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

Annual Report 2012-13

Research & Development in Science, Technology and Mathematics Education

Science Education Research

Students' Understanding of Evolution

Students' and teachers' conceptions and misconceptions about evolution by natural selection were probed through questionnaires and interviews, to find out what students understand about evolution and how and why misconceptions arise. Individual and classroom sessions were conducted with students from Class VII, BSc students from USA and from Mumbai colleges, high school teachers from Madhya Pradesh, and college teachers from Mumbai, in which students learnt about evolution through inquiry, activity-based, and discussion methods. Assessments before, during, and after the interventions showed up significant difficulties in understanding evolution and using it to analyse and evaluate problems in biology. Reasons could be, inherent complexity of concepts, conflict with teleological reasoning and idealistic or dualistic rather than materialistic thinking, conflict with the logic of evolution or with previous beliefs, or lack of scientific temper.

Primary and middle school CBSE textbooks were analysed in order to find out how areas related to evolution (e.g. on variation, classification, etc.) are introduced and what misconceptions may be reinforced by textbooks. The primary level textbooks were found to encourage observation and activities, forming a good basis for understanding evolution. Secondary textbooks, though improved over older textbooks, sometimes show overly didactic, simplified and determinist accounts of evolution with apparently teleological reasoning, partially due to ambiguous language. [Karen Haydock and M. C. Arunan]

Model Systems for Learning about Evolution

A ubiquitous local ephemeral weed, Cardamine hirsuta, was identified as a suitable candidate to develop model systems for school and college students to do experiments related to evolution. Our aim is to characterise the plant, identify phenotypic variations, find out the germination rate under different conditions, and ways to propagate and maintain it. Photographic and video records are being made and simple experiments are being developed which will be useful in teaching and learning. [Subeer Kangsabanik, Kranti Patil and Karen Haydock]

Farmers' Understandings about Science and Evolution

We are investigating whether uneducated farmers working in fields carry out plant breeding, experimentation, and development of agricultural methods, with some implicit understanding of doing science, and of evolution by artificial selection. Case studies with a few farmers in

Maharashtra, Madhya Pradesh and Kerala indicate that they relate 'science' to new seeds, fertilisers, pesticides, and machinery. They sometimes carry out experiments which however are limited by the risks of economic loss. Hence they must rely on authorities, or take decisions in cooperatives (in Kerala), or fall back on traditions based on rituals or myths. [Rosemary Varkey, Subeer Kangsabanik, Kranti Patil and Karen Haydock]

Students' Misconceptions in Biology

Students' misconceptions about various life processes and classification were studied resulting in design of remedial teaching material. Concept-based objective tests developed on respiration and photosynthesis; transport of material and excretion; nutrition and growth; reproduction and; classifications of living organisms, were useful for identifying students' misconceptions. Misconceptions were related to common terms in Marathi such as 'shwasan' (respiration), 'kamjor dil' (weak heart), 'hruday' (heart), 'shuddha ani ashuddha rakta' (pure and impure blood), 'pranvayu' (oxygen) and 'ashudha hawa' (impure air). A few textbook descriptions and diagrams were found to be ambiguous and misleading. Remedial teaching based on the developed materials had some positive effect. Structure-function relations and evolutionary perspective were found helpful. [N. D. Deshmukh, Ph.D. work supervised by Veena M. Deshmukh, University of Mumbai]

Middle school student's ideas of about fundamental concepts in biology

A project to test grade 8 students' ideas of spontaneous generation was completed. Detailed analysis revealed interesting aspects of students' ideas, in particular that they did not adhere to a particular framework to explain the seemingly sudden appearance of life forms, but instead used multiple, inconsistent frameworks such as biogenesis, spontaneous generation or transformation of one species to another. [Jyotsna Vijapurkar and Pooja Konde] A study on the biological cell is in the review process. [Jyotsna Vijapurkar, Aisha Kawalkar and Priya Nambiar]

Outcomes of Teaching Science as Inquiry

Students' reflective writing, in the form of diary entries (learning logs) of two batches of Grade 8 students, each undergoing inquiry or traditional science teaching during a month-long science summer camp, were analysed. The analysis brought out differences in the outcomes of these two teaching modes in a range of aspects - conceptual, affective and epistemic. The differences in how students characterised inquiry teaching and traditional teaching were particularly striking because these aspects were never explicitly addressed in class. [Aisha Kawalkar and Jyotsna Vijapurkar]

Designing learning contexts to facilitate model-based reasoning in the context of research-based learning.

