroom with children and also in out-of-school situations. It would be a combination of text like material with notes for teachers. In this sense it is different from a usual textbook chapter. It can be used with children whether by teacher, parents or others. Other modules are like supplementary materials. We are also thinking of exploring the possibility of simultaneously bringing out 'stand-alone' material for children. Hence a module may have two components, one for teachers and the other for children. Many of them would have bilingual editions.

How do we decide topics for these modules?

The topics on which we plan to develop modules have emerged from our concerted and regular interaction with schools, teachers, children, and resource group through various programs of Eklavya – the Hoshangabad Science Training Programme, the Kishoravastha Shikshan Karyakram, the Science and Technology Literacy Project as well as through our magazine publications and wall newspapers.

In deciding the topics of our modules and in developing their content, we shall be guided by a number of factors including curricular discussions with our wide network of resource persons all over the country, difficulties expressed by teachers during our training programmes and school follow-ups, questions raised by children through both classroom interaction and columns like Sawaliram in our publications, and problems expressed and faced by parents.

The topics suggested during the curricular discussions with resource group and teachers who have been part of the HSTP programme, and some of whom are now involved with the development of the curricular work for high school, are basic concepts like cells, atomic theory, light, nutrition in plants and

animals. More topics will emerge as we plan ahead for a comprehensive science programme covering classes 6 to 10. These will be based on the needs expressed by teachers and on the curricular framework that we develop. The added advantage of these modules will be that they will go through field trials in our own cultural contexts and will be accompanied by a required minimum kit to assist the user.

In the course of our work in the Kishoravastha shikshan Karyakram where we interacted with both teachers and adolescent girls and boys studying in school from class VI to class XII as well as those who have dropped out of school we realized how empowering science could be, if it related to their lives and was taught in a friendly manner. During these workshops we dealt with a wide range of topics through interactive methods, experiments and demonstrations. Topics included the human body, puberty, menstruation, reproduction, care during pregnancy, birth of a girl-child, infertility, birth-control, HIV-AIDS, irrational use of medicines, nutrition, herbal remedies in management of primary health care problems, mental health, tobacco abuse, and domestic violence. During a review of the programme adolescents and teachers have clearly articulated the need and relevance of discussing such issues. They also felt it was important to provide interesting and attractive educational materials which they could carry back home. These would not only serve as a future reference but also reinforce what they had learnt during the workshop.

Some of the topics have come out from our efforts to develop supplementary materials and through our two magazines Chakmak and Sandarbh, and from Srote, a science feature service that covers issues of topical interest in science.

How do we develop modules?

A small team of two or three persons will work on each module. The team members may be teachers, full-time staff, research fellows and others. This team will conceptualize, write and conduct the field trials. An advisory group drawn from a wider resource group will assist them.

The field trials will be with teachers, schools, staff of other like-minded NGOs working on education, health and development who will be selected on the basis of convenience and interest. Wherever possible this will be a mix of school situations – urban and rural, government and private schools, those affiliated to state board and those affiliated to central boards.

Based on the comments and feedback from both the resource group and the school / out of school trials, the draft modules will be revised and finalized.

Design and illustrations will be an integral part of the module's conception. The drafts to be used for school trials will have most of the design elements in place. The final editing, layout and design will be done with the help of the publication team of Eklavya, so that they can then be published.

How will the modules be used?

These modules will be used in a variety of ways -- as resource material for teachers to use in the classroom, as supplementary material for students that will help them comprehend some basic concepts of science, as reference material for parents, schools and for voluntary groups who run educational activities.

These materials once published can reach a larger audience through book fairs and Pitara outlets of Eklavya.

List of Topics

Work has begun on topics 1 to 16. Topics 17 to 20 are tentative and will be decided on the basis of discussions with the resource group and teachers.

- | | |
|-------------------------------------|----------------------------|
| 1. Cells | 5. Plant Physiology |
| 2. Light- reflection and refraction | 6. Human Body Picture book |
| 3. Nutrition in plant and animals | 7. Skin |
| 4. Atomic theory | 8. Bones |

- | | |
|-------------------------|--------------------------------------|
| 9. Muscles | 15. Hormonal System |
| 10. Digestive System | 16. Immune System |
| 11. Respiratory System | 17. Periodic table |
| 12. Urinary System | 18. Evolution |
| 13. Circulatory System | 19. Understanding Chemical Reactions |
| 14. Reproductive System | 20. Water testing |

Examples of some modules

1. **Human Body Series: (See appendix section A1 of the Annual Report)**

A series of eleven booklets and teaching-learning material are being developed on the Human Body. These booklets are for curricular as well as extra-curricular reading for children and young adults with notes for teachers to conduct activities. They aim at viewing the human body not only within the physiology or anatomy framework but taking it further and understanding it within the health framework. They follow an integrated approach to development by combining health and education, a social outlook with scientific rigour.

Team: Anu Gupta, and Karen Haydock

Advisory: Arvind Gupte, Sushil Joshi, Mira Sadgopal, and A.V. Ramani.

2. **Cells and its study:** We have done a series of training sessions with teachers on the topic 'Organization of the living world'. In this process we have felt the need to devote a module on the study of cells and why this is a fundamental idea for biology. We found that teachers were quite appreciative of how one could approach this topic in a hands-on manner. We also felt that textbook chapters often loose sight of the 'cell doctrine' within the mass of terminology.

Team: Bharat Poorey, Javed Siddique, Kishore Panwar, Bholeshwar Dubey, Sushil Joshi

Advisory: Anil Dixit, Arvind Gupte, Satyajit Rath, M C Arunan

3. **Light:**

During a training workshop for high school teachers the theme of light was introduced through a set of experiments and worksheets on the laws of reflection and refraction. We soon realized that most of them had not done these experiments and even if they had done them, it was only a verification exercise. They could solve a number of problems using geometry without grasping what was actually occurring to light. Nor could they easily apply this knowledge to unknown situations. Hence we thought of a module that would take them through conceptual ideas about light that children are exposed to at high school.

Team: Ammod Kharkhanis, Pramod Maithil, Uma Sudhir

Advisory: Rama Chari, Urjit Yagnik, Bhas Bapat

4. **Atoms and molecules:**

The atomic theory is an abstract concept, which lies at the heart of modern chemistry. Normally, the theory is treated in a very perfunctory manner in middle school to high school. This module provides the historical background to this theory along with its development by Dalton. Since the various laws that lead to the atomic theory require rigorous measurements, there is no attempt to replicate any of the experiments. Instead, the attempt is to

get the teacher / student to draw conclusions from the data given. A draft version of this module has been tried out in two teacher trainings. The final version also proposes to incorporate the difficulties children face with this concept and how the going can be made easier for them.

Team: Uma Sudhir, Sushil Joshi

Advisory: Manmohan Kapoor, P K Srivastava, Shashi Saxena