Science motivational training programme

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The concept of science motivation has been recognized by the scientific community as a means to address the imbalance that exists between developed and developing countries. Although India has made remarkable progress in the scientific field since independence, recently it has been observed by scientists, researchers, and academicians, as highlighted in several forums, that the interests of students towards basic sciences has declined considerably in India due to various reasons. The science motivational training programme (SMTP), supported by the DST and NCSTC for high-school science students and launched at an appropriate time is considered as an effective tool in generating and invigorating curiosity and interest among them to have a preference for future careers in science and technology. Based on our involvement in such programmes since 2000 onwards, the framework, approaches and strategies designed and developed by us under this programme have helped students change their mind-set and attitude towards the role and values under changing socio-economic and developmental scenarios. In this article the outcome of the SMTP has been synthesized, and it has been concluded that the action-oriented approaches are more challenging than traditional chalk-and-talk methods. The study further concluded that adequate training exposure, skill and capacity-building support is necessary to check the further decline of interest of students in science in India.

Keywords: Basic sciences, school systems, science motivation, training programme.

SINCE independence, India has been committed to the task of promoting the spread of science and technology. The Government of India enunciated a New Science and Technology Policy in January 2003 for advancing scientific temper in the new era of globalization. The focus of the policy is to ensure that the message of science reaches every citizen of India, so that we as a progressive and enlightened society can make it possible for all our people to participate fully in the process of development. Imparting motivation and popularization of science education in the country could have grown at a faster pace with phenomenal increase in the growing number of universities and colleges. However, various studies reported that there has been a consistent decline in science in India[1–3] as well the percentage of school students opting for science after passing out their secondary/higher secondary examinations[4,5]. At the grass-root level factors such as proliferation of schools/colleges/institutions without basic science laboratories, abolishing the basic courses of science, reservation policies in institutions/universities rather than merit, starting applied courses/subjects without basic facilities and availability of specialized faculties are responsible for the decline of science education in India[3].

As an activity sponsored by the Department of Science and Technology (DST), New Delhi, a series of science motivational training programmes (SMTPs) were conducted in Garhwal region, Uttarakhand, with the objectives of enhancement of scientific thinking and understanding among the students. Before initiating these programmes, an in-depth, rapid appraisal survey was carried out to select schools and students in the Garhwal region. A total of ten training programmes (each of five days duration) were conducted between 2000 and 2007 where about 448 students (boys and girls) were trained (Table 1). For

Table 1. Preference/choice indicated by the students towards different science subjects for higher studies during the training programme

Subject (science)	No. of students	Percentage
Physics	39	8.70
Chemistry	56	12.5
Biology	74	16.5
Geology	29	16.5
Environmental sciences/studies	98	21.9
Computer science	152	33.9
Total	448	

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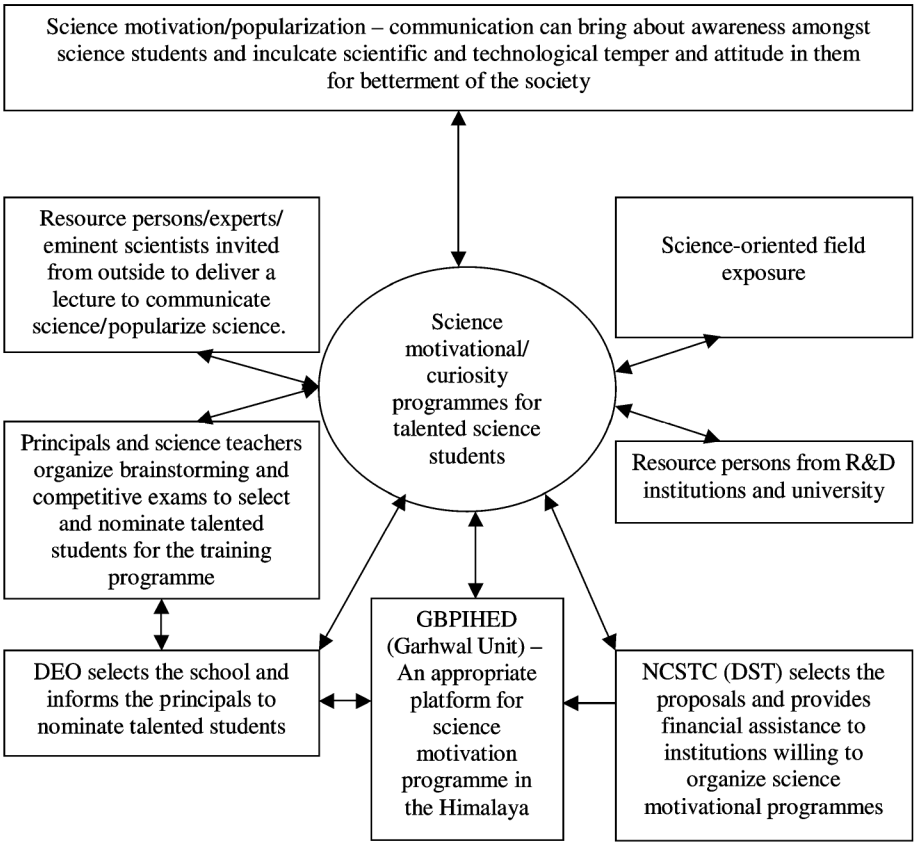