We study the processes by which students constantly negotiate and derive meaning from the various kinds of models that are either available to them or are constructed by them while they engage in open-ended research projects. The study would be carried as part of an ongoing project Collaborative Undergraduate Biology Education (CUBE). Apart from the major thrust of the study on model-based reasoning in the context of open-ended research, we also expect the study to throw some light on the effectiveness of research-based learning at the level of undergraduate biology. [Shraddha Ghumre and G. Nagarjuna]

Measurement in elementary school science

Measurement from a mathematics education perspective often overlooks real-world motivations hence it is important to study measurement in the context of science learning. We view measurement as a graded transition from qualitative to quantitative accounts of phenomena and propose that qualitative experiences of attributes of objects could develop into quantitative measures through intermediate steps like comparison, seriation and use of a referent. Strategies of six students were documented, in response to questions and tasks on length measurement, starting from experiencing the attribute qualitatively to quantifying it through the proposed steps. [Prajakt Pande and J. Ramadas]

Concept Inventories in Physics

A concept inventory is a set of carefully crafted multiple choice questions aimed at probing misconceptions and deficient understanding, and eliciting ill suited reasoning patterns. A concept inventory on rotational kinematics developed last year was administered to around 50 teachers, 200 pre-university students and 75 high ability students (the last had qualified for the final phase of selection to represent India in the international Physics, Mathematics or Chemistry Olympiads). Interesting misconceptions and pitfalls in reasoning were uncovered. The results were presented in international conferences and published in international journals. The final phase of data analysis is under way. A massive pan-Indian survey of our inventory along with three other internationally standardized inventories is currently being carried out. [K. K. Mashood and Vijay Singh].

Transferability of problem-solving skills

We studied the transferability of general problem solving skills among higher secondary school students. The pedagogic potential of physics in this regard was also 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 database (half a million students). Encouraged by significant correlations we interviewed 20 students to explore the pedagogic potentials of physics. We report strategies and practices relevant to physics which facilitate transfer. [K. K. Mashood and Vijay Singh].

Addressing misconceptions in Thermodynamics

After investigating students' conceptions related to pressure, heat, heat transfer, equilibrium and first law of thermodynamics, we focused on designing and building demonstrations and activities to help students in overcoming some of their misconceptions. Specifically, we have designed and built the following activities/demonstrations/devices. 1. Heat flow indicator: a convincing indicator of thermal equilibrium between two bodies. 2. Liquid flow indicator: indicates hydrostatic equilibrium and, in analogy, thermal equilibrium. 3. Transitivity of hydrostatic equilibrium: two liquid reservoirs in equilibrium with a third reservoir are in equilibrium with each other. Transitivity of thermal equilibrium can be argued in analogy to infer the existence of temperature. 4. First law of thermodynamics: work done and the change in the internal energy in the process of air expansion in a heated syringe are calculated to verify whether the sum of the two equals the heat supplied (agreement with the first law within 15%). 5. Pressure: simple models show how pressure arises, that inside a liquid the pressure at a point is the same in all directions and how this pressure varies with depth. [Shirish Pathare, Savita Ladage and H. C. Pradhan]

Project Based Learning

We studied ideas on assessment and its practices (a) as expressed by teachers in response to questionnaire, and as recorded in a session on assessment in a project based learning (PBL) workshop, (b) rubrics produced by teachers during the PBL workshop and (c) researcher's observations of assessment practices of these teachers during school visits. Analysis of teacher responses to an initial questionnaire during a series of PBL workshops conducted in 2010 showed that they associate projects with learning but not with assessment of that learning. An exploration of students' ideas of species conducted as part of a workshop on energy and environment among Class VIII students in 2008 was analysed to identify misunderstandings about terms like endangered, extinct and endemic species, as well as other core concepts related to flow of energy in living organisms and in the environment.

