

Action-based Science Education for Health and Environment

Kulwanti Bellara, Suma Nair & Bakhtaver S. Mahajan

Homi Bhabha Centre for Science Education, TIFR, Mumbai, India

India's attempts to industrialise and become a developed country have led to a heavy burden of diseases, both communicable and non-communicable. India loses about 292 million Disability-Adjusted Life Year (DALY) against 201 DALY loss in China. In other words, an average Indian loses 63 Disability-Adjusted Life Days (DALD) per year due to communicable diseases, as against 16, 5, and 4 DALD loss in China, Former Socialist Countries (FSC) and More Developed Countries (MDC), respectively. These communicable diseases are closely linked to our environment.

Homi Bhabha Centre for Science Education (HBCSE) has a broad objective of improving science education in the country. The Centre carries out a variety of activities at different levels to achieve its goal of equity and excellence in education. The Health Education Programme of HBCSE (1993-1997) attempted to find

out students' understanding about different aspects of health. The results showed that students had 'poor' understanding of genetics, nutrition and social factors, which affect health. Further probing revealed that though students were aware about microorganisms as causative agents of diseases, they were unaware of the different environmental reservoirs and their role in disease-transmission. Considering the heavy disease-burden in India, on one hand, and the fast deteriorating environment, on the other, a more proactive educational approach was recommended to be followed in our school and college curricula.

Health and Environment Action-based Learning (HEAL) is a new educational initiative of HBCSE, with the potential to sensitize large number of students about their immediate environment and its effect on health. HEAL coordinators have put together relevant

theoretical information, experimental protocols and data sheets in a comprehensive Protocol Guide. This Guide enables students to carry out detailed studies, experiments and observations of different environmental parameters (air, water, soil, green-cover and waste) and symptom-based health surveys, yielding provisional diagnosis of environment related health problems

For the execution of HEAL, HBCSE is collaborating with the National Service Scheme (NSS) unit of the Mumbai University. A large number of students (~1000) along with their teachers from five colleges of Navi Mumbai are involved in collecting data for various environmental parameters, followed by health surveys. This study will be carried out seasonally (three times in a year, i.e. pre-monsoon, post-monsoon and winter) in different nodes of Navi Mumbai, covering an area of 79.24 sq. kms.

The programme is executed as follows:

HBCSE scientists and other resource persons train NSS teacher co-ordinators.

Trained teachers guide the participating NSS students to carry out the study at their allotted study site.

Students perform experiments, surveys, carry out analysis and prepare a final report of the observed results.

These results are validated by HBCSE scientists and from records supplied by the Navi Mumbai Municipal Corporation.

HEAL: Pilot Study (December 2003)

HEAL was initiated in 2003 with a pilot study confined to an area of ~ 0.18 sq. kms (Sector 9 of Vashi, Navi Mumbai). *Air quality* was studied at different sites (residential and commercial) using a high volume dust sampler. *Drinking water quality* was analysed chemically and microbiologically (MPN count: Most Probable Number, which is an indication of the presence of coli forms). The *soil* of the study area was also analysed for its physical and chemical properties. *Green cover, solid domestic waste and health studies* were carried out as per the guidelines given in the Protocol Guide.

This study, though limited in nature, showed some interesting results:

High levels of particulate matter {Suspended Particulate Matter, SPM (>10mm) and Respirable Particulate Matter, RSPM (<10mm)} were accompanied by high incidence of the upper respiratory tract problems in the surveyed area.

The green cover in the planned gardens, which were

well maintained, was about 40-58%.

Residents did not segregate domestic solid waste. Ill-equipped rag pickers carried out the same with expertise and were well aware of the risks involved, including that of AIDS.

Only five medical set-ups out of 16 in the study area were segregating medical waste.

Presence of large number of stray dogs was a strong indicator of non-scientific management of waste in the area.

Malaria is prevalent in the area of Navi Mumbai. The overall observations of the houses and house lane surroundings revealed a clean environment, though mosquito larvae were observed in water containers in about 10% of houses.

HEAL: Annual Seasonal Study (September 2004)

Equipped with the pilot study experience, a large-scale seasonal study, involving nearly one thousand NSS students, is now underway (2004-2005) in five nodes of Navi Mumbai (Vashi, Turbe, Koparkhairne, Airoli, Nerul). The preliminary results of the first seasonal study largely confirm the trends of the pilot study, especially in the context of high levels of particulates and incidence of upper respiratory tract problems. The green cover greatly varied in different zones, and the open water bodies were largely unpolluted and well maintained.

Educational Implications of HEAL

HEAL has the potential to sensitise a large number of students about the important and complex issues of health and environment. The hope is that the students will reflect and imbibe scientific knowledge about these issues, so essential for our survival.

HEAL emphasizes hands-on experience. Use of different scientific methods, involving experiments, fieldwork, graph making and analysis of their results, exposes students to the intricacies of science.

HEAL takes scientific knowledge to the common people, thus 'bridging the know-do gap' — knowledge leading to action/doing.

Students' understanding of different scientific concepts (pH, dilutions, solubility, settling velocities of particulates, microorganisms and their reservoirs, plant diversity, to name only a few) in several disciplines is clarified with their experiences in the field and in the laboratory.

HEAL provides an opportunity to generate time-series data for different environmental parameters and health

status of people in a study site. This inculcates the culture of data collection and analysis in our young students. Simultaneously, the data could have implications for policy changes.

HEAL is a multi-disciplinary programme. The participating students soon realize the many perspectives/dimensions involved in health and environment.

The study gives a true picture of complexities in the context of both environment and health, as it exists at the ground level. Thus the students are exposed to real life situations where science can be directly applied.

HEAL with its scientific analysis provokes students to think of alternatives/ possible solutions to the present health and environment problems in their respective areas.

HEAL encourages students to adopt sustainable development methods in their homes, localities and colleges. It is hoped that HEAL can help in the efforts to prevent further deterioration of our environment and reduce the related disease-burden.

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