HOMI BHABHA CENTRE FOR SCIENCE EDUCATION
Tata Institute of Fundamental Research
Mumbai

Annual Report 2013-14

HIGHLIGHTS

At the Homi Bhabha Centre for Science Education, research continued on learning and reasoning with representations, pedagogy, socio-cultural issues in science and mathematics education, and curriculum redesign. A National Repository of Open Educational resources was launched in collaboration with MHRD. Out of the 36 student team members who represented India in the International Olympiads in Physics, Chemistry, Biology, Mathematics, Astronomy and Junior Science, 35 bagged medals and this included 12 gold medals. HBCSE organized the 10th International Junior Science Olympiad (IJSO) in Pune from 3 to 12 December 2013.

Research & Development in Science, Technology and Mathematics Education

Science Education Research

The research projects in science, mathematics and technology education in HBCSE can be broadly grouped under three categories: Learning and Reasoning with Representations, Learning and Pedagogy, Policy and Curriculum Redesign. Projects in the first two categories work towards improving teaching and learning within the current curriculum, projects in the last category seek to critique and extend the existing curriculum and policies.

Learning and Reasoning with Representations (LRR)

Much of science deals with entities and mechanisms that cannot be tracked using human sensory and perceptual systems. Learning science therefore calls for understanding, integrating and reasoning with a range of representational systems that stand in for unobservable entities, concepts and mechanisms. Such systems include mathematical equations, chemical structures and symbols, physical models, animations, textual descriptions, computer simulations and combinations of these media. The LRR research area examines how students learn new concepts using different representational systems, limitations of these representations and how these could be addressed, and how students learn to integrate and reason across different representational systems. The LRR research area studies learning using a variety of tools of reasoning including physical models, diagrams and gestures, model systems, computational models and equations. The following projects were pursued in this area this year.

Visuospatial Reasoning in Astronomy

Research in visuospatial reasoning has contributed to the development of a pedagogy for elementary astronomy that connects phenomena and their external representations, specifically concrete models and diagrams, with internal mental models that people use to reason in science. Grounded in the theoretical perspective of embodied cognition, this research has aimed to link perception and action on the one hand, with abstractions of science on the other.

A set of tasks, administered as part of the Indian National Astronomy Olympiad 2014, related to reading and interpreting a polar projection sky map. The tasks required students to mark the directions in the map, locate the horizon, identify the celestial equator and the ecliptic, and place the sun and the moon on the map, based on information about the time of day and the moon's phase. Data from about 500 students between the ages of 14-17 years is being analysed. This analysis will be followed by interviews of a sample of students to understand their ways of reasoning. Shri Swapnil Jawkar of SIES College is a collaborator. [A. Sule, J. Ramadas, S. Chopde and G. Narwankar]

Cognitive Mechanisms Underlying Model-Based Discovery and Learning

This DST funded project started in October 2013, and involves developing experiments to understand how students learn new concepts via the manipulation of external models and artifacts. The focus of the project is understanding this process at the cognitive/neural mechanism level. Most studies would be behavioral, and would be based on eye-tracking, finger-movement tracking, galvanic skin response tracking, and manipulation of stimuli using virtual reality goggles. The project would also seek to develop a guiding framework for designing video games and interfaces that support learning and discovery, based on the identified cognitive mechanisms. [S. Chandrasekharan, The Learning Sciences Research Group]

Representational Competence in Chemistry

Representational competence' (RC) in chemistry refers to the ease of handling various representations (chemical equations, graphs, 2D and 3D molecular diagrams, animations, etc.) simultaneously, particularly interlinking multiple representations, transforming among them, and building information through those representations. The main goal is to understand how RC changes over time, especially how academic exposure changes the ability to do representational transformations. A second goal is to explore the cognitive mechanisms underlying representational transformations. In an ongoing study where categorization, transformation and equation-balancing tasks are posed to participants with varying academic backgrounds from undergraduate to post-graduate. The study uses eye-tracking and task analysis to isolate elements of representational competence. [P. Pande and S. Chandrasekharan]

Role of Multiple Representations in Understanding DNA Structure

This research explores the difficulties faced by students while understanding the concept of DNA structure and how different external representations (such as concept maps and models) could help in learning different facets of DNA structure. A physical manipulation task was used to study how students conceptualize the inter-linkages between different biological concepts related to the structure of the DNA. 12 biology undergraduate students were each provided with 37 type-written concept-cards, from which they had assemble a concept-map of DNA structure. The building activity required a participant to organize movable materials

(concept-cards, chart-paper arrows and stick-it notes). A structural analysis of the generated maps (nodes, links, linking phrases) helped identify two groups of map-builders, 'Concrete' and 'Vague'. A paper based on procedural analysis of the task (different actions and moves made in building the map) and the structural analysis was presented at the American Educational Research Association conference, where it was selected as a full paper from more than 12,000 submissions. [A. Srivastava and S. Chandrasekharan]

How is student drawing used in learning about biology?

We investigated how student drawing is used in a few schools in Mumbai in connection with learning about biology. In each school, we collected, photographed, categorised, and analysed examples of drawings that students made of plants, animals, and other subjects related to biology. Some students and teachers were also interviewed. Most of the drawings we found were drawn by copying textbook illustrations, with the apparent objective of memorising appearances and remembering the names of organisms and their parts. We did not find any examples in which students drew while they observed specimens, models, or organisms, or in which students drew in order to record observations of experiments. Teachers assessed the student drawings only on the basis of neatness and accuracy in copying. [A. Akhtar, K. Patil and K. Haydock]

Sound Visualisation

We investigated, designed and tested an activity in which school students of Class VII investigate visual representations of sound waves produced by an oscilloscope. The objective was to expose students to the visualisations of sounds they produced so that through empirical observation and reasoning (but without formal ‘teaching’) they start realising that louder sounds produce waves of greater amplitude and higher-pitched sounds produce waves of shorter wavelength. [K. Haydock]

Modelling

We investigated, designed and tested a teaching activity in which students of Class VIII make 2-d representations of 3-d geometric models, and then use each other’s 2-d representations to reconstruct the 3-d models. The learning objectives include practicing keen observation and model making, and analysing the nature of science. [K. Haydock]

Learning Mathematics in a Social Context: A Chat Studio

A new game application was designed to help develop arithmetic skills in primary school students. It extends the instant messenger activity in the Sugar Platform, running on OLPC (One Laptop per Child) machines. The logging feature of this activity was modified to record events in microsecond resolution, to track student response times as they played the game. This game will soon be field tested as part of the research on learning mathematics in a social context. [R. Shaikh, Nagarjuna G., S. Chandrasekharan, R. Katkam, G. Wadekar and S. Mohanan.]

Concept Inventories

A concept inventory on rotational kinematics developed by us, was administered to around thousand students from 5 urban centres (Jaipur, Patna, Mumbai, Hyderabad and Bangalore).

Part of the inventory was also administered to around 400 introductory level students at the University of Washington, Seattle carried out while Mashood K. K. was on an internship with the physics education group at the University, was under the supervision of Prof. Paula Heron. Statistical analysis of the data included calculation of indices for assessing the reliability and discriminatory power of individual items as well as the whole test. Item response curve (IRC) analysis was also carried out for all the 39 items presented at the Foundations and Frontiers of Physics Education Research (FFPER) conference at Bar Harbor, Maine, June 17 – 21, 2013, also communicated part of the analysis to a peer reviewed journal.

We have been experimenting with the peer instruction pedagogy developed by Eric Mazur at the University of Harvard. A workshop for teachers in peer instruction by Prof. Mazur at the Indian Institute of Technology, Bombay, led to translating part of the Peer Instruction manual in Hindi for teachers in rural India with the help of Ms. Ranjana Pathak.

We also studied the transferability of general problem solving skills among higher secondary school students. The pedagogic potential of physics in this regard was investigated. The correlation of physics performance of students with their performance in chemistry and mathematics in highly competitive problem solving examinations was studied using a massive data base (half a million students). Encouraged by significant correlations we interviewed 20 students to explore the pedagogic potentials of physics, and identify strategies and practices relevant to physics which facilitate transfer. [V. Singh and K.K. Mashood]

Learning Trajectories for Area Measurement

The school mathematics topic of area measurement has strong connections with other topics such as whole number multiplication, geometry, proportion, fractions and decimals, and also with operational schemes such as unit iteration, unitizing and partitioning. It is conjectured that knowledge acquisition in this topic is better described by a network model, where connections between 'knowledge pieces' are increasingly strengthened, rather than a sequential model of acquiring new concepts. We designed a spiral learning trajectory in the light of this hypothesis, and tested it in two summer vacation camps. We are analyzing data collected from these camps, conducted during April-May, 2013, with two batches of students. We are also running an eye-tracking experiment to explore the effect of an intervention in solving two problems based on area-measurement. This study is a blend of cognition and mathematics education research. [J. Rahaman, S. Chandrashekaran and K. Subramaniam]

Systems Thinking

A study on students' thinking about systems involved students across various age groups ranging from 12-15 years, studying in grades 7, 9, 10 and 11 from different schools across India. Problems and tasks about stocks and flows were presented as text, tables, graphs in worksheet formats. The preliminary findings indicate that students at all levels lack an understanding of flows and accumulation of stocks, which are essential components of systems thinking. These have opened up several areas of investigations, including students' understanding of representation of information, especially of rates of change and accumulation. [C. Natarajan, D. Prabhu and A. Jamakhandi]

Student Learning and Pedagogy

The problem of helping students understand science and mathematics is very complex, and a major strand of HBCSE research investigates how science teaching and pedagogy could be made more effective. This include improving the institutional framework for teaching, as well

as developing new teaching models. The following projects were pursued under this theme this year.

Science Teaching at the Middle School Level

A paper on grade 8 students' ideas of spontaneous generation, titled "Omne Vivum Ex vivo"? A study of middle school students' explanations of the seemingly sudden appearance of some life forms" was completed. It will be published in Research in Science Education (currently available on-line: DOI 10.1007/s11165-014-9406-1). [J. Vijapurkar and P. Konde]

A study on another fundamental concept, the biological cell, titled, "What do Cells Really Look Like? An Inquiry into Students' Difficulties in Visualizing a 3-D Biological Cell and Lessons for Pedagogy" has been accepted . It will be published in Research in Science Education April 2014 issue (currently available online: DOI 10.1007/s11165-013-9379-5). [J. Vijapurkar, A. Kawalkar and P. Nambiar]

A study on students' reflective writing, in the form of diary entries (learning logs) of two batches of Grade 8 students, each undergoing either inquiry or traditional science teaching is written up for publication. [J. Vijapurkar and A. Kawalkar]

Using contradictions to teach

We investigated and compared how students and teachers learn (change their beliefs) through the recognition of contradictions of various kinds: (1) between two beliefs of a student; (2) between beliefs of different students; (3) between beliefs of a student and the teacher; (4) between belief of a student and what a teacher states (but does not actually believe); (5) between beliefs of characters in a text that a student reads or hears; or (6) between students' beliefs and their observations. Students were put in situations where contradictions were likely to occur and their conversations were recorded and analysed. For example, we asked students to explore and evaluate different ways of paying income tax. [K. Haydock, R. Shaikh and Saurabh]

Close-observation

We filmed videos of microbial activities through a microscope and investigated teacher and student education methods which use them as the basis for teaching science process skills such as close observation, questioning, documenting observations, and analysis. They were tested with children and with teachers from Uttarakhand, and were found to be useful in stimulating the viewer to go beyond merely naming and identifying. They stimulated viewers to ask questions regarding microbial behaviour, motility, reproduction, and 'consciousness' (teleological problems). [K. Patil, K. Haydock and Durgaprasad K.]

The Cultivation of Cultivation

A history of the development of science and agriculture in ancient India (and Greece), as studied by well-known marxist scholars such as JD Bernal, Debiprasad Chattopadhyaya, and Romila Thapar, as well as primary sources quoted by these authors, was used to compare factors that affected and were affected by the development of science and agriculture. The insights were used to formulate a study among farmers. We conducted semi-structured interviews of five cultivators from Kottayam District in Kerala as case studies in order to find out their beliefs and understandings related to science, education, and cultivation. The long-term objective of this study is to find out how farmers form their beliefs, understandings,

skills and practices, and explore the controversy regarding whether cultivators do science - whether and how they do experiments, make detailed observations, keep records, etc. [R. Varkey and K. Haydock]

Do seeds float?

We investigated, designed and tested an activity: “Do seeds float?” which is suitable for students to explore in relation to evolution. This activity is related to experiments Charles Darwin conducted in order to find out if it is possible that seeds were carried long distances across the sea and survived so that they could form new populations. Students design and carry out experiments in order to see if various types of seeds float in sea water and in fresh water, and if they germinate afterwards. This activity was included in the book “What is Science?” as an example of the scientific method. [K. Haydock, K. Patil and S. Kangsabanik]

Teacher Professional Development

The National Curriculum Framework places demands on teachers in terms of understanding and responding to students’ thinking, that go beyond the prevalent teaching practice in classrooms. Research on teacher professional development at HBCSE explores how teachers can meet this expectations through specially designed programs and tasks. The efficacy of tasks related to students' mathematical thinking drawn from the teacher's own classroom teaching practice in improving teaching practice is being explored. Many researchers have shown that teachers’ specialized content knowledge (SCK) of mathematics is a critical component of effective teaching. The topic-wise outlines of SCK for the teaching of school mathematics needs to be identified to guide the design of pre-service and in-service teacher education curricula. The discussion during a collaborative workshop where middle school teachers explored SCK on the topic of integers was analyzed for take-up by teachers and relevance to their teaching concerns. This will contribute to building a base of SCK for the topic of integers. An additional study exploring SCK elements for the topic of decimal numbers is underway. In this study artefact's from teachers' practice were used to support teacher reflection and learning [R. Kumar, K. Subramaniam, S. Naik and S. Takker]

Implementing Project Based Learning (PBL)

We had designed and conducted a series of teacher workshops, and prepared PBL related materials for teachers. We have shared our experience gained from this exercise in various platforms, and four papers were published based on this work. A paper reported a study of four Indian middle school teachers' views on projects and practice of projects and presented a model of PBL to address the suggestions made by the National Curriculum Framework (NCF) 2005 and the difficulties presented by these suggestions, particularly for teachers. Another paper reported a middle school science teacher's practice of projects, and the scope for improvement in the teacher's existing project practice. [S. Shome and C. Natarajan]

A study explored teachers', teacher educators', and researchers' understanding of force, in relation to interpreting middle school textbook content. Another paper suggested pedagogic strategies to introduce concepts of species at the middle school level. A study of Indian teachers' views about and practice of school projects was presented in the HBCSE annual research meet 2013. This was based on the responses of participant teachers to initial questionnaires circulated during the PBL workshops. [S. Shome]

Science Education for Diversity (SED)

Science Education for Diversity (SED), a three-year project funded by the European Union's (EU) Seventh Framework Programme concluded in December 2013. The project attempted to understand and effectively address the dynamics of relationships between gender, culture, ethnicity, language, diversity and science education. The research groups from the University of Exeter, UK, the Netherlands, Turkey, Lebanon, India (HBCSE) and Malaysia studied student's attitudes towards science, scientific issues and careers and their perceptions of nature of science and issues such as gender, religion and science. Technical reports based on four case studies of the intervention carried out in 3 schools, with 4 teachers and 4 classes of seventh and eighth standards were written up. Two papers were coauthored by SIC and PB. One titled "An Innovative Strategy for Addressing Diversity in a Science Class" was presented at an ICSSR sponsored National Seminar on "Innovations in 21st century education" organised by the K. J. Somaiya Comprehensive College of Education, Training and Research. Another titled "Responding to diversities in a science classroom" derived from the study has been accepted for publication in a teacher education magazine TeacherPlus. [S. Chunawala, C. Natarajan, P. Birwatkar, A. Muralidhar, B. Thakur, G. Battin, D. Prabhu and N. Shaikh]

Design and technology research

In the Design and Technology Education group Farhat Ara submitted her doctoral thesis on Investigating Students', Teachers' and Designers' Ideas about Design and Developing Design Activities for Indian Middle School Students (April, 2013). The thesis charted new territory by focusing on "Design" at the elementary and middle school levels in the Indian context, and provided a rich documentation of the overlap between the understanding of design among different groups. Design-based activities appropriate for the Indian context were developed through trials among urban middle school students, and the influence of these activities on students' ideas about design and designers were assessed. Students' responses to design activities highlighted students' ideas about structure-function relation in artefact's, their creativity and design decision skills. The study made a comparative analysis of students' design solutions to "design-without-make" and "design-with-make" tasks, which revealed that when not constrained with making, students showed more evidences of creativity and risk-taking than when constrained by having to materialise – or make – their designs. Showing that the two kinds of tasks were complementary and not substitutes of each other, "design-with-make" tasks provided opportunities for students to recreate the whole design process, from identification of a need, to creating a brief, generating specifications and ideas, developing them, modeling them, and finally producing a working product. [F. Ara, S. Chunawala and C. Natarajan]

Policy and Curriculum Redesign

HBCSE plays a significant advocacy role, particularly to refocus the existing institutional, policy and curricular frameworks. The advocacy is based on developing research-based critiques of established patterns of education, and proposing alternate frameworks. The following projects were pursued under this theme this year.