Figure 1. Operational and organizational mechanism developed for conducting science motivational programmes for science students.

selection of talented and bright students, a brainstorming or competitive exam was also conducted by the science teachers in each school. The feedback assessment or impact assessment of SMTPs was carried out with the help of objective-type questions to select bright students, questionnaires administered at the time of registration, at the end of the training programme and another one year after completion of the training programme. The goal of each training programme was to ensure that every participating student was motivated to acquire full knowledge imparted during the training.

Although the capacity building and training programme was initiated mainly to develop curiosity and encourage students in the field of science, a number of issues started emerging during such interactions that led to designing, testing and developing appropriate strategies for making SMTPs more impressive, effective and successful (Figures 1 and 2). Combining the experiences and expertise of diverse disciplines provided the most effective method for improving scientific understanding and knowledge among students.

The way students were trained in the programme was thus radically different from the way a teacher taught students in a formal school. This learner-centred experimental learning method, initially tried out in the training programme, is now gaining more popularity among the schools as many of such trained researchers are being requested to deliver lectures in several programmes organized by many schools in this region. Besides, delivering lectures, the students were encouraged to make detailed observations during field visits (such as run of river and hydroelectric power project sites (i.e. Tehri, Vishnuprayag, etc.), rural agro-eco technology park (Triyuginarayan, Maletha, Tapovan), rehabilitated degraded sites (Bhiri Bansbara), protected areas (i.e. Nanda Devi Biosphere Reserve), medicinal plant cultivation and conservation site, biodiversity rich areas, etc.) and later present their views/observations in group discussions.

There is need to revise the goals and scope of the old system of science education, and reorient them in the perspective of the sustainable future: this calls for a 'paradigm shift'. Majority of the students who participated in the training programme, showed a keen interest for computer science (33.9%), followed by environmental science (21.9%), biology (16.5%), chemistry (12.5%), and least for physics (8.7%; Table 1). The students were also asked about job interests/preferences after completion of their studies. It was revealed that majority of the students preferred to become engineers/computer engineers (31.5%), followed by MBA and management-related jobs in MNCs