Blogs and other online resources were generated to document and support teachers in conducting projects including a booklet for NCERT Class VI Science textbook, analysing it for the materials required for conducting experiments given in it with their estimated cost <www.pblteachers.wordpress.com>, <www.continuinglearning2teach.wordpress.com>. [Saurav Shome and Chitra Natarajan]

Inclusive Science Education

We study the aspirations in science of students with disability (SWD) and their views on science education and inclusion. The historical background of inclusion in education worldwide and its status in India was analysed to argue that 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 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.

An empirical study on the aspirations in science of SWD was conducted among 30 students with different physical disabilities, studying in Classes 6 and 10, from 6 schools. Most SWD had a positive attitude towards science and found it important, interesting and useful. Yet many found science to be difficult. The study throws light on the aspirations (SWD) and indicates importance of making science education more inclusive. [Amit Sharma and Sugra Chunawala]

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. Through an empirical study a case is made for fostering critical scientific literacy using SSI for students in the 14-20 age group at school and undergraduate level in India. Five SSIs related to controversial medical technologies were identified from the Indian media and analysed in terms of a theoretical framework proposed by Levinson (2006). The possibility of whether the Indian educational curriculum has space to accommodate SSIs was explored by critically examining curricular documents at the school and the undergraduate level for the vision of scientific literacy and science-technology-society education that they advocate. [Aswathy Raveendran and Sugra Chunawala]

Gender Imbalance in Education

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. [Praveen Pathak and Vijay Singh]

Science Education for Diversity

The project Science Education for Diversity (SED), funded by the European Union's Seventh Framework Programme continued into the third and final year of collaboration among research groups from the University of Exeter, UK, the Netherlands, Turkey, Lebanon, India (HBCSE) and Malaysia. In the first year HBCSE led the literature review and documentary analysis of the status of science education and diversity as well as the policies towards the same in each country. Since then, HBCSE has actively provided country relevant inputs to the other work packages of the project. Surveys were conducted and contribution made in developing a theoretical framework for the relationship between culture and science education and planning interventions in classrooms. Monthly virtual project meetings were held and two face to face meetings at Indianapolis (March 2012) and Malaysia (September 2012). Intervention workshops were held for teachers and a presentation made at NIE Singapore. An India expert panel provided guidance.

Interactions for SED Classroom

Questionnaire responses from 1522 (Classes V to VIII) students and 48 teachers, and interview responses of 108 students and 11 teachers were analysed. Students were positive about mathematics and science related disciplines and careers, and felt that India would be the S&T leader by 2030. However they were confused about what was science, and half of those surveyed believed that science always or sometimes includes predicting future luck. Most teachers believed that differential academic abilities, and not their ethnic, religious and social backgrounds were an obstacle to the teaching of science and stated that they did not adjust their teaching to take account of cultural differences, reasoning that everybody is equal.

The analysis led to a framework for understanding the relationship between culture and science education within classroom settings. The intervention in 3 schools with 4 teachers, showed that science learning was not seen by teachers and students as involving critical reasoning, argumentation, and dialogue. It is a matter of concern, that even when students face conflicts with the teachings of science, or are unsure, they do not argue or raise questions. However more dialogues - teacher-student, student-student and student-group - occurred during the planned intervention phase. The participating teachers did not comprehend diversity nor pedagogical strategies to address them. Teachers hardly reflected on cultural diversity among their students and the crucial role it could play in planning for the teaching learning process. [Sugra Chunawala, Chitra Natarajan, Pooja Birwatkar, Bandana Thakur, Adithi Muralidhar, Geeta Battin and Devashree Prabhu]

Design and Technology Education Research

The research activities in this area involved either consolidating the data collection and analysis carried out earlier, or development of design and technology (D&T) units and conducting trials by potential entrants to the field of D&T education research.