Inclusive Science Education

In spite of efforts by the Government and other educational agencies in India, the dream of inclusive education for all students with differential abilities, and students coming from

diverse backgrounds, remains unfulfilled. The little available data on the status of students from marginalised backgrounds in India shows that science education is not inclusive, possibly due to: lack of positive attitude towards inclusion; lack of institutionalisation of inclusive strategies; lack of use of adaptive technologies; and low expectations in science from students with disabilities. We study the aspirations of students with disability (SWD) to study science, and their views on science education and inclusion.

Our research on inclusive education progressed with two studies. A study involved a survey of attitudes to inclusive education among teachers, school principals, parents and over 500 students in a large number of schools in Delhi. Another was a study on visualization through verbal descriptions and 3D representations conducted among students with and without visual disability in an inclusive setting. The study (ATIES: Attitude Towards Inclusive Education Scale) was administered in 9 schools: Government primary and senior secondary schools – 3 for boys and 3 for girls, in a private school, a special school for students with visual impairments, and an inclusive school. Participants included students, parents, teachers and Principals. A questionnaire on aspirations of students in science was administered to students with and without disabilities from 5 schools. The data collected with teachers and principals has provided insights for further work in classroom intervention.

Science classes in inclusive and special settings were observed, with students with visual impairments. Two studies were conducted on using diagrams for students in inclusive settings. A study on visualization through verbal descriptions and 3D representations was done in the Vivekanand foundation school, Mumbai and the Bharatiya Netraheen Vidyalaya, Delhi. [A. Sharma and S. Chunawala]

Gender Imbalance

Gender imbalance has social and historical roots. We have examined gender distribution among candidates who have qualified for the Olympiads and the candidates entering both medical and engineering streams. This has involved sifting through a large database of over a hundred thousand students. We hope to complete this study in the coming year. [V. Singh and P. Pathak]

Socio-Scientific Issues

Socio-Scientific Issues (SSI) are issues at the interface of science, technology and society, which have ethical, moral, or social dimensions to them. SSI while representing social dilemmas, involve open-ended, debatable and real-world problems subject to multiple perspectives and solutions. Two aspects of research on reasoning among students on socio-scientific issues were completed this year. A study examined from a critical feminist perspective how reproductive health is presented in the higher secondary biology curriculum and found that the textbook supports reproductive control of citizens through the use of technology. A paper on this was presented at the Indian Associaton of Women's studies (IAWS) conference in Guwahati (February 2014). Another study on biology doctoral students' critical examination of a deterministic claim in a media article found that students uncritically accepted fallacious claims and harbored linear cause-effect models of genotype-phenotype relationship without drawing on disciplinary knowledge. Besides, a 2-day workshop on SSI was conducted in December 2013 for 13 students from Atomic Energy Junior College. Students debated the social and ethical aspects of commercial surrogacy and were also exposed, in a structured manner, to evaluating complex and conflicting evidences in the context of SSI. [A. Raveendran and S. Chunawala]

Relating Children's Out-of-School Knowledge to School Mathematics

Contextual knowledge of mathematics gained outside school by students from low SES backgrounds are an important resource for classroom learning of mathematics. Our study showed that knowledge gained from participation in work contexts by low SES urban school children can form a foundation for the teaching and learning of the topic of measurement in the middle school. The study further argues that experiences from everyday work-contexts makes students familiar with artefacts and practices that represent a crystallised and embodied form of mathematics, which can be resources to make potentially powerful connections with school mathematics. It also argues that school mathematical knowledge represents a form of generalisation or abstraction consisting of ideas or constructs that illuminates diverse instances in the everyday settings. [A. Bose and K. Subramaniam]

Curriculum and Material Development

Science Education

Understanding Chemical Elements

Some unique and interesting print resources for chemistry education were designed, aiming to help students and teachers from diverse backgrounds in India appreciate the relevance of the chemical elements and the periodic table. The first is an info-graphic folded booklet highlighting the milestones in the development of the periodic table. The booklet opens up to an activity-based periodic table. Next a set of 114 intricately designed flashcards were produced, each introducing various facets of one chemical element using a mix of technical and popular information. An open access web portal for these resources is under development. [T. Joshi and S. Ladage]

e-Learning portal and educational materials in Hindi

The e-learning portal in Hindi (http://ehindi.hbcse.tifr.res.in) was further enriched. It now has a variety of curricular, co-curricular, and popular science materials that include pedagogic presentations, books, lectures, magazines, articles, reports, documentaries, glossaries, questionnaires and biographies of some Indian scientist. Most of these materials are downloadable in pdf format. A unique 'Vigyan Calendar' was prepared in Hindi, containing salient science events and information about scientists whose birth date falls on each of the 366 dates of the year. It is published by Vigyan Prasar, Department of Science and Technology. A pedagogic book 'Gyan Vigyan - Shaikshik Nibandh' was published, containing 18 selected articles based on presentations made by experts at the National e-Hindi Workshop organised by HBCSE. [K. K. Mishra, V. Singh, A. Gajbhiye, S. Chandrakar and H. Kamble]

Science books in Marathi

Two books were produced in Marathi, one addressing a wide variety of questions and doubts related to everyday and school science, and another describing interesting experiments in chemistry at the middle and secondary school levels. Guidelines for teachers and colour photographs of the experimental setups were included. [V. C. Sonawane, V. D. Lale and S. C. Agarkar]

Teaching Science Processes

Several posters were designed on the theme of 'division of hand and mind' and 'contradictions between observation and beliefs'. Teaching ideas were developed using filmed videos of microbial activity, to teach science process skills like close observation, documentation questioning and analysis. Illustration were prepared relating to the processes of science: 'Necessity of Freedom', 'Observation in Science', 'Exploring Cardamine hirsuta', 'Do Gorillas make plans?', 'Materialism or idealism', 'Science is value laden' and 'Inductive logic in science'. [K. Haydock and K. Patil]

Figure 1: Illustration indicating inductive logic in science.

Primary School Science Curriculum

Online video and other resource links were compiled corresponding to various topics addressed in Classes 1-5 of the Small Science Curriculum. Specific emphasis was on activities developed by Arvind Gupta of the Children's Science Centre of IUCAA. A feature on the snakes of HBCSE campus was added to the website. Common Hindi, Marathi, English and scientific names were compiled for 53 trees and 125 small plants on HBCSE campus. Labels with this information were affixed and used in guided walks with students and teachers.

http://coglab.hbcse.tifr.res.in/teacher-resources/multimedia-resources .

Layout for the Class 5 Teacher's Book in Marathi was completed, with technical terms from English included in it. This brought to conclusion the Marathi set of Class 5 text, work and teacher's book titled 'Halke Phulke Vidnyan'. [V. Bansode, J. Vijapurkar, K. Haydock and J. Ramadas]

The young country of Timor-Leste has embarked on a complete overhaul of its school science curriculum and is exploring the adoption of the Small Science curriculum, which is particularly suitable for its socio-economic conditions. In this context, a member was invited to meetings and workshops on the curriculum - its philosophy, development, implementation - as well as on insights from the Centre's work at the middle school level. These were held in Dili, Timor-Leste at the invitation of the Ministry of Education, Govt. of Timor-Leste during September-October 2013. [J. Vijapurkar]

Middle School Inquiry Science Curriculum

Transcriptions of video records of classes conducted for curriculum development continued to facilitate the writing of curricular material. Additional experiments on topics such as light and vision were developed and tested. Writing up of the curricular material continued. [J. Vijapurkar, G. Sharma and A. Unmesh]

Knowledge Laboratory

National Repository of Open Educational Resources (NROER)

Central Institute of Educational Technology (CIET) of NCERT Delhi and HBCSE are core partners to develop a collaborative online platform http://nroer.gov.in for students and teachers. The repository aims to bring together all digital and digitizable resources for the

entire school system in the country in all Indian languages and for all subjects. This project is supported by the Department of School Education and Literacy, Ministry of Human Resource Development, Govt. of India. The platform is designed and developed as a part of the gnowledge lab's metaStudio initiative. The repository provides features to organise its collections into an ever growing semantic map of themes, topics and resources. [G. Nagarjuna, G. Anuja, S. Sawant, S. Chaudhary and K. Aitawdekar.]

National University Students Skills Development (NUSSD)

NUSSD is a three year pilot program undertaken by the Tata institute of Social Sciences (TISS) in 9 states across 11 Universities in backward rural districts, particularly in Central India, and aimed at increasing employability of undergraduate students by imparting knowledge and skills. As a partner in this scheme gnowledge lab developed a course on Digital Literacy on a Massive Open Online Course (MOOC) platform based on available free software http://courses.metastudio.org . The metaStudio platform was integrated with MOOC delivery systems. It is expected that the platform http://studio.tiss.edu is expected to be used by about 50,000 students during the pilot project. [Nagarjuna G., A. Nachankar, K. K. Pal, A. Ganesh and D. Singh]

The digital literacy course developed by the lab includes six projects: 1. recording and transcribing oral history while learning of typing in Indian languages; 2. making banners, visiting cards and posters using DTP software; 3. mapping rural India at http://openstreetmap.org; 4. making a five minute video documentary; 5. school survey basic statistics and data presentation; and 6. publishing an online illustrated essay in a wiki style. The course was pilot tested in GSP college in Talasari in Dahanu Taluka, Thane District, Maharastra. [A. Dhakulkar, H. Pakrashi, C. Mukherjee (Comet Media Foundation) and G. Nagarjuna]

As part of a vocational education course initiated by TISS, a detailed review was carried out of the course material for basic sciences and the accompanying facilitator guide. Changes in the materials and processes were recommended. [J. Vijapurkar and J. Kumbhare]

Software Development

GNOWSYS is evolving to support the metaStudio platform. Key features developed during this period include: mongodb migration; RCS for full version control of data and metadata; online webapp development through the designer; file and resource sharing; and support for emacs orgmode as a wiki markup. [G. Nagarjuna, G. Anuja, S. Sawant, D. Singh, K. K. Pal, A. Nachankar, S. Chaudhary and K. Aitawdekar]

Chat Studio for Learning Mathematics

As a part of the Sugar Platform that runs on One Laptop per Child (OLPC) a new game application has been designed, to extend instant messengering activity to help develop arithmetic skills of primary school students. The journal store of this activity is modifed to record events in microsecond resolution for response times. This activity will be field tested as a part of the research on learning mathematics in a social context. [R. Shaikh, G. Nagarjuna, R. Katkam, G. Wadekar and S. Mohanan.]

Collaborative Undergraduate Biology Education (CUBE)

This program which started in 2012 continued with increasing participation from college

students. New nodal centers were developed in Carmel College, Goa; Acharya Narendradev College in Delhi; SIES College, Nerul and Vivekananda College, Chembur. Each of these colleges are developing simple model systems round the year to facilitate experiments by students. More than 300 students have participated online and 120 students in two workshops held in 2013. As the students are engaged in the CUBE program, we do a rigorous analysis of the appropriateness of the research question being asked, experimental apparatus, experimental design, analytical skills, use of language and communication, reframing of questions, models and representations. [M.C. Arunan, G. Nagarjuna, S. Ghumre, R. Shaikh and student mentors]

Collaboration with Government and other Agencies

Collaboration with DST for development of BEST project for Teachers

Building Educators for Science Teaching (BEST) is a joint project between MST and MHRD, aimed at in-service educators at primary, secondary and tertiary levels of education. Several organizations were involved in consultation to generate the project outline and detailed project report: MST, MHRD, HBCSE, NCSTC, VP, Ekalavya, NCERT, GujCoST, IISc Bengaluru, IISER Pune, Navnirmiti, Kendriya Vidyalay Sanghathan, Agastya Foundation, Azim Premji Foundation, MPCoST, VSCSC, CIE, and Indo-US S&T Forum.

After a brainstorming session at DST in April 2013, HBCSE was commissioned to develop a Table of Contents for a final DPR in consultation with other institutions. A series of consultative discussions were held within HBCSE, and a two-day brainstorming meeting was held with several stakeholders in education within and outside Maharashtra State in July 2013. Consultative meetings were also held with teachers, teacher educators and members of State education bodies by Eklavya in Madhya Pradesh State, and by Vigyan Prasar members in Puducherry (August) and by HBCSE in Mumbai (August).

With inputs from the workshops and consultative meetings, a detailed DPR was developed and submitted to DST. It recommends that teacher professional development must be taken up at the elementary school level with integration across all educational levels and collaboration among all stakeholders. [J. Ramadas, C. Natarajan, K. Subramaniam, S. Chunawala, G. Nagarjuna, A. S. Sule, N. D. Deshmukh and M. C. Arunan]

Eyes on Comet ISON National Campaign

Eyes on Comet ISON outreach campaign was a national effort to increase awareness about astronomy amongst the masses. Astronomy Cell members of HBCSE actively contributed to various aspects of the campaign by developing and translating resource materials like presentations, posters and activity books as well as conducting lectures and activity sessions in different locations. [A. Sule and A. Ghaisas]

Maharashtra State Collaborations

HBCSE collaborates with several agencies of the Government of Maharashtra: the State Council of Educational Research and Training (SCERT) which prepares the curriculum framework and syllabi, Balbharati, which produces textbooks, the State Education Department which administers the school system and the Maharashtra Prathamik Shikshan Parishad (MPSP), which implements the Sarva Shiksha Abhiyan (SSA) and Rashtriya Madhyamik Shiksha Abhiyan (RMSA).