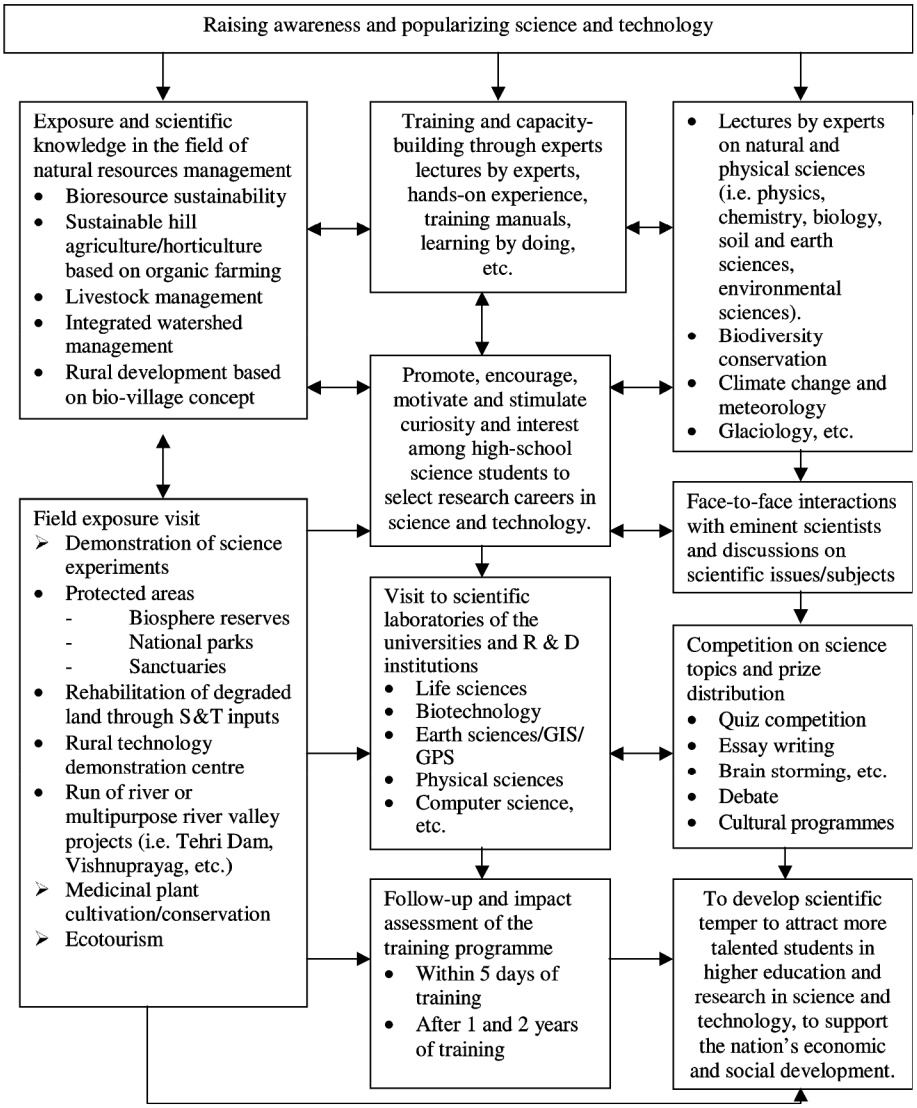

Figure 2. Approach and framework developed for science motivational training programmes for the science students.

Table 2. Job preference/interest shown by students after completion of their education

Job	No. of Students	Percentage
Medical doctors	60	13.4
Engineers/computer engineers	140	31.5
Civil services	25	5.6
Scientists in R&D institutions	61	13.6
MBA and management-related jobs in MNCs	122	27.2
Defence services	10	2.2
Education (teaching)	30	6.7
Total	448	

(27.2%), scientists in R&D institutions (13.6%); very few students showed interest on civil (5.6%) and defence services (2.2%; Table 2).

The assessment of the existing knowledge base of the students, and impact and follow-up assessment of the training programme were carried out among students belonging to the rural and remote set-up (245) and towns/small townships (203; Table 3). Objective-type questions were given to the students for feedback assessment during the training programme, whereas questionnaire-based survey was conducted after one year in each school to assess the impact of the motivation programme. It was revealed that the framework and approaches applied for capacity-building played a positive and significant role in motivating and stimulating curiosity and interest among students as indicated by the marks they obtained in science subjects, as reported by their teachers and principals.

As a matter of fact, a set of analytical and critical thinking skills and approaches needs to be developed and

Table 3. Knowledge and impact assessment of students who participated in science motivation programmes organized at different times (2000 and 2007)

	General knowledge related to science subjects, personality test, etc. at the time of registration				General knowledge related to science subjects relevant to training after 5 days				Academic performance of students in science subject after 1 year			
Total no. of students (348)	D	C	B	A	D	C	B	A	D	C	B	A
Students from remote and rural background (245)	115	60	41	29	59	55	79	52	65	66	87	27
Students from towns/small townships (203)	66	53	41	43	33	35	67	68	43	42	74	44

Grading: Poor (D) 0–25%; Medium (C) 25–50%, Good (B) 50–75%, and Very Good (A) 75–100%.

shared at various levels in the context of science education. School systems need to develop a capacity to conceive, design and produce materials which support actions, stimulate concerns and offer relevant knowledge in each aspect of science. Science education through motivation does not give answers, but creates inquisitiveness to find answers. We need curiosity and interest to interact with experts and feelings need to be cultivated, whereas conventional feeling is not treated as in science education. The science-learning process must reflect a concern for, and commitment to the pursuit of science motivation. Learner-centred approaches based on collective learning, need to focus on critical assessment of problems, options and responses. Such action-oriented approaches are more challenging than traditional chalk-and-talk methods, and for this adequate training and capacity-building support is required. In other words, this implies much higher levels of investment in quality training, as well as restructuring of science educational approaches and improvement in quality. The major findings of the SMTP are summarized as follows:

- The assessment studies indicated that the impact of such programmes was encouraging and many students were found committed towards science education.
- The noteworthy feature of this programme was open and face-to-face discussions of students from remote and rural areas with eminent scientists and researchers, without any hesitation.
- Experiences gained and suggestions obtained during the last several years from the experts, researchers, academicians, etc. helped in designing appropriate strategies, framework and approaches for improvement of such programmes in future, so that they can attract more students.
- The efficiency of the training programme needs to be increased on a sustained basis by widely publicizing in the local newspapers, magazines, TV and radio programmes and also by sending related information to school principals, so that students from remote and far-flung areas can also avail of such an opportunity.

Some most important suggestions/recommendations that would help set the future directions of the SMTP are listed below.

1. Science motivation can be seen as a tool for empowerment leading to action and has to be a two-way process, involving actual participation and also develop a linkage between students and science teachers, and students and scientists.
2. A dialogue is needed between two kinds of knowledge-holders, i.e. knowledge of science and knowledge of technology, so as to improve the skills of the students.
3. Strong linkages and networking need to be established between schools, regional universities/scientific institutions and NGOs involved in educational programmes and the DST and NCSTC for effective training programmes.
4. To equip students with problem-solving skills, and train, promote and encourage teachers to develop innovative, interesting and suitable methods to deliver science lectures effectively.

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