Development of D&T units and their trials

As part of a course conducted during January to May 2012, three D&T education units were planned and implemented by course participants on (a) designing multi-purpose shoes, (b) designing a self-propelled boat and (c) designing the interiors of a friend's room. Course participants worked in groups to plan their lessons as part of the course, discussed the structure, coordinated with schools to invite about 15 to 20 students of Class 8, and each group conducted their planned sessions over 3 days during April 24 to May 6, 2012. Each of the three groups wrote a report and analysed their trials in the light of the goals of design and technology education in schools.

Images of Designers

Investigation into Indian elementary and middle school students' images of designers using the 'Draw a designer at work' test was conducted with 511 students from Classes 5 to 9 from a school located in Mumbai. Findings indicate that Indian elementary and middle school students, with no experience in D&T, perceive designers mostly as fashion/dress designers or artists. Designing is associated more with arts and less with engineering and technology. These results are consistent with our earlier work on Indian middle school students' ideas about design and designers using written responses, where students demonstrated an incomplete understanding of design and designing. In the present study students, mostly older ones depicted gender and professional stereotypes: design as engineering or building shown more often by boys was mostly associated with male designers. Insights from the study have implications for curriculum development at the school level in India. A paper based on the investigation has been submitted for publication.

Designing with and without make

A debate in D&T education has revolved around the importance of freedom to design without the constraint of having to make versus the benefits of making. A study of Indian middle school students was undertaken to see the differences between the two situations. Two different sets of students from Class 7, about 14 to 25 in each set, were given the brief to solve the same real-world design problem. One set was told that they would have to make the artefact they has designed, while the other did not have to make their solutions work. Students' design solutions were compared in terms of elements of creativity and their design decision skills. Students unconstrained with making showed more evidences of creativity and risk taking. However, students in a design-with-make activity had and used the greater number of opportunities to make design decisions that were conceptual, technical, constructional, aesthetic or marketing. The making activity also allowed students to recreate the entire design process and develop skills in designing. It is proposed that both the activities need to be used in design education to foster students' creativity and design decision skills. [Farhat Ara, Sugra Chunawala and Chitra Natarajan]

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 widens the scope of the research topic previously titled visuo-spatial reasoning, to include a variety of tools of reasoning, beyond physical models, diagrams and gestures, to model systems, computational models and equations.

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 provided with 37 type-written concept-cards, and each student was asked to assemble a concept-map of the 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 procedural analysis of the task (different actions and moves made in building the map) is ongoing. [Anveshna Srivastava and Sanjay Chandrasekharan]

Representational competence in chemistry

This research seeks to understand 'representational competence' (RC) in chemistry. RC 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. These goals are operationalised using a study where categorisation, transformation and equation-balancing tasks are posed to participants with varying academic backgrounds from undergraduate to post-graduate. A preliminary study based on this method has already been conducted. [Prajakt Pande and Sanjay Chandrasekharan]

Learning Contexts for Graphicacy

The ability to read, analyze and make graphs is an essential interdisciplinary skill for science education. The work has the objective of developing learning contexts for these skills by providing students with opportunities to engage with graphs in a meaningful way. Design principles used for these activities include: constructionism (as against instructionism), real-world data, context of calculation and measurement. In designing the activities, connections between the different mathematical modes of representation and their connection to the real world have been made. The tools include GeoGebra, expEYES and GPS units. Development and design of the activities was done through a series of workshops for teachers and students. The activities were replicated for over two years with different set of students (~ 120 students per year), mostly from IX grade, and from mixed socio-economic backgrounds. The students were given probing questionnaires, also written reports were used as feedback, for enhancing the activities and also to understand the learning of students. The activities include: measuring the average diameter of the mustard seeds, finding the distance to diameter ratio of the Sun, exploring the quadratic function with GeoGebra, physics with GPS Units, exploring AC and DC with expEYES, exploring human sensations with expEYES, electromagnetic induction with expEYES and modelling the geocentric and heliocentric theories with GeoGebra. [Amit Dhakulkar and G. Nagarjuna]