HBCSE members contributed to the curriculum and syllabus committees for elementary school mathematics, and review of the environmental studies syllabus for SCERT and for Balbharati. At the textbook writing stage one member contributed as member of the committee for primary mathematics and one as member for primary environmental studies (EVS) for Classes 3 and 4. A group of members carried out a review of the State EVS textbook for Class 3. These books will be used in the state schools from June 2014. One member was part of a team to write and review teachers' handbooks for Classes 9 and 10 science, which are to be distributed to 3000 schools by MPSP under RMSA. [K. Subramaniam, V. D. Lale, N. D. Deshmukh, J. Ramadas, S. Chunawala, A. Muralidhar and V. Bansode]

Marathi Vishwakosh

HBCSE continued to collaborate with the Maharashtra Rajya Vishwakosh Nirmiti Mandal to produce the 'Kumar Vishwakosh' (Junior Encyclopedia) Volume 2, on the topic of 'Biology and Environment' with about 280 entries. This encyclopedia, which is planned in many volumes, is envisaged to be a reference material for teachers and students at secondary and higher secondary school level and is being brought out in Marathi. The print as well as the web version of Volume 2 were released in February 2013.

http://vishwakosh.org.in/kumar-vishwakosh/, http://vishwakosh.org.in/kumarmv/.

[V. D. Lale, N. D. Deshmukh, K. Pednekar and H. C. Pradhan (Raja Ramanna Fellow)]

RGSTC-HBCSE SIAC Workshop

Workshop on ‘Setting Sustainable Goals, Resources and Practices for Science and Innovation Activity Centers (SIAC) proposed in Maharashtra’ was organized by Homi Bhabha Centre for Science Education, Mumbai, in collaboration with the Nehru Science Centre, Mumbai; Exploratory, Pune and Vigyan Ashram, Pabal and funded by Rajiv Gandhi Science and Technology Commission, Mumbai. The SIAC workshop was held from July 1-5, 2013 for the representatives of the 5 institutions. Two Science and Innovation Activity Centers will be finalized at Warananagar and Praveranagar. (N.D. Deshmukh - Coordinator, J. Ramadas, C. Natarajan, V. Lale, V. Sonawane and K. Hambir).

Collaboration with other agencies

HBCSE worked with teachers of the Nashik Education Society in action research program. Some 500 teachers submitted their action research proposal in different disciplines. After screening 70 teachers were selected to conduct action research in the classrooms. Necessary guidelines were given to these teachers and a seminar was organized at the end of the academic year [V.D. Lale]

The development of open educational resource for students (OER4S) in science and mathematics is an important program of the Maharashtra state. HBCSE has been contributing to it in a significant way. This program is run by Rajiv Gandhi Science and Technology Commission (RGSTC), Mumbai and Maharashtra Knowledge Corporation Limited (MKCL), Pune. HBCSE staff members worked in the Content Committee for Shikshan Pandhari project in Padharpur. [H.C. Pradhan and V.D. Lale]

Olympiads and Related Activities

Out of the 36 student team members who represented India in the International Olympiads in Physics, Chemistry, Biology, Mathematics, Astronomy and Junior Science, 35 bagged medals and this included 12 coveted gold medals. Like the sports Olympics, nations are not officially ranked in the Olympiads. However, based on aggregate scores, India is generally among the top ten nations in the Physics, Chemistry, Biology, Astronomy and Junior Science Olympiads. Over 200 of the best students from across the nation were given experimental and theoretical training.

By designing conceptual and challenging problems, developing novel experiments, actively participating in book writing for Olympiads, national and state bodies, participating in assessment committees [KVPY (DST), NEST (DAE), NTSE (NCERT), etc.] among others, the cell members of the Olympiad programme have provided a benchmark for quality education at the Higher Secondary and Undergraduate level in the country. They have contributed research articles in peer-reviewed technical journals. More than three hundred teachers attended resource generation and exposure camps, some from Bangladesh, Sri Lanka, Nepal. Thus, by organizing teacher and scientist Resource Generation and Exposure Camps and further by providing meaningful support to voluntary Teacher Associations; the programme has disseminated the quality material developed as well as striven to evolve a positive atmosphere for excellence in science.

The Olympiad selection procedure at HBCSE in all the six subjects (mathematics, physics, chemistry, biology, astronomy and junior science) has now been standardized. Briefly, for science and astronomy Olympiads, it consists of: two theory tests conducted all over the country with the assistance of the Indian Association of Physics Teacher (IAPT), Association of Chemistry Teachers (ACT) and Association of Teachers in Biological Sciences (ATBS). The first test, conducted in over 900 centres all over the country, has mainly objective type questions; the second test conducted at 16 centres and by HBCSE, has subjective problems, and is of high difficulty level comparable to the international Olympiads. This constitutes the Indian National (Physics / Chemistry / Biology / Astronomy / Junior Science) Olympiad Examinations (INPhO, INChO, INBO, INAO and INJSO respectively). While the participation in the first test runs into tens of thousands (the enrollment in the year 2013-14, was about 39,000 in Physics, 33,500 in Chemistry, 14,000 in Biology, 11,600 in Astronomy, 25,000 in Junior Science and 31000 in Mathematics), the second test sees the participation of the top 300 students in each subject except mathematics which has 850 students. We also note that in mathematics the first stage is organised regionally and the second stage is organised by HBCSE and both stages have subjective questions. In the next phase of selection, about forty students in each subject are selected from the Indian National Olympiad examinations and are invited for orientation-cum-selection camps held at HBCSE. Students appear for several theoretical and experimental tests, leading to the selection of Indian Teams for the final international Olympiads. The selected teams for International Olympiads again go through two weeks of pre-departure training at HBCSE.

[V.A. Singh, National Coordinator (Science Olympiads: Physics, Chemistry, Biology and Junior Science), M.N. Vahia, TIFR, National Coordinator (Astronomy Olympiad), V.M. Sholapurkar, National Coordinator, Mathematical Olympiad, C.R. Pranesachar, B.J. Venkatachala and Prithwijit De (Mathematics), P. Pathak (Physics Theory), S.R. Pathare (Physics Experiment), S. Ladage, S. Narvekar and I. Das (Sen) (Chemistry), R.R. Vartak, A. Ronad and V. Ghanekar (Biology), A.P. Sule and A. Ghaisas, A. Mazumdar (Astronomy and Astrophysics), P. K. Joshi and P. Nawale (Junior Science)]

10th International Junior Science Olympiad 2013

HBCSE organized the 10th International Junior Science Olympiad (IJSO) in Pune from 3 to 12 December 2013. Participants, including 226 students, accompanied by 111 leaders, 19 observers, 8 visitors and one executive committee member, came from 42 countries. The event was funded by the Government of India through DAE, Ministry of Human Resources Development, and Department of Science and Technology. The academic programme of the event, planned by a team of teachers and reputed scientists from universities and research institutes across India, consisted of three tests: 'multiple choice' test, 'theory' test and experimental tasks. The experimental tasks were assigned to teams of students. These challenging problems, based on school-level physics, chemistry and biology, were designed to test the students' understanding of concepts, their applications in familiar or new contexts, and their analytical thinking. In the longer term aims of IJSO are to have a positive influence on science and mathematics education at school level.

Keeping the broader aims of the event in mind, HBCSE included excursions, sports, and also informal science events for the participating teams of students. Outreach activities were conducted as part of IJSO 2013. About 100 school students in the State, who are winners of the Homi Bhabha Bal Vaidnyanik award, along with their mentor teachers, were provided an opportunity to attempt some of the challenging experimental and theoretical problems developed for the competition. A booklet of problems in different science subjects, akin to those in the different Olympiads, titled 'Invitation to Olympiads' was developed for the occasion by the Olympiad team of experts at HBCSE. Initially made in English, the booklet will be translated into local Indian languages for wider distribution and use around the country. The event was inaugurated by Dr. Anil Kakodkar, former Chair, Atomic Energy Commission, and Dr. R. Chidambaram, Principal Scientific Advisor to the Government of India, gave away the medals to the young meritorious students from all over the world.

Orientation–cum– Selection Camps (OCSC) and International Olympiads

Physics

The Physics Olympiad cell conducted OCSC during April 11-20, 2013 and the Pre-Departure Training (PDT) for the Indian Team in July 2012. 43 students attended the OCSC. Lectures were taken on advanced topics such as Special Relativity and Quantum Physics. Theoretical problems in the test were of high standard and included topics such as the Central force, Landau theory of phase transition, Bohr model and Weizsaker’s optical fiber. A theoretical problem related to the semi empirical mass formula was set with assistance of Dr. Praveen Pathak and Prof. Vijay Singh. This problem was selected for the Indian Physics Association award for theory. The five-member team was selected at the end of the camp to represent India at the International Physics Olympiad held at Copenhagen, Denmark in July 2013.

A set of four experiments were designed and developed by Shri Shirish Pathare. These experiments were:

1. Mechanical Black Box: This mechanical black box is a rectangular box which consists of two cylindrical cavities (each length 13.0 and 5.0 cm respectively and radius of 1.6 cm). The task is to determine their length and radius.
2. Refractive index of prisms using laser pointer: In this experiments students were asked

to determine the refractive index of prism using a laser pointer. They were given a 2 ft × 2 ft protractor sheet fitted with a prism table. The refractive index determination was done using minimum deviation method, critical angle method and using Brewster law method.

3. Liquid drops under horizontal surfaces: Liquid drops formed under a horizontal surface appear to have the same size. The size of the drop is determined by the surface tension and the density of the liquid as well as the diameter of the surface under which the drop is formed. Students were asked to design appropriate experiments to make suitable observations and to deduce correct relationships between various quantities.
4. Study of inductance of a coil with ferromagnetic core: In these experiment students uses a specially designed two-coil transformer wound on a single loop (O shaped) ferrite core. The two coils (coil X and coil Y) were made up of an insulated copper wire. A steady or direct current (DC) passing through the coils would develop a steady magnetic field in the core while an alternating current (AC) would develop an alternating magnetic field in the core. In part I, students used an AC source to study the dependence of inductance of coil with ferrite core with respect to current. The used a three-voltage method to calculate the inductance. Further they studied the variation of the effective inductance of coil Y with different DC through coil X. In part II, students studied the dependence of the mutual inductance between the two coils on the DC in the coil X. In part III, they estimated the unknown number of turns of coil Y considering the two-coil assembly as an ideal transformer.

Prof. Sunil Mukhi, IISER Pune was the chief guest for the OCSC (Physics) Valedictory Function.

On the basis of camp performance, a team of 5 students was selected. The team underwent pre-departure training camp at HBCSE in July 2013. The 5 member Indian physics team at the 44th International Physics Olympiad held at Copenhagen, Denmark in July 2013 won one gold, four silver medals. Prof. M. L. Oglapurkar, NSE Coordinator, IAPT Pune and Dr. Praveen Pathak (HBCSE, Mumbai) were the team Leaders and Prof. Vijay Singh (HBCSE, Mumbai) was the Scientific Observer.

Chemistry

The Chemistry Olympiad cell conducted OCSC during April 23 – May 2, 2013 and the PDT for the Indian Team in July 2013. 35 students attended the OCSC. The theoretical sessions at OCSC 2013 involved problem solving in areas of chemical kinetics, solid state, catalysis, stereochemistry and organic reaction mechanism, heterocyclic chemistry, chemistry of transition group elements and solubility equilibrium. The four-member team was selected at the end of the camp to represent India at the International Chemistry Olympiad held at Moscow, Russia in July 2013.

The experiments that were developed and standardized for experimental examinations at OCSC 2013 covered the following areas-

1. Analysis of copper nickel coin using complexometric titrations,
2. Estimation of calcium and magnesium ions in a mixture,
3. Two step synthesis of 5-(4-bromophenylaminomethyl)-2-methoxyphenol
4. Synthesis of p-iodonitrobenzene
5. Identification of unknown compounds by qualitative organic tests and
6. Study of reactions of transition metal cations in basic medium.

Dr. Chinmoy Nandi, Vice President, R & D, NOCIL India Pvt. Ltd. was the chief guest for the OCSC (Chemistry) Valedictory Function.

On the basis of camp performance, a team of 4 students was selected. The team underwent pre-departure training camp at HBCSE in July 2013. The 4 member Indian chemistry team at the 45th International Chemistry Olympiad held at Moscow, Russia in July 2013 won two gold and two silver medals. Prof. Savita Ladage (HBCSE, Mumbai) and Prof. Sudha Jain (President, Association of Chemistry Teachers) and Ms. Gomathi Shridhar (V. K. Menon College, Mumbai) were the team Leaders and Dr. Prabhakar Rohankar (Jagadmaba Mahavidyalaya, Amravati, Maharashtra) was the Scientific Observer.

Biology

The Biology Olympiad cell conducted OCSC during June 4 - 12, 2013 and the PDT for the Indian Team in July 2013. 41 students attended the OCSC. Problem solving sessions in Cell Biology, Plant Sciences, Animal Sciences, Genetics and Evolution, Ecology and Ethology were conducted. Experimental tasks for orientation and selection tests were standardized in the areas of Comparative and functional Biosystematics, Molecular Cell Biology, Plant Ecology and physiology and Evolutionary Ethology. The students were given two theoretical tests and four experimental tests during the camp. The four-member team was selected at the end of the camp to represent India at the International Biology Olympiad held at Bern, Switzerland in July 2013.

Prof. Renee Borges, Professor and Chairperson, Centre for Ecological Sciences, Indian Institute of Science, Bangalore was the chief guest for the OCSC (Biology) Valedictory Function.

On the basis of camp performance, a team of 4 students was selected. The team underwent pre-departure training camp at HBCSE in July 2013. The 4 member Indian Biology team at the 24th International Biology Olympiad held at Bern, Switzerland in July 2013 won three silver medals and one bronze medal. Dr. Shashikant Acharya, Maharaja Sayajirao University of Baroda and Dr. Pravin Nayak, Jhunjhunwala College were the team Leaders and Dr. Rekha Vartak, HBCSE, Mumbai.

Junior Science

The Junior Science cell conducted OCSC during May 16 – June 1, 2013 and the PDT for the Indian Team was held from November 25 – December 1, 2013. 47 students attended the OCSC. Lectures were taken on advanced topics in Biology, Chemistry and Physics at the Class X level. Problems of high standards where set for theoretical and practical exams. The six-member team selected at the end of the camp to represent India at Pune, India in December, 2013.

The six-member team at the 10th International Junior Science Olympiad held at Pune, India in December 3 -11, 2013. As a host country, India was allowed to have two six-member teams who won 9 Gold medals and 3 silver medals, Dr. Jogeswar S. Purohit. Smt. C.H.M. College, Ulhasnagar, Shri Vinayak Katdare, D.G. Ruparel College, Mumbai and Dr. Chitra R. Kamath, K.J. Somaiya College of Science and Commerce, Vidyavihar were the leaders of team 1. Dr. P.A. Sathe, Ramnarain Ruia College, Mumbai, Shri Zohar Attari, Mainadevi Bajaj International School, Malad, Ms. Priya Lagvankar, Dombivli were the leaders of team 2.

Astronomy Olympiads

The Astronomy Olympiad Cell conducted OCSC during May 1 – 16, 2013 and Pre-departure training (PDT) for the Indian team in July-August 2013. A total of 16 students attended OCSC. Astronomy OCSC programme covers a wide range of topics in Astrophysics from positional astronomy, stellar and solar physics to large scale structure of the universe and cosmology. The students were evaluated on basis of 3 theoratical, 2 practical and 2 observation tests conducted during the camp and top 5 students were selected for merit awards. The five-member team was selected at the end of the camp to represent India at the International Astronomy and Astrophysics Olympiad held at Volos, Greece in August 2012.

Prof. Ram Sagar, Director, ARIES, Nainital was the chief guest for OCSC (Astronomy) valedictory function.

The five-member team at the 7th International Astronomy and Astrophysics Olympiad held at Volos, Greece in July 27 – August 5, 2013 won two silver, three bronze medals. Dr. Aniket Sule (HBCSE) and Prof. Jasjeet Singh Bagla, IISER, Mohali were the team leaders and Prof. Jayashree Ramadas (HBCSE) and Dr. Manojendu choudhury were the Scientific Observers.

Mathematics

The Mathematics Cell conducted IMOTC during April 29 to May 27, 2013 and Pre–departure Training (PDT) for the Indian team during July 11 to July 20, 2013. A total of 46 students attended IMOTC. The six-member team was selected at the end of the camp to represent India at the International Mathematical Olympiad held at Santa Marta, Colombia in July, 2013.

Prof. M. S. Raghunathan, IIT Bombay was the chief guest for OCSC (Mathematics) valedictory function.

The six-member team at the 54th International Mathematical Olympiad held at Santa Marta, Colombia from July 18 – 28, 2013 won two silver medals and three Bronze medals. Prof. C. R. Pranesachar, Mathematical Olympiad Cell, HBCE (TIFR), Bangalore and Dr. Aditi Phadake, Nowrosjee Wadia College, Pune were the team leaders and Prof. S. S. Sane (IIT – Bombay) was the Scientific Observer.

Junior Mathematics and Science Olympiad – 2013

The fourteenth junior mathematics and science olympiad camp conducted jointly by The Atomic Energy Educational Society (AEES) and HBCSE from May 6 to 15, 2013 drew about 60 of the best students of the Atomic Energy Schools from around 30 schools all over the country. Students chose one of three subject pairs Math-Phys, Phys-Chem, and Chem-Bio, and participated in 6 to 7 sessions in each subject during the camp. HBCSE staff were resource persons for the lecture, problem solving sessions and enrichment sessions. The laboratory sessions in physics, chemistry, biology and mathematics were planned and conducted by HBCSE staff members at HBCSE. The co-curricular sessions focused on creative and divergent thinking skills. [C. Natarajan - Coordinator, R. Vartak, A. Ronad, P. Pathak, S. Pathare, V. Ghanekar, S. Narvekar and I. Das (Sen), S. Chunawala, P. Birwatkar].

Resource Generation Camps (RGC)

Resource Generation Camps in which teachers and scientists from across the nation gathered at HBCSE for development of curriculum and Olympiad material was held in Physics, Chemistry, Biology and Mathematics.

There were two Resource Generation Camps for Physics; theory camps during Dec 26 - 28, 2013 for 8 participants and during Feb 6 – 12, 2014 for 11 participants. There was one

Resource Generation Camp of Chemistry during October 21 – 24, 2013 for 15 participants. There were six Resource Generation Camps for Biology; each of 5 participants during October 14 – 15, 2013 on Animal Sciences, October 22 – 23, 2013 on Plant Sciences, November 22 – 23, 2013 on Cell and Molecular Biology, November 25 – 26, 2013 on Ecology & Ethology, December 18 – 20, 2013 on RGC in collaboration with ATBS, and December 22 – 23, 2013 on Genetics & Evolution. There were nine Resource Generation Camps of Junior Science; during Jan 7, 2013 for 12 participants, Jan 19, 2013 for 15 participants, March 3, 2013 for 10 participants, March 24, 2013 for 7 participants, April 21, 2013 for 8 participants, May 21, 2013 for 12 participants, July 20, 2013 for 20 participants, September 14, 2013 for 15 participants, and October 15, 2013 for 11 participants. A Resource Generation Camp for Astronomy; was held on November 1, 2013 for 20 participants.

Olympiad Exposure Camps

There has been a long standing suggestion that a larger number of teachers be involved in the Olympiad effort. Since 2009, we have held shorter 3 day exposure camps where a large number of school and college teachers would be invited. Some were outstation camps. The Physics exposure camp held during Dec 28 – 30, 2013 had 35 participants. The Chemistry exposure camp held during Nov 24 – 26, 2013 had 32 participants. The Biology exposure camp held during Sept 4 – 6, 2013 had 39 participants. The Astronomy exposure camp held during Oct 28 – 31, 2013 had 46 participants.

A large number of teachers and scientists from across the nation were involved in this effort. A number of faculty members from Nepal, Bangladesh and Sri Lanka participated in the Astronomy and Astrophysics as well as the Physics Olympiad Exposure camps. A proactive attempt was made to invite faculty from Jammu & Kashmir, Uttaranchal and North-east. India will be hosting the International Physics Olympiad (IPhO) in 2015 where approximately 100 countries are expected to participate.

Kishore Vaigyanik Protsahan Yojana

KVPY is a prestigious scholarship scheme for meritorious students at the Higher Secondary School and College level instituted by the Govt. of India. From 2006, HBCSE has become a zonal centre of KVPY. Accordingly, the Centre oversaw the conduct of the Aptitude Test held in November 2012. Cell members [V. Singh (Convenor-Physics), P. Pathak and A. Mazumdar] participated in the development of assessment resources.

Nationwide Education and Scholarship Test (NEST)

HBCSE faculty has participated in NEST giving it structure and shape since its inception. Like the previous years, they were part of the academic committee [A. Sule, P. De and V. Singh]

The Olympiad effort was also supported by the Dept. of Science and Technology, the Ministry of Human Resource Development and the Dept of Space.

National Initiative on Undergraduate Science (NIUS)

From its inception in summer 2004, about 930 undergraduate students have been exposed to the National Initiative on Undergraduate Science programme (under the aegis of exposure-

cum-enrichment camps). With the thrust on promoting undergraduate research, the programme has been contributing towards development of theoretical and laboratory courses, preparation of lecture notes and pedagogical material, R&D in science education/laboratory training and training of students and teachers in experimental science. The administrative responsibilities of the programme involve co-ordination with scientists and students, organizing nurture camps and purchase of equipments, etc. Supporting college teachers to set up modest research programs at their own institutions is yet another important facet of the NIUS programme which further helps in mentoring undergraduate students at local levels.

This year 127 undergraduate students have attended the NIUS exposure-cum-enrichment camps. A fair fraction of the students were from non-metropolitan colleges. Leading scientists and researchers across the country interact with students intensely during these camps and deliver lectures on diverse topics. Parts of these lectures and discussions lead to preparation of lecture notes that are useful resources for Curriculum Development at the undergraduate level. Some of the projects carried out by students have been published in international journals. Special effort has been made to reach out to the college teachers in the non-metropolitan areas of Uttarakhand, Madhya Pradesh, Uttar Pradesh, Bihar and Maharashtra.

Physics

The NIUS camp for physics (X.1) was held at HBCSE from June 4 - 15, 2013. 62 students attended the first camp. These students were from three streams i) regular B.Sc ii) integrated M.Sc. and iii) B.Tech./B. E.

The speakers for the camp were Dr. Anwesh Mazumdar (HBCSE), Arvind Kumar (HBCSE), Asima Pradhan (IIT Kanpur), D. P. Roy (HBCSE), Divya Oberoi (NCRA, Pune), Jayant K. Bhattacharjee (HRI, Allahabad), Nissim Kanekar (NCRA, Pune), P.K.Joshi (HBCSE), Prasanta Panigrahi (IISER, Kolkata), Praveen Pathak (HBCSE), Rajeev Bhalerao (TIFR, Mumbai), Sudhir Jain (BARC, Mumbai), Rajesh Khaparde (HBCSE), S. M. Roy (HBCSE), and Vijay Singh (HBCSE).

The theoretical sessions at the camps covered topics such as astrophysics, nanophysics, particle physics, quantum computing and experimental physics. In addition, there were project related enrichment lectures. The short laboratory course at the camp was based on “Experimental Problem Solving” approach which covered experimental problems related to optics, mechanics, electronics, electricity and magnetism etc.

TIFR is a prominent centre for Astronomy and Astrophysics. More than two national centers are dedicated to this area. NIUS (Physics) has utilized this opportunity by guiding several students in this field and linked them to various experts in these centers.

From this batch, 34 students were selected and they are currently pursuing their projects. In addition, 24 students from previous batches continued their projects at HBCSE and with mentors in Delhi University, Patna Science College, Harishchandra Research Institute (Allahabad), Physical Research Laboratory, (Ahmedabad), Chennai Mathematical Institute (Chennai), TIFR and BARC. The areas covered are as varied as mentioned above.

Summer Course in Experimental Physics is yet another enrichment course that is conducted as part of NIUS physics. This course is open to undergraduate students and is based on Experimental Problem Solving approach that has been developed at HBCSE. The main aim of this course is to promote independent thinking and foster procedural understanding among students while they are working in physics laboratory. Thus, the course covers sessions related to introduction to experimental physics and its essentials, experimental problem solving in physics, procedural understanding along with the laboratory sessions. Participants of the camp

also visited TIFR main campus and presented their work towards end of the camp. 52 students from the second year B.Sc./BS/ Integrated M.S./M.Sc. participated in this course that was held at HBCSE in May 2013. A three - day preparatory workshop was conducted prior to this summer course. Nine teachers from different parts of the country, teaching physics at undergraduate level, participated in this workshop. With orientation and exposure to procedural understanding and experimental problem solving in physics, these teachers then act as mentors for summer camp.

In another project titled 'Development of Instruments and Experimental setups for the Undergraduate Physics Teaching Laboratories', several complete experimental setups and measuring/laboratory instruments, that include laser power supply, laser mounts, universal clamp, velocity measurement unit, mechanical simple harmonic vibrator, power amplifier, magnetic physical pendulum, high voltage power supply, etc. were designed and developed at HBCSE. Number of NIUS students have been involved with this project and have contributed towards the developmental work.

NIUS Astronomy Winter School

Like every year, past astronomy Olympiad students were invited to participate in a 2 week winter school at a astronomical institution from 2nd to 13th December 2013. This year's school held at HBCSE, Mumbai, in collaboration with B.A.R.C., Mumbai, was attended by 12 students. The students participated in various projects related to high energy astrophysics. [M. N. Vahia (DAA, TIFR) and A. Sule]

Chemistry

The NIUS camp for chemistry (X.1) was held at HBCSE from 23rd December to 31st December, 2013. 41 students from regular B.Sc./BS or integrated M.Sc. courses attended the camp.

The resource persons for the camp were Dr. Arvind Kumar (HBCSE), A. A. Natu (IISER, Pune), M. Balakrishnan (IIT Mumbai), N. D. Gangal (NOCIL India Ltd., Thane-Belapur), P. Chobe (BASF India, Mumbai.), P. A. Hassan (BARC, Mumbai), R. Jayaram (ICT, Mumbai), S. K. Ghosh (BARC, Mumbai), S. Ladage (HBCSE), M. Sundararajan (BARC, Mumbai), S. D. Samant (ICT, Mumbai), T. Ghanty (BARC, Mumbai), V. Singh (HBCSE); Ms.G. Shridhar (V. K. Menon College, Mumbai) Ms.S. Narvekar (HBCSE), Ms.I. Das Sen (HBCSE) and Mr.T. Joshi (HBCSE).

The theoretical sessions at the camp covered some of the core and advanced areas in chemistry. These topics were chemical thermodynamics, stereochemistry, spectroscopic techniques for structural elucidation, chromatographic separation techniques, surfactant science and catalysis including enzyme catalysis, soft condensed matter, innovations in chemistry and chemical industries, computational chemistry, and organo-metallic chemistry.

This year, the lab activity sessions were designed in a unique way, with each student assuming the role of a synthetic chemist. The activity was designed in the context of multi-component synthesis in pharmaceuticals and deployed detailed task-sheets that were different for each student. It was followed by a discussion session when the entire group came together and discussed what they did, thereby arriving at the variety of parameters involved in an experimental research project.

The camp also covered computational chemistry laboratory sessions. Participants of the camp performed short computational calculations related to different conformations of molecules such as water, hydrogen peroxide, hydronium ion, formaldehyde, ferrous chloride and butane

and were expected to determine the energies of their stable structures. The computing was done using GAUSSIAN and students were able to visualize the molecules in MOLDEN.

The camp comprised a visit to the pharmaceutical plant of CIPLA located at Patalganga, Navi Mumbai. Students visited different Quality Control (QC) laboratories, production and packaging units. The QC laboratory exposed students to the utilization of several advanced analytical instruments in assay of pharmaceutical preparations. They were also exposed to several protocols regarding testing of different formulations and their preservation. The visit also sensitized them to various safety aspects in pharmaceutical industries.

Towards the end of this camp, 24 students were selected and currently these students are in the process of completing assignments related to the prospective projects. In addition, 16 students from earlier batches of NIUS Chemistry also visited HBCSE to complete their projects and prepare manuscripts for publications and conferences.

Biology

The NIUS camp for Biology (Batch X.1) was conducted at HBCSE from 28th Oct 2013 – 1st Nov 2013. 24 students from regular B.Sc. or integrated M.Sc. courses attended the camp.

The resource persons for the camp were Drs. B. B. Nath (Pune University), Dharmendra Shah (M.S.University, Vadodara), Rekha Vartak (HBCSE), Sasikumar Menon (Therapeutic Drug Monitoring Lab, Mumbai), Swati Chitnis,(NIRRH, Mumbai), Vijay Singh (HBCSE); Ms. Anupama Ronad (HBCSE) and Mr. Vikrant Ghanekar (HBCSE).

The theoretical sessions at the camp were related to basic concepts of biology and biostatistics, holistic approach to studies on traditional medicine, plant identification, scaling laws in biology, protein chemistry, and tools and techniques for chromosome studies. The laboratory sessions covered experiments related to biochemistry, molecular biology, bioinformatics and genetics.

From this batch, 9 students have been selected to pursue NIUS projects. In addition, 8 students from earlier batches of NIUS Biology also visited HBCSE to complete their projects and prepare manuscripts for publications and conferences.

Computational Facility

Computational science at the undergraduate level is one of the planned thrust areas of NIUS. The computational laboratory in the NIUS building has been equipped with 30 high-end computers. Apart from NIUS programme, this facility is being used on regular basis for various teachers and students programmes conducted at HBCSE. This year, the facility was used by i) Undergraduate student participants in NIUS Chemistry (for computational chemistry modules and research project work), ii) NIUS Physics students for their research work and iii) several training and orientation programmes for teachers and students, including sessions on Geogebra and biology olympiad training.

This year, the First NIUS Workshop on Introductory Computational Science was held at the computational laboratory from September 29 to October 2, 2013 at HBCSE. The workshop consisted of lectures on various tools of computational science and extended sessions of hands-on programming and problem-solving on computers. The workshop introduced basic concepts of numerical techniques and their implementation in the context of physics problems. It was attended by 20 second-year physics undergraduate students from B.Sc. colleges and 19 teachers from undergraduate and higher secondary schools across the country. The resource persons were Dr. Anwesh Mazumdar (HBCSE), H. M. Antia (TIFR), Praveen

Pathak (HBCSE) and Vijay Singh (HBCSE).

Teacher Orientation and Science Popularization

In-service Teacher Professional Development

HBCSE conducts a range of activities for the professional development of in-service school and college teachers. These activities have multiple objectives: dissemination of insights generated from STME research in the Indian education system, capacity building of teachers and educational institutions, maintaining an organic link with educators, generating data for HBCSE research in teacher development.