Visual Learning and Visual Teaching in Biology

We propose to investigate how middle school biology teachers could use student drawings to enhance their observation skills, as part of learning science, and how they could assess student learning by analysing and assessing their drawings. Sessions were conducted on students' observation and drawing of plants, and listing similarities and differences between individual plants of the same species before and after drawing. These are motivated by our work in teaching evolution, since variation and similarity is the basis for understanding natural selection. [Karen Haydock]

Mathematics Education Research

Teacher Professional Development

Although school teachers are now increasingly aware of the principles of student centred teaching as recommended in the National Curriculum Framework, they still base their practice on a strong belief in the efficacy of 'telling'. In dealing with errors, teachers focus on correction and repetition of correct solutions, rather than on understanding the origin of the errors in students' thinking. Analysis of the extensive data collected in the project on teacher-researcher collaboration in the classroom has indicated that middle school mathematics teachers need and appreciate specific topic and content related inputs. Focus on interpreting student responses, student questions and student errors arising during classroom teaching is readily taken up by teachers to introduce changes in teaching. 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. [Ruchi Kumar, K. Subramaniam, Shweta Naik and Shikha Takker]

Relating children's out-of-school knowledge to school mathematics

While children from low income families living in crowded urban areas have extensive exposure to different kinds of work, such exposure may lead to different kinds and degrees of learning. We have hypothesized that knowledge about the network of production relations, sense of ownership, and the diversity of work influence what students learn from work contexts. Familiarity with the 'mathematics of earning' may indicate potential connections between out-of-school knowledge and school mathematics. Exposure to diversity of measurement units and modes have potential in supporting the learning of school mathematics. [Arindam Bose and K. Subramaniam]

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. Learning trajectories are currently being explored in the light of this hypothesis. [Jeenath Rahaman, Sanjay Chandrashekaran and K. Subramaniam]

Teaching, learning and assessment of elementary mathematics through a collaborative, constructive and distributed instant messaging environment.

The research seeks to find answers for the following specific research questions: (1) Can chat application be used to help primary school students learn arithmetic skills? (2) If yes, can it be extended to other topics in science? The field work is being done in a village named Khairat Dhangar Wada, where OLPC (One Laptop Per Child) laptops are being used to help students learn language and mathematics among other skills. Preliminary results of the work are reported in the epiSTEME-5 conference. [Rafikh Shaikh and G. Nagarjuna]

Curriculum and Material Development

School Science Education

Primary School Science Curriculum

The Marathi translation of the Class 5 TextBook and WorkBook of the Homi Bhabha Curriculum for Primary Science, "Small Science", was updated and finalised; their layout was also completed. The translation of the class V teacher's book was completed by Deepali Palshikar, and layout work on going. The English version of the Small Science class V teacher's book was revised. [Vishaka Bansode, R. S. Patwardhan, Priya Nambiar, Pooja Konde and Jyotsna Vijapurkar]

In a follow-up of the Small Science curriculum, a team from HBCSE worked with Sri Sri Ravishankar Vidya Mandir, Mulund, helping the teachers through the problems encountered on adopting a new curriculum. These pertained to i) teaching an activity-based curriculum with a perceived low factual content ii) continuous assessment while still retaining the school's requirement of exams iii) role and expectations of parents iv) continuity with the ICSE curriculum Class 6 onwards; a detailed report was prepared for the school. Mind maps were developed for Classes 3 and 4, as a part of Teachers Resource section of the website. Two past students of Small Science, now in college, contributed their experiences <http://coglab.hbcse.tifr.res.in/StudentSpeak>. Al Qamar Academy of Chennai enriched the Small Science website with lively classroom experiences including a musical video on teaching of science <http://coglab.hbcse.tifr.res.in/view-from-classroom>, <http://coglab.hbcse.tifr.res.in/teacher-resources/multimedia-resources> [Vishakha Bansode, Kumar Arunachal, Priya Nambiar, Karen Haydock, Jyotsna Vijapurkar and J. Ramadas]