Three workshops, each of three days' duration, were organized at HBCSE for secondary science teachers, secondary mathematics teachers and for a group of primary science and maths teachers respectively of the Kendriya Vidyalaya Sangathan. The secondary science workshop included hands-on experiments in physics, chemistry, biology, talks on on scientific topics, and sessions on science pedagogy. The secondary mathematics workshop had a focus on problem solving and on the use of ICT in teaching mathematics. The primary science and maths workshop aimed at providing an experience of inquiry-based science learning through designing and conducting experiments and reflection on the practice of teaching. Teachers analysed textbooks and classroom teaching videos and participated in hands-on activities in mathematics. [C. Natarajan, M. Kharatmal, R. Shaikh, Tejaswi N., S. Takker, R. Diwakar, S. Chunawala, J. Vijapurkar and HBCSE members]

HBCSE members conducted several workshops for teachers in collaboration with teacher associations and educational organizations. These included (i) 3-day workshop for 66 science teachers from Pandharpur Taluka in collaboration with SVERI Education society followed by a 4-day workshop for 36 teachers from this group at HBCSE (ii) 2-day workshop for over 43 science teacher from Z.P. schools in Chandrapur (iii) 2-day workshop for science teachers from Nashik organized in collaboration with Nashik Education Society (iv) 1-day workshop for 90 science teachers from Mahad Taluka in collaboration with People's Education Society (v) 3-day workshop for 45 science teachers in collaboration with Shri Shivaji Science College, Amravati on constructivist teaching approaches (vi) 3-day workshop for 42 science teachers from Goa on activity based learning organized in collaboration with SCERT, Goa (vii) 3-day conference on inquiry-based learning for 1200 teacher participants organized in collaboration with Rayat Shikshan Santha in Ahmednagar (viii) Workshop for tribal teachers in Ambernath (ix) Teachers training program at GNFC school in Bharuch (x) Teacher training program for school teachers on introduction of the olympiad program and role of science experiments in teaching at Rajkot science city [A. Sule, P.K. Joshi, N.D. Deshmukh, V. Sonawane, K. P. Nawale, Hambir and other HBCSE members]

HBCSE conducted a two-week internship program for 11 student-teachers from a neighbouring B.Ed. college. [N.D. Deshmukh, C. Natarajan, V. Sonawane and V. Lale]

At the college level, HBCSE's NIUS faculty organize workshops especially focused on laboratory based science education. Teachers and researchers who are involved in physics laboratory courses at the undergraduate level were invited to attend an 'Exposure cum Preparatory Workshop for Teachers' and subsequently be a resource person / mentor during a summer course organized for students. Nine undergraduate teachers from different parts of India participated in such a workshop at HBCSE during May 17 – 19, 2013. The workshop consisted of sessions on training in experimental physics, procedural understanding, experimental problem solving in physics, design and development sessions and discussion

sessions [Rajesh Khaparde]. A four-day Astronomy Olympiad Exposure Camp was organised at HBCSE for 70 teachers selected from all over India. [A. Sule, A. Mazumdar, A.D. Ghaisas, S. Chopde and G. Narvankar]

HBCSE is collaborating with the Royal Society of Chemistry in their efforts to improve chemistry teaching in India. This collaboration was initiated with a 3-day workshop that was held at HBCSE in October 2013 for high school chemistry teachers from Mumbai and surrounding regions. Several sessions were conducted with the teachers by RSC, both in and outside the laboratory. [J. Vijapurkar, S. Ladage, S. Narvekar, I. Bhattacharya and other members of the HBCSE chemistry cell]

Professional Development of Teacher Educators

HBCSE has in recent years conducted programmes for the professional development of teacher educators (faculty) in DIETs, which are the main government institutions for teacher education at the elementary level. A three day workshop for mathematics teacher educators from DIETs in Uttarakhand and Karnataka, faculty from SCERT and resource persons from Azim Premji Foundation (26 participants) was conducted in January 2014. The theme of the workshop was use of artefacts in teacher education. There were sessions on knowing and using artefacts, subject matter knowledge, learning through problems and mathematical modeling. A four-day workshop for science teacher educators of Uttarakhand DIETs and SCERT faculty (28 participants) was also held in February, 2014. The workshop theme was teachers' professional development and capacity building, and included components like hands-on-experiments, science through investigation, enrichment lectures, and a one-day educational tour to Nehru Science Centre. [K.K. Mishra, M. Kharatmal, S. Takker, S. Naik, R. Shaikh, R. Diwakar, S. Chunawala and HBCSE members]

Two workshops, each of two days' duration, were conducted for field level mathematics subject experts of Azim Premji Foundation on the school topics of algebra and functions respectively. The aim of the workshop was to explore content and pedagogy in an integrated manner in depth. The participants in the workshop were resource persons who develop material as well as work with teachers and teacher educators [K. Subramaniam]. A six-day workshop for teacher educators was conducted in collaboration with the Azim Premji Foundation, Jaipur on "Evolution: IV Capacity Enhancement Workshop" [K. Haydock].

Support to policy making

The MHRD, GoI constituted Joint Review Missions (JRMs) on Teacher Education in various states of the country to review the status of teacher education and to also consider issues related to program planning, implementation, monitoring and evaluation at each level of institutions, to assess the progress made by various states towards implementation of the revised Centrally Sponsored Scheme on Teacher Education (CSSTE). HBCSE played a leadership role in the JRM for the state of Punjab. The 9-member JRM team for Punjab visited the State from June 14 to 19, 2013 and met with the faculty and staff of key state government and non-governmental organisations, and teacher education institutions. A detailed JRM Report for Punjab was prepared by HBCSE members with inputs from JRM members and submitted to the MHRD. It is available at

http://www.teindia.nic.in/Files/jrm/JRM_Reports/JRM_Report_Punjab-2013-14.pdf

[J. Ramadas, M. Kharatmal, Kumar A., R. Shaikh and R. Diwakar]

TIFR Founder's Day

HBCSE has a very strong outreach and science popularization program and played key role in various exhibitions and science fair programs. HBCSE took an active part in Science Festival program at TIFR Campus, Navy Nagar, on the occasion of its Founder's Day program. Centre put many interesting hands-on experiments of science and mathematics, on the Open Day (27.10.2013). HBCSE publications were also put there for display and sale on both days- October 27 & 30, 2013. One of the faculty staff from HBCSE was a Member of the Apex Organizing Committee of the TIFR Founders Day program and coordinated Centre's participation in this annual event. (K. K. Mishra). Experiments on electricity, magnetism, robotic models, earth model, demonstration of Newton's Laws, etc were demonstrated on the occasion on October 27, 2013. [V.C. Sonawane, Kumar A., R. Diwakar, S. Ayare, V. Bansode, K.T. Hambir, T. Shirodkar, and S. Bamne]

3rd Pro-Am Meeting in Astronomy

Astronomy Cell of HBCSE organized the 3rd Pro-Am meeting in Astronomy at HBCSE on October 26-27, 2013. This is a flagship outreach activity of Astronomical Society of India to bring together amateur and professional astronomers to discuss problems of mutual interest and promotional aspects of Astronomy education in India. Pro-Am3 was attended by more than 80 participants.

Activities of the Hindi Cell and Rajbhasha Samiti

The Hindi Cell was involved in promoting the use of Hindi language in general at the Centre and in particular in the area of innovation and development in science education and science popularization. Members associated with the Cell were actively involved in the dissemination of educational and popular science materials in the country. They wrote science-based articles in the print media, delivered popular talks at different places on different occasions and gave radio talks. Hindi Cell also played a key role in Hindi Divas celebration and conducting various competitions on this occasion. [K.K. Mishra, V. Singh, A. Gajbhiye, S. Chandrakar and H. Kamble]

Vijay Singh gave many popular talks on Science including the Hindi Power Point Presentation on Ethnomathematics, and Mathematical folk riddles of Bhojpur region in a number of schools and as public lectures in many towns in the country like Allahabad, Gorakhpur and Siwan. These presentations were personally prepared along with Ranjana Pathak.

Visits to HBCSE

Teachers and students from many schools and colleges, and children from some NGOs visited HBCSE during the period of this report. Nearly 950 visitors visited HBCSE and its integrated lab facilities where they had exposure to hands-on-experiments in science and mathematics. Apart from experimental component, lectures and demonstrations were also organized for the visitors in science and mathematics. Visitors from junior colleges took keen interest in the experiments in the Olympiad laboratories of the Centre. Sometimes such visits are also arranged for some foreign delegates. [V.C. Sonawane (Coordinator), N.D. Deshmukh, K.T. Hambir, S. Ayare, A. Bose and J. Rahaman]

National Science Day 2014

As every year, the National Science Day was celebrated this year also. We had an "open

house" that witnessed over 1350 visitors to the Centre from schools and colleges of Mumbai and nearby areas. Several new experimental demonstrations were added this year and project staff members were trained for demonstrations. Demonstrations on the working of gadgets were also displayed in the program. Robotics education corner, glass blowing, liquid nitrogen show, computer corner, brain and cognition, and botanical garden were a few of the major attractions of the day. A demonstration on the working of a rocket was a new addition and a major attraction this year. This year trainee teachers, who visited HBCSE in past for their project work, were also involved in the demonstration of exhibits related to electricity, magnetism, biology and mathematics. [V.C. Sonawane-Coordinator and all HBCSE staff]

MSTA-HBCSE Dr Homi Bhabha Young Scientist Camp

Mumbai Science Teacher Association (MSTA) organized two-day camp at HBCSE on April 11 and 12, 2013 for Dr Homi Bhabha Young Scientist Awardees 6th standard students. More than 92 students of VI Std. were participated in this camp. [N.D. Deshmukh - Coordinator, V. Lale, S. Agarkar, V. Sonawane, A. Ghaisas, K. Hambir and R. Divakar]

IIE Programme

Indian Institute of Education, Pune had organized Tiger Reserve areas Resource Persons workshop at Pune, on June 05, 2014 [N.D. Deshmukh-Coordinator and K. Hambir]

Ambuja Cement Foundation Programme

Ambuja Cement Foundation, Chandrapur had organized Students camp, on January 15 and 16, 2014, more than 120 students from Z P Schools were participated. [N.D. Deshmukh-Coordinator and K. Hambir]

Udayanchal High School Programme

Activity Based Workshop was organized for Udayanchal High School, Vikroli students on March 5 and 6, 2014. [V. Sonawane-Coordinator, N. Deshmukh, K. Hambir, V. Bansode, Susneha and Rajkumar]

NTSE

Nurture camp organized for NTSE awardees, in the month of August, 2013 for 60 NTSE scholars. Students from all over Maharashtra attended the program consisting of motivational lectures and laboratory sessions. The programs were funded by NCERT. [P.K. Joshi]

4. Photographs/ Captions

Figure 1: See text for caption.

Photograph: NIUS Camp in Experimental Physics

5. Staff List

Members

S.I. Chunawala, S. Chandrasekharan, P. De, K. Haydock, P.K. Joshi, R.B. Khaparde, S.A. Ladage, A. Muzumdar, K.K. Mishra, G. Nagarjuna, C. Natarajan (Dean), J. Ramadas (Centre Director), V.A. Singh, K. Subramaniam, A. Sule, R.R. Vartak, B.J. Venkatachala, J. Vijapurkar, C.R. Pranesachar, S.C. Agarkar (upto 30/06/2013).

N.D. Deshmukh, A.D. Ghaisas, V.S. Ghanekar, M.B. Kharatmal, V.D. Lale, K.R.Manoj, A.T. Mavalankar, S.S. Naik, S.M. Narvekar, P.K. Nawale, R.P. Nichat, P.P. Pathak, S.R. Pathare, D.D. Pednekar, T.S. Rajashekar, A. Ronad, A.K. Sankhwar, I. Das (Sen), V.C. Sonawane.

V.P. Ahire, S.S. Chavan, K.T. Hambir, V.C. Jacob, S.D. Pardeshi, H.H. Rane, N.Y. Tribhuvan.

Visiting Fellows

M. Bhattacharya (upto 17/07/2013), P. Birwatkar (upto 30/04/2013), A. Jamkhandi, T. Navilarekallu (upto 24/02/2014), S. Paul (upto 25/10/2013), E. Sam (upto 23/10/2013).

Research Scholars

A. Bose, Mashood K. K., S. Shome, A. Shrivastava, S. Ghumre, S. Takker, J. Rahaman, R. Shaikh, P. Pande, R. Varkey M, G. Singh, B.J. Ram Rao, R. D'souza, H. Srivastava, G. Date, A. Raveendran (upto 31/01/2014), A. Dhakulkar (upto 31/07/2013), R. Kumar (upto 31/07/2013).

Raja Ramanna Fellows

A. Kumar (upto 14/10/2013), H.C. Pradhan.

INSA Senior Scientists

D.P. Roy, S.M. Roy.

Administration

S.V.Amin, M.B. Bamne, S.N. Burli, S.K. Desai, M.B. Deshmukh, M.D. Gaitonde (SAO), R.S. Korgaonkar (upto 31/01/2014), M.D. Mastakar (upto 31/08/2013), M.M. Mastakar, D.R. Mhapsekar, H.M. Mandlik, C.S. Pawar (upto 30/06/2013), S.L. Rasam, V.P. Raul, M.G. Shinde, R.A. Shrotri, T.S. Shirodkar, M.S. Thakur, G.A. Tawate, R.N. Sawant (from 18/03/2014).

Auxiliary

B.S. Bhagit, N.K. Kadam, G.V. Mestry, R.G. More, U.V. Shenoy, J.J. Tambe, N.S. Thigale, B.L. Valvi, J. Waghmare.

6. National and International Involvement (Professional and Academic)

S. Chunawala was 1) reviewer for Indian Educational Review, NCERT; and 2) Executive Council Member of the Peoples Council of Education for the year 2012-2015.

N.D. Deshmukh was 1) Executive Committee Member of Asian Association of Biology Education (AABE). 2) Editorial Board Member of Asian Journal of Biology Education (AJBE) 3) Member of executive committee of All India Association for Educational Research and Joint Secretary of Maharashtra Association for Educational Research. 4) Inspection team member of National Institute of Open Schooling centre.

A.D. Ghaisas was 1) Member of the Astronomy Sub-committee of the academic committee for International Earth Science Olympiad 2013 organised by Geological Society of India at Mysore, India in September 2013. 2) Member of the academic committees for The Maharashtra Public Service Commission, for preparing the question bank in the subjects of Physics and Astronomy and for reviewing final question papers for the year 2013 as well as 2014.

Karen Haydock was Independent Reviewer for the course package for 'Teaching Science: the Upper Primary Years' to develop course materials for teacher education 2013-2014, at Azim Premji University.

S. Ladage was 1) Co-opted member of International Steering Committee for International Chemistry Olympiad, 2012-2013; and 2) Vice president, West Zone, Association of Chemistry Teachers (ACT) (from 2010).

K.K. Mishra was 1) Member, (Executive Council), Lok Vigyan Parishad, New Delhi. 2) Member, Vigyan Parishad Prayag, Allahabad 3) Member, (Advisory Board) Vigyan Ganga, a science journal of Banaras Hindu University (BHU), Varanasi 4) Member (Editorial Board) Vigyan Prakash, World Hindi Foundation, Oswego, New York, USA. 5) Joint Secretary, Peoples Council of Education, Allahabad.

G. Nagarjuna was 1) Member, Institutional Advisory Board, Central Institute of Educational Technology, NCERT, New Delhi. 2) Associate Editor, International Journal of Conceptual Structures and Smart Applications (IJCSSA), an Official Publication of the Information Resources Management Association. 3) Reviewer, Science & Education, Springer. 4) Chairperson, Free Software Foundation of India. 5) Member, Board of Software Freedom Law Centre of India, New Delhi. 6) Member, Advisory Board, K.J. Somaiya College of Engineering, Mumbai.

S. Narvekar was 1)Secretary West zone- Association of Chemistry Teachers (ACT) (2013-2016)

C. Natarajan was 1) Member, Editorial Board of International Journal of Technology and Design Education, Springer, Netherlands; 2) Editorial Board, Design and Technology Education: An International Journal, Trentham Books Ltd., UK; 3) Member of Executive Council of the Indian Physics Association; and 4) Member, Academic Advisory Committee of Kendriya Vidyalaya Sangathan

P. K. Joshi was 1) Vice – President of International Junior Science Olympiad Executive Committee and 2) Chairman, Bombay Association for Science Education, since June 2008.

J. Ramadas was 1) Member, IUPAP International Commission on Physics Education (ICPE) for the period 2011-13; 2) Chair, Project Advisory Committee of the National Council for Science & Technology Communication (NCSTC), Department of Science and Technology; 3) Member, Governing Council, Vigyan Prasar, Department of Science and Technology; 4) Member, Central Advisory Board on Education (CABE) Committee for developing a framework and processes of the National Mission on Teachers and Teaching; and 5) Member, Governing Council of the Atomic Energy Education Society (AEES).

V. Singh was 1) National Coordinator, Science Olympiads (Physics, Chemistry, Biology and Junior Science). 2) Member of Standing Committee, Earth Science Olympiad. 3) Member of IAPT Asian Physics Olympiad (APhO) cell till December 2016. 4) National Coordinator, National Initiative on Undergraduate Students (NIUS) till October 2012 at HBCSE. 5) Elected in Executive Committee of TIFR Alumni association (2013 – 2015). 6) Adjunt Professor and Member Academic Advisory Committee, UM DAE CBS (University of Mumbai – Department of Atomic Energy Centre for Excellence in Basic Sciences) (from April 2011); 7) Adjunct Professor, IIT Bombay (from Jan.2011); 8) Chair, Physics Question Bank Committee, Kishore Vaigyanik Protsahan Yojana (KVPY) and Member of Interview panel; 8) Member, Examination Board for Proficiency Test, Central Board of Secondary Education (CBSE); 9) Panel of Judges: Aditya Birla Scholarships; 10) Subject Expert (B.Sc. General Science), 2013 – 2015 for YCMOU, Maharashtra, 11) Scientific Observer to IPhO July 7 – 15, 2013 (Copenhagen, Denmark) 12) Faculty Selection Committee for: Mumbai University and NCERT. 13) Chairperson Physics Committee of NEST (National Entrance Screening Test).

K. Subramaniam was 1) India representative to the International Commission of Mathematics Instruction; 2) Member, editorial board and Reviewer for the journal At Right Angles: Mathematical Reflections; 3) Member, Advisory Board, International Sourcebooks in

mathematics and science education, Information Age Publishing; 4) Member, National Council for Teacher Education; 5) Member, Textbook Committee for Mathematics Textbooks, Balbharati, Maharashtra; 6) Member, Executive Committee of National Mission of Sarva Shiksha Abhiyan (SSA) 7) Member, Educational Research and Innovations Committee, NCERT.

A. Sule was 1) Regional Coordinator (Asia-Pacific) for the International Olympiad in Astronomy and Astrophysics (IOAA) from 1-1-2012 to 31-12-2016. 2) Chair of Astronomy Sub-committee of the academic committee for International Earth Science Olympiad 2013 organised by Geological Society of India at Mysore, India in September 2013. 3) Member of coordination committee for National Entrance Screening Test 2013 as well as 2014.

R. B. Khaparde was 1) Member of Board of Studies in Physics, University of Mumbai, Mumbai. 2) An Associate Editor of the Physics Education, a journal published by University of Pune in association with IAPT. 3) Member of the Advisory Committee for the Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE), NCERT, NewDelhi.

7. Visits

A. Mazumdar visited Astronomical Institute Anton Pannekoek, University of Amsterdam, Netherlands from 8th May to 8th June, 2013 for collaborative work on asteroseismology of red giant stars.

K. K. Mashood visited the Physics Education Group at the University of Washington, the ? Group at The University of Harvard.

J. Vijapurkar visited Ministry of Education, Govt. of Timor-Leste, Dili, Timor-Leste from September 29 - October 3, 2013 for meetings and workshops on the curriculum its philosophy, development, implementation.

8. Awards and Distinctions

K. K. Mishra

Bharatiya Bhasha Pratishthapan Samman Patra-2014, Bharatiya Bhasha Pratishthapan Rashtriya Parishad, Lucknow, U.P.

A. Ghaisas

The Marathi Book "Akash Kase Pahaave" written by Anand Ghaisas and published by Manovikas Prakashan, Pune was awarded with "Yadunath Thatte Puraskar" by The State Government of Maharashtra for best writing in the category of "Scientific and extra curricular writings for Children". The book is on '101 things everybody should know about how to observe the night sky'.

9. Invited Talks

A. Mazumdar

"Diagnostics from an observational perspective", Red Giants Workshop, University of Amsterdam, June 3 to 7 , 2013

V. Singh

“Identification and Nurturing of Scientific Talent at the Pre-University level” Vijay A. Singh, First International Conference for Research in Education and Curriculum Planning for Gifted Students, Delhi, February 4 to 7, 2014. [Keynote Speaker]

K. Subramaniam

"Towards Achieving Numeracy for All". Invited talk at the meeting of the International Panel for Numeracy, Johannesburg, S.Africa, August, 2013.

10. Conference Organised by the School / Deptt. / Group (Title, Place, Date, Short Description)

10th International Junior Science Olympiad 2013, 3 to 10 December, Pune, India

HBCSE organized the 10th International Junior Science Olympiad (IJSO) in Pune from 3 to 12 December 2013. Participants, including 226 students, accompanied by 111 leaders, 19 observers, 8 visitors and one executive committee member, came from 42 countries. The event was funded by the Government of India through DAE, Ministry of Human Resources Development, and Department of Science and Technology.

NIUS Workshops

1. First NIUS Workshop on Introductory Computational Science, HBCSE, (September 29 to October 2, 2013). 20 second-year physics undergraduate students from B.Sc. colleges and 19 teachers from undergraduate and higher secondary schools across the country. The resource persons were Drs. Anwesh Mazumdar (HBCSE), H. M. Antia (TIFR), Praveen Pathak (HBCSE) and Vijay Singh (HBCSE).
2. Workshop on Chemical Thermodynamics, HBCSE (November 15 to 20, 2013). As part of NIUS chemistry programme, a project on developing pedagogical material on advance core topics taught as part of chemistry syllabi at undergraduate and postgraduate level has been initiated at HBCSE in May 2013. The current workshop was part of this ongoing work. 15 students from local colleges of Mumbai and studying in B.Sc. and M.Sc. (part I) courses participated in the workshop.
3. Refresher course on Statistical Mechanics for college teachers, HBCSE, (November 6 to 19, 2013). NIUS physics hosted the Refresher course on Statistical Mechanics for College Teachers sponsored by the Indian Academy of Sciences. Over 40 participants from across India attended the course. Prof. Deepak Dhar (TIFR) was the director of the workshop and Dr. Praveen Pathak (HBCSE) was one of the Co-ordinators. Prof. Vijay A. Singhand Dr. Praveen Pathak from HBCSE took lectures and tutorials for the camp.

Astronomy

1. 3rd Pro-Am Meeting in Astronomy, HBCSE, Mumbai, in collaboration with Astronomical Society of India, 26th and 27th October 2013

2. Eyes on Comet ISON National Campaign Brainstroming Workshop, HBCSE, Mumbai, In association with All India People's Science Network, 26-27 Apr 2013 (A. Sule, A. Ghaisas)
3. Training workshop for resource persons of 'Akhil Bharatiya Andhashraddha Nirmulan Samiti', Konkan Region, At Sane Guruji Smarak, Mangaon, in collaboration with ABANS, December 11 and 12, 2013. (A. Ghaisas)
4. Training workshop for resource persons of 'Akhil Bharatiya Andhashraddha Nirmulan Samiti' from Mumbai and Pune, At Sane Guruji Smarak, Mangaon, in collaboration with ABANS, January 18 to 20, 2014. (A. Ghaisas, A. Sule, G. Narawankar)
5. State level training workshop for resource persons of 'Akhil Bharatiya Andhashraddha Nirmulan Samiti' from Mumbai and Pune, At HBCSE, in collaboration with ABANS, funded by NCSTC, February 17 to 21, 2014. (A. Ghaisas, A. Sule, G. Narawankar)

Chemistry

POGIL workshop for chemistry teachers, HBCSE, (August 20, 2013). Process oriented Guided Inquiry Learning (POGIL) is a different teaching approach and to acquaint chemistry teachers with this approach, NIUS chemistry organized a POGIL workshop. Prof. Kelly Butler (Chestnut Hill College, Pennsylvania, USA) was the main resource person for the workshop and 25 teachers from colleges of Mumbai and Pune attended the workshop.

11. Non DAE Research Projects (Investigators, Title, Funding Agency, Duration)

G. Nagarjuna and M. C. Arunan

Developing simple model systems and experimental paradigms in cognitive sciences for undergraduate science education, DST Project under Cognitive Science Initiative, 2010- 13, extended to October 2014.

S. Chandrashekaran

The cognitive mechanisms underlying model-based discovery and learning, DST Project, October 2013 to September 2016.

J. Vijapurkar

A collaborative project proposal titled “A multidisciplinary approach to language issues in science education in multilingual contexts”, funded by the National Research Foundation of South Africa and Research and Innovation Support and Advancement with PI Audrey Msimanga of the University of Witwatersrand, approved in February 2014. Researchers from SA, Brazil and UK are among the other collaborators.

12. Publications

a) In Journals [Authors, Title, Journal, Volume No., Page, Year]

1. Aguirre, V. S., Ruchti, G.R., Hekker, S., Cassisi, S., Christensen-Dalsgaard, J., Datta, A., Jendreieck, A., Jessen-Hansen, J., Mazumdar, A., Mosser, B., Stello, D., Beck, P. G., & De Ridder, J. (2014). Old puzzle, new insights: a lithium-rich giant quietly burning helium in its core. The Astrophysical Journal Letters, 784, L16.
2. Ara, F., Chunawala, S. & Natarajan, C. (2013). Investigating Indian elementary and middle school student's images of designers. Design and Technology Education: An International Journal,18(2), 50-65.
3. Arunan, M.C., & Nagarjuna G. (2013). Simple systems and sophisticated questions: The scientific legacy of Obaid Siddiqi. Annals of Neurosciences, 20(4), 131-132.
4. Chandrasekharan, S. (2013). The Cognitive Science of Feynmen. Metascience, 22, 647–652.
5. De, P., Titus, S., & Sircar, S. (2014). A Fair Division. At Right Angles, 3(1), 31-34.
6. Gupta, R., Kshirsagar S., Ladage, S. & Samant, S. D. (2013). Effect of different phases of Mg- Al Hydrotalcites formed by calcinations on the Knoevenagel reaction of benzaldehydes and malononitrile. SMC Bulletin, 4(3), 29-33.
7. Haydock, K. (2013). Modaney ka anubhav. Sandarbh, 6(32), 11-19. करन हेडाक "मोड़ने का अनुभव ", संदर्भ 6(32) 11-19 (2013)
8. Haydock, K. (2014). An Analysis of the Treatment of Evolution by Natural Selection in NCERT Textbooks. Voices of Teachers and Teacher Educators, Vol 2.
9. Haydock, K. (2014). Chicken Eggs: which comes first - the expected results or the science?. School Science Review, 95(363), 65-74.
10. Hekker, S., Elsworth, Y., Basu, S., Mazumdar, A., Aguirre, V. S., & Chaplin, W. J. (2013). Tests of the asymptotic large frequency separation of acoustic oscillations in solar-type and red-giant stars. Monthly Notices of the Royal Astronomical Society, 434, 1668.
11. Kawalkar, A., & Vijapurkar, J. (2013). Scaffolding science talk: The role of teacher's questions in the inquiry classroom. International Journal of Science Education, 35(12), 2004-2027.
12. Ladage, S., & Ravishankar, L. (2013), Making learning in chemistry laboratory more meaningful. Current Science, 104(10), 1269-1270.
13. Manna, D., Sirohiwal A., & Ghanty, T. K. (2014). Pu@C24: A new example satisfying 32- electron principle. Journal of Physical Chemistry C, 118, 7211-7221.
14. Martin, A., & Roy, S. M. (2014). Froissart bound on total cross section without unknown constants. Physical Review D-Particles, Fields, Gravitation and Cosmology, 89(4). Article ID 045015, 7 pages. ISSN 1550-7998
15. Mashood, K. K., & Singh, V. A. (2013). Large-scale studies on the transferability of general problem-solving skills and the pedagogic potential of physics. Physical Education. 48, 629-635.
16. Mazumdar, A., Monteiro, M. J. P. F. G., Ballot, J., Antia, H.M., Basu, S., Houdek, G., & 12 co-authors (2014). Measurement of acoustic glitches in solar-type stars from oscillation frequencies observed by Kepler. The Astrophysical Journal, 782, 18.

17. Mishra, B., Ghildiyal, P., Agarkar S., & Khushalani, D. (2014). Synthetic precursor to vertical TiO_2 nanowires. Material Research Express, 1(025005), 1-13.

18. Mishra, K. K. (2013). Bharat ke antariksha karyakram ke pachaas varsh: Ek vihangavalokan. Anusandhan, 1(1), 142-144.

19. Mishra, K. K. (2013). Swarnajayanti varsha mein Bharat ka antariksh karyakram. Vigyan Ganga, 3(6), 23-26.

20. Nair, R., Nagarjuna, G., & Ray, A. K. (2014). Finite-size effects in the dependency networks of free and open-source software. Complex Systems, 23, 71-92.

21. Pant, S., Gera T., & Choudhury, N. (2013). Effect of attractive interactions on the water like anomalies of a core-softened model potential. Journal of Chemical Physics, 139(2 44505), 1- 9.

22. Ravishankar, L., Ladage, S., & Shridhar, G. (2013). Exciting undergraduates towards organic chemistry: A study circle approach. Current Science, 105(9), 1227-1229.

23. Roy, A. S., & Roy, S. M. (2014). Optimum phase space probabilities from quantum tomography. Journal of Mathematical Physics, 55 (1). Article ID 012102, 9 pages. ISSN 0022-2488

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32. Shome, S.(2013). When objects fail to move despite force being exerted! Voices of Teachers and Teacher Educators, 2(2), 38-43.