Middle School Inquiry Science Curriculum

Summer classes were held from May 7 thru June 1 with students of grade 8 in order to test introductory units on electrical circuits and an ecology unit for the series of the Homi Bhabha Middle school inquiry science curriculum. While some units were successful, leading to a plan for curricular material, a large part of the time and effort went into involving students in doing hands on science which proved to be challenging because students had no prior experience of it and equated learning and doing science with looking up information in books.

Transcriptions of audio and video data continued to enable the writing and fleshing out of chapters of text books for grades 6 thru 8; some background material was also collected, from publications in science journals that are of relevance to topics being covered in this series of curricular books. [Jyotsna Vijapurkar, Melissa Tata, Anju Unmesh, Priya Nambiar and Pooja Konde]

Supplementary book on evolution

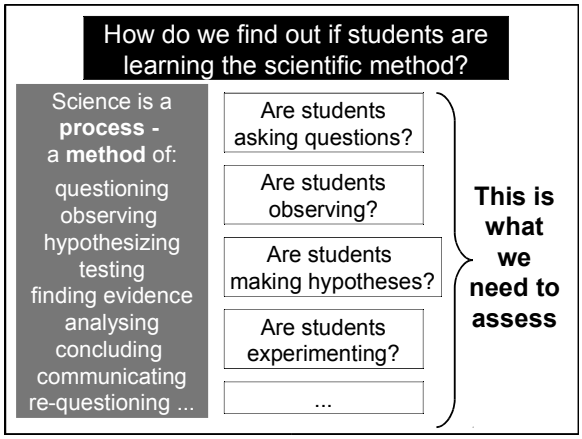
A book which is useful as a supplement to biology textbooks in middle school, high school, and at the college level about evolution of plants the mustard family was completed, after testing and revision. The book is written in a manner to encourage classroom discussions in order to understand and compare evolution by artificial and natural selection. It includes an appendix with material relevant for BSc level students and teachers. Publication of the English version, and its translation into Hindi and Marathi is underway. Versions in full colour and black and white have been prepared so as to provide a low cost alternative - the black and white version can be be downloaded, printed on A3 paper, and cut and stapled to make a low-cost book. [Karen Haydock]

Developing Teaching and Assessment Methods

Science teaching ideas for primary and secondary schools, including ideas for assessment, have been designed, tested, and made freely available on the internet. Additional materials have been designed specifically for teaching teachers how to teach, and they are being used in teacher education workshops.

Sessions on the topic of assessment, and in particular, on "How to Ask Good Questions" were conducted for teachers and teacher educators at HBCSE as well as at a DIET workshop in West Bengal The participants were offered a wide range of concrete suggestions for everyday classroom use, and they tested and evaluated various methods of teaching and assessing. Methods of both formative and summative assessment, and the reasons for their use were discussed and compared.

Different sets of questions and activities were developed in teacher education workshops about innovative teaching methods, and discussions about epistemology, pedagogy, the nature of science, and various social problems related to caste and class were generated using the film *'Young Historians'* by Deepa Dhanraj. The responses of different teachers of both natural and social science education were recorded and compared in order to investigate what participants learn by watching and discussing the film. Thus material was developed to be used with teacher educators, in-service and pre-pre-service teachers. [Karen Haydock, M. C. Arunan and G. Nagarjuna]



In workshops, teacher educators had discussions and developed ways to assess whether students are learning by doing science.