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b) In Proceedings [Authors, Title, Title of Proceedings, Volume, Page, Year]

1. Hekker, S., & Mazumdar, A. (2014). Solar-like oscillations in sub-giant and red-giant stars: mixed modes, in Precision steroseismology: Proceedings of the International Astronomical Union, IAU Symposium, 301, 325-331.
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c) Web Publications

1. Deshmukh N. D., "Field Testing Experiences of OER4s Project", PCF7 Papers, http://pcfpapers.colfinder.org/handle/5678/124
2. Deshmukh N. D., Criteria's for Quality Assurance in Designing and Developing Open Educational Resources for Schools
3. Ghaisas, A. Translations of posters on comet ISON awareness campaign (19 Posters) from English to Marathi. Eyes on comet ISON website.
4. Ghaisas, A. Translation of "Role Play method for understanding Basic Astronomy" from English to Marathi. Eyes on comet ISON website.
5. Haydock, K. "Children Draw Each Other in Celebration of Ambedkar Jayanti 2013", http://khaydock.com/books.php

6. Haydock, K. “Tota and beehive” , This was one of the video clips used in teaching the process of science to students and teachers, through raising of questions and investigations. On Youtube: https://www.youtube.com/watch?v=I7jDVEGDljc

7. Lale, V. D. 14 Article written in Marathi language (1. Metabolism, 2. Mole, 3. Global warming, 4. Biome, 5. Biopsy, 6. Bioassay, 7. DNA Fingerprinting, 8. Skin, 9. Tooth, 10. Nose, 11. Nitrogen cycle, 12. Nucleic acids 13. Pollination and 14. Osmosis)., Kumar Vishwakosh vol2, http://196.1.113.94/kumar-vishwakosh/

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d) In Books

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2. Mishra, K. K. (2013). Development of E-learning Portal for Science Education. In Digital Media and Science Communication in Hindi, V (pp.45-54), New Delhi, Vigyan Prasar (DST).
3. Mishra, K. K. (2013). Year 2012-2013 is Very Special for Science and Mathematics. In Centenary Year Book, (pp.31-35). Allahabad. Vigyan Parishad Prayag.
4. Nagarjuna, G. (2014). Towards a Model of Life and Cognition. In Foundations of Science edited by B. V. Srikantan, Ed. Centre for Studies in Civilizations, vol 13(5) (pp. 647–691).

e) Books

Sonawane, V., & Agarkar, S. (2014). Shaleya vidnyanatil shankaa bhautik vidnyan. Mumbai: HBCSE, TIFR.

f) Technical Reports/Internal Reports

1. Chaplin, W. J., & 57 co-authors including Mazumdar, A. (2011). Kepler White Paper: Asteroseismology of Solar-Like Oscillators in a 2-Wheel Mission, arXiv:1309.0702
2. Chunawala S., Natarajan C., Birwatkar P., Muralidhar A. & Thakur B (2012). Casestudy 4 – Academy of Fine Arts and Crafts (AFAC). Mumbai: HBCSE, TIFR.
3. Chunawala S., Natarajan C., Birwatkar P., Muralidhar A., & Thakur B. (2012). Casestudy 1– Atomic energy central school. Mumbai: HBCSE, TIFR.
4. Chunawala S., Natarajan C., Birwatkar P., Muralidhar A., & Thakur B. (2012). Casestudy 2– Atomic energy central school. Mumbai: HBCSE, TIFR.
5. Chunawala S., Natarajan C., Birwatkar P., Muralidhar A., & Thakur B. (2012). Casestudy 3 – Amulakh Amichand Bhimji Vidhyalaya. Mumbai: HBCSE, TIFR.
6. Deshmukh, N. D., & Agarkar S. C. (2014). A Report of the Project on Open Educational Resources for Schools (2007-2013); Technical Report: 1. Homi Bhabha Centre for Science Education, Mumbai, India.

7. Sule, A., & Chopde. S. (2013). Report of the Indian Astronomy Olympiad Programme.
8. Sule, A., & Chopde. S. (2013). Report of the 10th Astronomy Olympiad Nurture Programme

POPULAR SCIENCE ARTICLES:

K. K. Mishra

1. Dainik Jeevan mein Rasayano ki Bhumika, Vigyan Prakash, Vol.9, No.1-4, p.15-24, 2013.
2. Higgs Boson ki Khoj ke Nihitarth, Avadh-Archna, p.38-40, Feb-Apr. 2013.
3. Vaigyanik Vikram Sarabhai ko yaad karne ka Avasar, Chintan Disha, p.77-79, Apr-Sep. 2013.
4. Kabir- Lok-chetna ke Sachche Kavi, Avadh-Archna, p.7-9, May-July, 2013.
5. Bharat ke liye Saur Urja ki Upadeyata, Vigyan Aapke Liye, p.30-32, January-March, 2014.
6. Rajbhasha Hindi ka Sankraman Kaal aur Bhavishya, Hindi Garima-2014, p.22-24, March 2014.

N. D. Deshmukh

Garaj Shikshak ani Sanstha Sabalikarnachi (Need of Capacity Building of Science Teacher and Institutes) Rayat Vidnyan Shikshan Sanstha Souvenir, 2014.

Joshi, T., & Ladage, S. (co-authors)

1. 'Let's Meet the Chemical Elements!' (Cards) HBCSE, TIFR, September, 2013.
2. 'Oh Yes! I'm going to be a Chemist!'. The Chemical Axis, 12 (2), 8-13, September, 2013.

Ladage, S., & Joshi, T. (co-authors)

'The Fascinating Story of the Periodic Table', a poster, HBCSE, TIFR, 2013, June

Ph.D. Theses / M.Sc. Theses

Investigating Students', Teachers' and Designers' Ideas about Design and Developing Design Activities for Indian Middle School Students, Farhat Ara, April, 2013, TIFR Deemed University.

http://www.hbcse.tifr.res.in/research-de

13. Lectures Given Elsewhere

Aswathy R. & Chunawala S.

Reproducing values: Examining how the higher secondary biology curriculum discusses reproductive health from critical feminist perspective. Paper presented at the XIVth National conference on Women's Studies organized by the the Indian Association of Women Studies (IAWS) in Guwahati. (February, 2014)

Birwatkar P. & Chunawala S.

An Innovative Strategy for Addressing Diversity in a Science Class. Paper presented at an ICSSR sponsored National Seminar on “Innovations in 21st century education” the 21st in the Senior Scholar's Seminar Series, organized by the K J Somaiya Comprehensive College of Education, Training and Research. (March 2014)

C. Natarajan

1. Teaching-Learning Science in Primary School, In-service course for primary teachers of various Kendriya Vidyalaya Sangathan schools of Maharashtra State, May 20, 2013.
2. On Teaching and Learning, at workshop on “Setting Sustainable Goals, Resources and Practices for Science and Innovation Activity Centers (SIAC)”, organised jointly by HBCSE and Nehru Science Centre, Mumbai, July 1-5, 2013
3. On Teaching, Learning and Assessment, half day workshop with teachers of St. Mary's High School, Navi Mumbai, July 13, 2013.
4. Ethical Issues in Research, for Teachers of Vivekananda Education Society's College, August 9, 2013.
5. Research-based Practice of Science Education: Science, Learning and Education Research, at Discussion meeting on Science Education, SINP, Kokata, August 20, 2013.
6. “Nature of Science” Workshop for Primary Science Teachers of Kendriya Vidyalaya Sangathan, HBCSE, August 23, 2013.
7. Project Based Learning. Workshop for Secondary Science Teachers of Kendriya Vidyalaya Sangathan, HBCSE, September 2-4, 2013.
8. What do we know about the effectiveness of ICT in Education? At Refresher Course in Education on theme, Technological Integration in Teacher Education, University of Mumbai, Education Department, October 27, 2013.
9. Ethics and Technology, at two day course on Ethics in Scientific Research for College Teachers of Mumbai, organised jointly by Indian Women Scientists’ Association (IWSA) and Rayat Shikshan Sanstha’s Karmaveer Bhaurao Patil College (KBPC), Navi Mumbai at IWSA, Navi Mumbai, March 1, 2014.
10. Socio-Scientific Issues: Role in Teaching-Learning, at Teaching Learning Workshop, Institute for Chemical Technology, March 28, 2014.

S. Chunawala

1. Delivered a talk to teachers at Kendriya Vidyalaya Sangathan school, Mankhurd on "Gender and School Education" during refresher course for teachers, September 6, 2013.
2. Gave a lecture in a University of Mumbai, Course on Research Methodology and computer applications at K. J. Somaiya College of Science and Engineering, December 6, 2013.
3. Conducted a guest lecture at KVS school, Mankhurd on Gender Sensitisation during refresher course for teachers, January 2, 2014 .

N. D. Deshmukh

1. 'Need of Capacity Building of Teacher Educator: HBCSE Role', MPSP organized seminar at Yashwantrao Chavan Pratisthan Mumbai, on April 16, 2013.
2. 'Role of Headmasters in School Capacity Building', Swami Vivekananda Shikshan sanstha Kolhapur organized seminar at Purandare High School, Saswad, Pune, on May 9, 2013.
3. 'Capacity Building of Science Teachers: HBCSE Role', Loksatta organized two days seminar at Hotel Taj, Mumbai, on August 2-3, 2013.
4. 'Constructivist Approach in Science Education', Rayat Education Society organized workshop for science teachers at Y C College Satara, on September 6, 2013.
5. 'How to write Research Paper', Rayat Education Society organized workshop for Rayat Education Society teachers at D G College, Satara, on September 7, 2013.
6. 'Students Misconceptions', Smt K. K. College of Education, Juhu, on September 14, 2013.
7. 'Role of Literature Review', K. J. Somaiya College, Vidyvihar, on September 21, 2013.
8. 'Understanding Students Conceptions', P. V. D. T college Education, Churchgate, on March 7, 2014.
9. 'Tribal Education: Role of peergroup interaction', Aide et Action organized 2nd review workshop (LEARNET2) at Bandipur, Kranataka on March 19, 2014.
10. 'Role of OER in Education', Aide et Action organized 2nd review workshop (LEARNET2) at Bandipur, Kranataka on March 21, 2014.

A. Ghaisas

1. "Telescopes and Observatories" - A. Ghaisas, Basic Course in Astronomy, Department of Physics,Wilson College, Mumbai, December 2013.
2. Multiple lectures covering topics of Concept mapping, Science experiments, Mathematics laboratory and Astronomy - A. Ghaisas, Workshop for 130 Teachers from Khiroda district for 3 days, Organised by Janata Shikshan Mandal and Satpuda Vikas Mandal, Khiroda on December 6 to 7, 2013.

J. Ramadas

1. Visuospatial models of the Sun-Earth-Moon system, International Conference on Physics Education, Prague, Czech Republic, August 2013.
2. Constructivism and NCF 2005 (In Marathi), Shree Shivaji Vidnyan Parishad, Amravati, December 23, 2013.
3. Science Education Research: What is it, why do it?, Colloquium at the Centre for Excellence in Basic Sciences, University of Mumbai, March 25, 2014.

M. Kharatmal

"Innovative Trends in Teaching of Science Methods - Concept Mapping and Vee Diagrams" at The Lords Universal College of Education, Malad, Mumbai on October 28, 2013.

R. B. Khaparde

1. It Is Never Too Late to Introduce Procedural Understanding: A Case of Physics Laboratory Course for Undergraduate Students, ICPE-EPEC 2013, Prague, Czech Republic, August 8, 2013.
2. "Physics Laboratory Training in India: What can we do about it?", keynote address during a Workshop on Innovative Experiments in Physics, organized by Indian Association of Physics Teachers (IAPT RC-7) at St. Xavier's College, Ahmedabad, March 9, 2014.

S. Ladage

1. Understanding Chemistry through Problem solving: National Seminar on Chemistry Education and Research & National Convention of Chemistry Teachers (NCCT-2013), Annamalai University, Chennai Nov 9, 2013.
2. Learning in laboratory, Teaching-Learning Workshop, Institute of Chemical Technology, Mumbai, March 29, 2014.

A. Mazumdar

1. "Stars and Planets around them", at K. J. Somaiyya College, Mumbai on September 16, 2013.
2. "Astronomy in CBSE School Textbooks of Class VI to IX: a review", at Teachers' Workshop, Navy Children's School, Navy Nagar, Mumbai on October 10, 2013.
3. "Asteroseismology: Understanding Starquakes" at Fergusson College, Pune on January 22, 2014.

S. Narvekar

Experimental problems at the Chemistry Olympiad Examinations: National Seminar on Chemistry Education and Research & National Convention of Chemistry Teachers (NCCT-2013), Annamalai University, Chennai Nov 8, 2013.

K. K. Mishra

1. Development of an innovative e-learning portal in Hindi, National Workshop on Science Writing and Resource Development in Indian Languages, AERB, Mumbai, May 9-11, 2013.
2. Changing Scenario of Education with Advances in Science and Technology, International Conference on Role of Science and Technology in the Progress of the World, DRDO, New Delhi, December 5-7, 2013.

V. Singh

1. "How to frame Questions", Workshop on Innovative Teaching Techniques, Nehru Science Centre, Mumbai, June 29, 2013.
2. “Identifying and nurturing Scientific Talent Careers in Science and Allied subject”, Workshop, Jagdam College, Jai Prakash University, Chapra, August 16 – 17, 2013.
3. “Research in Nonstructural Physics by Undergraduate Students”, A. N. College, Patna, August 18, 2013.
4. “Thermodynamics Biological Systems”, BASE Workshop on Integrating Science for Biology College Teachers, Nehru Science Centre, Mumbai, August 24, 2013.

K. Subramaniam

“Understanding and Changing Teaching'. Invited talk at the Conference on Developing Mathematics Teachers for Quality Learning for All. Regional Institute of Education, Ajmer, December, 2013.

J. Vijapurkar

Feedback was given to teachers at their presentation of projects, and teaching strategies suggested. This was part of the Kendriya Vidyalaya primary teachers' workshop held at HBCSE Aug 21-24, 2013. Workshop organised and conducted by the TPD group.

P. K. Joshi

Lectures given at AEES- Jr. Science Olympiad held at AEES school Anushaktinagar in the month of May, 2013, in the INSPIRE camps and the Nurture program of NTS awardees. The lectures were on the topics of “activities of Nuclear World” and “Basic Experiments in Science”.

Undergraduate/ Graduate Courses outside HBCSE

K. Haydock

Centre for Excellence in Basic Sciences, University of Mumbai, part of course on Science and Ethics, Undergraduate Course, Semester, January to April, 2014.

V. Singh

1. Centre for Excellence in Basic Sciences, University of Mumbai, Statistical Mechanics, Undergraduate Course, Semester, January to April, 2014.
2. Semiconductor Physics, IIT Bombay, July – Nov 2013.

A. Sule

1. "Teaching Mathematics Through Softwares" – A. Sule, BASE Teacher Workshop for Science and Mathematics Teachers, Nehru Science Centre, Mumbai, June 29, 2013.
2. "Geometric Astronomy" – A. Sule, Astronomy Study Circle, Nehru Planetarium, Mumbai, July 6, 2013.
3. "Overview of BEST Proposal" – A. Sule, BEST planning workshop, Tamilnadu & Pudducherry Science Forum, Pudducherry, August 14, 2013.
4. "The Solar System" – A. Sule, Eyes on Comet ISON National Campaign Zonal Workshop (East), Guwahati Planetarium, Guwahati, August 22, 2013.

R. Vartak

1. "Innovative Teaching Techniques in Biology", for teachers Workshop in Nehru Science Centre, Mumbai, June 29, 2013.
2. "Innovative experients in biology" - Lecture by Dr. Rekha Vartak on September 3, 2013 for KV teachers.

14. Lectures, Colloquia, Seminar at TIFR (HBCSE)

Lectures by Visitors

Seminars

Renato Marcone (State University of Sao Paulo, Brazil) A brief report of my work in Mumbai and my HBCSE farewell, June 27, 2013.

Oscar João Abdounur (Instituto de Matemática, Universidade de São Paulo, Brazil) Historic-didactical aspects of the relationships between mathematics and music until Renaissance, November 27, 2013.

Prof. Eleanor Duckworth (a cognitive psychologist, educational theorist and teacher educator, a renowned senior Professor at Harvard Graduate School of Education) gave a three day intensive seminar on Teaching, Teacher Education and Science Education, December 24 to 27, 2013.

Roli Verma (Carl Hatch Endowed Professor, Regents' Lecturer, University of New Mexico School of Public Administration) gave a series of lectures as part of a graduate course on Science, Technology and Society between January 1 and March 31, 2014.

V.G. Kulkarni Memorial Lecture

HBCSE, September 5, 2013

HBCSE organizes every August-September a lecture in memory of Shri V.G. Kulkarni, its founder director. The twelfth memorial lecture was on “Astronomy and Society” by Prof. Shashikumar M. Chitre, Distinguished Faculty at the Centre for Excellence in Basic Sciences, INSA Honorary Scientist, University of Mumbai.

Olympiad Valedictory and Infosys Lectures

Prof. Sunil Mukhi (International Physics Olympiad OCSC Camp Valedictory function), “Windows onto Nature”, April 20, 2013.

Dr. Chinmoy Nandi (International Chemistry Olympiad OCSC Camp Valedictory function), Chemistry: A Green Path To Prosperity, May 2, 2013.

Prof. Ram Sagar (Astronomy OCSC Valedictory Function), New Age Telescopes Facilities at ARIES?, May 16, 2013.

Prof. Renee Borges (Biology Valedictory Function), "Visible and Invisible Messages: How plants communicate with insects", June 12, 2013.

Prof. Shobhana Narasimhan (Infosys Awards Function 2013) “When Every Atom Counts: The Wonderful World of Nanoscience”, December 22, 2013.

Prof. Naveen Garg (Infosys Awards Function 2013) “Match Making”, December 22, 2013.

NIUS seminar series (HBCSE)

As a part of NIUS programme, a new series of seminars has been initiated from this year. The idea of this seminar series is to stimulate scientific discourse at the undergraduate level and thus these seminars are open to students from local colleges. So far three seminars in the areas of astronomy, physics and chemistry have been held as part of this series.

Deepak Dhar (TIFR) A simple model of proportionate growth, November 18, 2013.

Sreerup Raychaudhury (TIFR) Particle Physics - the best of times; the worst of times March 11, 2014.

Research Seminars at Annual Research Meet
23 to 25 September 2013
(By research students, faculty)

- P. Pande, Learning with multiple representations in science, mathematics and engineering: A brief review of theoretical and empirical accounts.
- S. Pathare, Understanding Thermal Equilibrium through activities.
- A. Srivastava, Measure concept-mapping, not concept-maps: Procedural Analysis elucidates stages in students' understanding of Biology concepts.
- A. Sharma, Understanding diagrams for inclusion.
- M. Kharatmal, Trends in concept mapping research: A two decade review of literature.
- R. Varkey, Farmers' understandings of their own knowledge - Case studies.
- K. Subramaniam, Knowledge of contexts for the teaching of mathematics.
- S. Takker, Making meaning of teachers' knowledge of students' mathematical thinking and its impact on classroom practice.
- S. Shome, Exploring Indian teachers' views about and practice of school projects.
- J. Rahaman, Exploring the network model for area-measurement concept in classroom.
- R. Shaikh, Learning to change the world: The social impact of one laptop per child.
- G. Singh, The state of experimental activities in Indian school science.
- S. Chandrasekharan, Four year plan.
- A. Raveendran, Reproducing values: Examining how the higher secondary science curriculum and students discuss reproductive technologies from a critical scientific literacy perspective.
- A. Dhakulkar, Exploring the phenomena of Electromagnetic Induction.
- S. Ghumre, Exploring knowledge generating practices in a laboratory environment.
- A. Bose, Revisiting transfer of learning in Mathematics: Insights from an urban low income settlement.

Lectures by TIFR Members

HBCSE, Mumbai

Prof. S. C. Agarkar,

Designing and Field Testing Open Educational Resources for Schools, April 19, 2013**.**

K. Haydock

1. Karen Haydock "Rigorous Observation" July 4, 2013.
2. ASET Forum: Karen Haydock "Why don't students understand evolution by natural selection?" Friday, August 16, 2013.
3. "What is Science?", workshop for KVS Teachers, August 21, 2013.

M. Kharatmal

1. Science Through Investigation Sessions. Workshop for Science Teacher Educators of Uttarakhand, HBCSE, February 5-8, 2014.
2. Textbook Analysis Based on NCF 2005. Workshop for Science Teacher Educators of Uttarakhand, HBCSE, February 6, 2014.
3. Science Through Investigation Sessions. Workshop for Primary Science Teachers of Kendriya Vidyalaya Sangathan, HBCSE, August, 21-23, 2013.
4. Textbook Analysis – Science. Workshop for Primary Science Teachers of Kendriya Vidyalaya Sangathan, HBCSE, August, 21, 2013.
5. Concept Mapping. Workshop for Secondary Science Teachers of Kendriya Vidyalaya Sangathan, HBCSE, September 2, 2013
6. Trends in Concept Mapping Research – A Two Decade Review of Literature. 4Th Annual Research Meet, HBCSE, September 23, 2013.

K. K. Mashood

Physics education research in US: Some observations, July 18, 2013**.**

J. Ramadas

1. Innovation in Science Education: Case of the "Small Science" Curriculum, April 4, 2013.
2. Inquiry Based Science Curriculum. Workshop for Primary Science Teachers of Kendriya Vidyalaya Sangathan, HBCSE, August, 22, 2013.

A. Srivastava

"EteRNA": A game with a purpose, August 1, 2013**.**

A. Sule

"Physics behind Astronomy" – A. Sule, Kendriya Vidyalaya Teacher Workshop for Science and Mathematics Teachers, HBCSE, Mumbai, September 3, 2013.

NIUS Seminar series at HBCSE (Lectures delivered by HBCSE members)

- R. Vartak
    - Nucleic Acids: A Hands-on Session, April 10, 2013.

- International Olympiads 2013 (Biology), November 29, 2013.

- P. De & T. Navirelakallu
  - International Olympiads 2013 (Mathematics), November 22, 2013.
- S. Ladage & I. Das (Sen)
  - International Olympiads 2013 (Chemistry), November 22, 2013.
- V. Singh & P. Pathak
  - International Olympiads 2013 (Physics), November 29, 2013.
- A. Sule
  - International Olympiads 2013 (Astronomy), November 29, 2013.
- P. K. Joshi
  - International Olympiads 2013 (Junior Science), March 7, 2014.

15. Graduate Courses

What is Science? **(**Karen Haydock)

Basic Readings in Mathematics Education Research (K. Subramaniam)

Science Teaching: a practical course **(**Karen Haydock)

Sociology of Science (Gita Chaddha, Mumbai University)

Philosophy of Technology (Arvind Jamkhandi)

Science, Technology and Society (Roli Verma, Univ of New Mexico)

Advanced Topics in Cognition (Sanjay Chandrashekharan)

16. Ph.D. Theses / M.Sc. Theses (Please indicate the University awarding the degree)

Farhat Ara

Investigating Students', Teachers' and Designers' Ideas about Design and Developing Design Activities for Indian Middle School Students (April, 2013), TIFR Deemed University, Guide: Sugra Chunawala

National Initiative in Undergraduate Science, HBCSE

Physics

Sainyam Galhota (IIT Delhi); Turing–Hopf instabilities through a combination of diffusion, advection, and finite size effects; (J.K. Bhattacharjee, HRI, Allahabad)

Mruganka Kashyap (IIT Kharagpur); Astrochemistry: Far-IR absorption and emission spectroscopy of the ISM with Herschel Space Observatory; (Bhaswati Mookerjea, TIFR and Anwesh Mazumdar)

G. V. S Vaishnavi (IIT Madras); Light Coupling in Quasi Periodic Waveguide Arrays; (Achanta Venugopal, TIFR and Rajesh Khaparde)

Kapil Kishor Bhorkar (K.E.T.'s V.G. Vaze College Mumbai); Fabry-Perot Plasmon modes at Metal Dielectric Interface; (Achanta Venugopal, TIFR and Rajesh Khaparde)

Ninad R. Jetty (CBS Mumbai); Novel cases of diffraction of light from a grating: Theory and Experiment; (Rajesh Khaparde)

Akash Suman (CBS Mumbai); Novel cases of diffraction of light from a grating: Theory and Experiment; (Rajesh Khaparde)

Y S Akshay (IISER Pune); Calculation of Relic Abundance of Dark Matter from Cosmology; (Subhendra Mohanty, Physical Research Laboratory Ahmedabad and D P Roy)

Ananya Rastogi (IISER Mohali); Study of Glycolytic Oscillator; (Jayanta Bhattacharjee, HRI, Allahabad and Vijay Singh)

Abhishek Kumar (Patna Science College, Patna); Complex Hamiltonian and its Trajectories; (Sumita Singh, Patna Science College, Patna and Vijay Singh)

Abhisek Datta (IIT Kharagpur); Asteroseismology of Red Giant Stars; (Anwesh Mazumdar)

Jayant Thatte (IIT Chennai); Red Giant Asteroseismology; (Anwesh Mazumdar)

Tamaghna Hazra (IIT Kanpur); Red Giant Asteroseismology; (Anwesh Mazumdar)

Nitica Sakharwade (IIT Kanpur); Remote tomography and entanglement swapping via von Neumann-Arthurs-Kelly; (S M Roy)

Abhinav Deshpande (IIT Kanpur); Remote tomography and entanglement swapping via von Neumann-Arthurs-Kelly; (S M Roy)

Chemistry

Aditya Ranade (Ramnarain Ruia College, Mumbai); Bioanalytical Approach to study the comparative efficacy and wound healing property of stem bark ultrafine powder and micropowder of ITT; (R T Sane, G. N. Khalsa College of Arts, Science and Commerce, Mumbai)

Aditi Prabhune (S.P. College, Pune); Study of electron solvated in water cluster of n-hydrated electron: H2O molecule (n = 2-6); (Dilip Maity, BARC)

Adhistha Parmar (K.E.T.'s V.G. Vaze College, Mumbai); Acid scavenging application of ionic liquid: precursors with formation of ionic liquid as byproduct in organic synthesis; (Prabodh Chobe, BASF India, Mumbai and Surendra Hinge BASF India, Mumbai)

Krishnav Goswami (Hindu College, Delhi); Annulled oligothiophenes in various configurations, their electronic properties under various different conditions and checking its potential for device applications; (Dilip Maity, BARC)

Tharique Ansari (IIRBS, Kottayam); Formulations of bitumen based fuels; (Prabodh Chobe, BASF India, Mumbai and Sharad Hardas, BASF India, Mumbai)

Ankush Singhal (CBS, Mumbai); Dissociation of haloacid in water: A study of HX(H2O)n, (X = Cl, F) clusters; (Dilip Maity, BARC)

Ashtami Jayakumar (IIRBS Kottayam); MnO2: A versatile catalyst for the selective oxidation of alcohols and decomposition of hydrogen peroxide; (Radha Jayaram, ICT, Mumbai and Savita Ladage)

Kesha Sorathiya (MS University, Vadodara); Characterization of Naga Bhasma using Electroanalytical techniques; (P A Sathe, Ramnarain Ruia College, Mumbai)

Indranil Samanta (R.K.M. Vidyamandira, Belur, West Bengal]; Lewis acid catalyzed three component one pot solvent free synthesis of oxazinone derivative; (Lakshmy Ravishankar, K.E.T.'s V.G. Vaze College, Mumbai and Gomathi Shridhar, V. K. Menon College, Mumbai)

Bhishek Manek (CBS, Mumbai); Structure of Solvent near a Solute: A Monte Carlo Study; (C N Patra, BARC)

Mahesh Vibhute (Fergusson College, Pune); A Green Synthesis of 2,3-Diphenyl Quinoxaline using Lewis Acid Catalysts; (Gomathi Shridhar, V.K.Menon College, Mumbai and Savita Ladage)

17. Popular Science Lectures

N. D. Deshmukh

'Scope in Biological Science', INSPIRE programme organized at Yashwantrao Chavan College, Karad, on January 10, 2014.

A. Ghaisas

1. "Basic Astronomy and superstitions" and Sky Observation Session - with G. Narawankar, organised by ABANS, Ratnagiri, at Lanja, Jaygad and Ratnagiri, December 13 to 15, 2013.
2. "Astronomy for the Beginners" workshop and public lecture – Sant Gadge Baba University, Amravati, January 7 to 8, 2014.
3. "My experiences about Science Activity Centres" Inaugural lecture at the opening of Asha Vidyan Mandal at Ratnagiri, January 12, 2014.
4. "Introduction to Astronomy Olympiad Program" and Sky Observation Session - with G. Narawankar, Rayat Shikshan Sanstha, Kandivli, February 15, 2014.
5. Introduction to Astronomy and Sky Observation Session - with G. Narawankar & A. Mazumdar, Naval Public School, Colaba, Mumbai, February 18, 2014.
6. 'Yes, You can do it!' experiments – with P. Nawale, G. Narawankar & S. Chopde, An exhibition of experiments was conducted at the Science Day Celebrations, at GMRT, Khodad, February 28 & March 1, 2014.
7. "Introduction to Astronomy Olympiad Program" and Sky Observation Session - with S. Chopde, Goregaonkar High School, Goregaon, March 4, 2014.
8. 'Yes you can do it!' training workshop" – with G. Narwankar, at Exploratory Laboratory, Suyash Gurukul Vidyalaya, Solapur, March 11 to 15, 2014.

K. Haydock

Series of informal sessions on art and science, HBCSE, January-March 2014.

A. Mazumdar

1. "The Expanding Universe", at the NTSE Students' Workshop in HBCSE, August 27, 2013.
2. "The Expanding Universe", at the KVS Teachers' Workshop in HBCSE, September 2, 2013.

C. Natarajan

Understanding stocks and flows, at camp for NTSE students, HBCSE, August 30, 2013.

A. Sule

1. "Geometry on the surface of Sphere" (English) – Special lecture orgniased by Vigyan Prasar, Khalsa High School, Kolkata, April 11, 2013.
2. "How to be a Scientist" (English) – Ruia Physics Forum, R. Ruia College, Mumbai,

July 17, 2013.

3. “How to be a Scientist” (English) – NTSE students nurture camp, HBCSE, Mumbai, August 29, 2013.
4. “Astronomy, Astrology and Scientific Temper” (Marathi) – Eyes on Comet ISON Maharashtra state workshop, October 2, 2013.
5. “Optical Observation of Stars” (English) – IIT(Bombay) Astronomy Club, October 7, 2013.
6. “Astronomy, Astrology and Scientific Temper” (English) – Eyes on Comet ISON Mumbai district workshop, October 16, 2013.
7. “Comets” (Marathi) – Maharashtra Sewa Sangh, Mulund (West), November 23, 2013.
8. “Astronomy, Astrology and Scientific Temper” (Marathi) – Maharashtra Sewa Sangh, Mulund (West), November 23, 2013.
9. “Astronomy, Astrology and Scientific Temper” (English) – INSPIRE science camp, K. T. H. M. College, Nashik, November 30, 2013.

V. Singh

1. “Nurturing of Talented students in India”, at INSPIRE Camp, A. N. College, Patna, September 24 - 28, 2013.
2. 15 lectures on the Olympiad Program.
3. “Physics in the City of Mumbai” in N. E. S. Ratnam College of Arts, Science and Commerce, Bhandup, Mumbai, September 6, 2013.
4. “Extrasolar Planets” in Several Colleges of U.P. and Uttrakhand, August 17 - 20, 2013.
5. “Ethnomathematics” in Several Colleges of Bihar, January 17 - 21, 2014.

R. Vartak

Animal behaviour, for NTSE students, August 27, 2013.