Knowledge Laboratory

Software Development

GNOWSYS data model for collaborative construction of knowledge networks has been fully developed. During this year the focus shifted from developing a network based storage model to implementing applications based on the network model. Three main portals have been developed based on the architecture: (1) beta.metaStudio.org as the main community portal (2) cube.metaStudio.org for the behaviorWatch@Home project and for the Collaborative Undergraduate Biology Education and (3) NROER.metaStudio.org a portal developed for CIET (Central Institute of Educational Technology) of NCERT. These portals offer a multimedia library (supporting sharing of videos, pictures, simulations and other digital creations), collaborative authoring of educational content, discussion forums and facilities for conducting online courses. The platform integrates video archiving features of Pan.do/ra which was used in creating video portal http://wetube.gnowledge.org/. This work consolidates several years of effort in creating semantic web ready knowledge and publication in an open standard. [Nagarjuna G., Anuja G, Supriya Sawant, Dhirendra B. Singh, Krishna Kumar Pal in collaboration with Johnson Chetty, Kabir Kukreti and student project interns from MET Bandra and BITS Pilani.]

Learning Studios DVD

An updated version of live and installable DVD called *learning studios* has been created based on Fedora GNU/Linux distribution, to include all the updated digital workspaces for teaching and learning based on a constructionist model of education. Special features of this DVD include Indian language support, Sugar Learning Platform, simulating scientific models using Netlogo, GeoGebra environments, Stellarium, Step, eToys, Logo, GNOWSYS- studio among many others. [Rupesh Shewalkar and Nagarjuna G.]

Collaborative Undergraduate Biology Education (CUBE)

CUBE (Collaborative Undergraduate Biology Education) program was launched in the summer of 2012 to create a few hubs to nurture the functional networking of undergraduate students and faculty for doing proto-scientific research. The cardinal point was maintaining a simple model organism and conducting collaborative research using the organism. CUBE Summer workshop (from 23 April to 30 May 2012) was followed by CUBE Diwali workshop in November for 12 days and CUBE X'Mas workshop for 6 days at the centre. Old students became mentors for subsequent workshops. The students and teacher mentors set up simple model systems based research in their colleges. Participants communicated through an email list. Obaid Siddiqui Collaborative Undergraduate Biology Research Start-up Award was given as an incentive and recognition to a few colleges. The program spread to six different colleges with active collaborations among them. An important outcome of the project is inclusion of Behavior Watch of Animals and Drosophila as model organisms in the Mumbai University syllabus for undergraduate Biology programs. [M.C. Arunan, Nagarjuna G., Shraddha Ghumre and Rafikh Shaikh]

Taxonomic Profiling of Motor Actions

The gnowledge lab is preparing to launch a citizen science project on Behavior Watch@Home. The general objective is:

- to make citizens develop interest in animal behavior
- to encourage groups of people to collaborate on a science project
- to facilitate collecting and organizing data
- to create a functional network of citizens interested in the area of animal behavior

- to harness the creative potential of people
- to collaboratively analyse the data and publish the results and make them accessible to everyone.

A pilot study was carried out with a group of ten students and three faculty from Acharya Narendra Dev College, New Delhi, on birds. Birds show a varied repertoire of motor actions across different species. In the study we observed 128 birds in 30 orders of the standard bird classification. About 400 video observations were made. The motor actions were tagged from the clips in about 20 different categories: walking (sideways, backwards), hopping, preening, bathing, swimming, running, jumping, disengaged motor actions, tail movements, etc. The data was collected by video recording of birds, uploading the clips to the collaborative portal http://cube.metaStudio.org, searching for birds on online video repositories like YouTube, and embedding the videos on a wiki page at the portal. The project was awarded "Innovation Project" by the Delhi University during 2012-2013 and the participating students were given scholarships to encourage undergraduate research. This study will be extended to other animal species as a citizen science project in August 2013. [Nagarjuna G., M.C. Arunan, (Savithri Singh, M.S. Rajeswari, Rajesh Choudhary and College Delhi.)]

Collaboration with government and other agencies

NCERT

Certificate Programme for Teaching of Elementary School Science

Sample lessons were designed for teacher educators to use to teach their student teachers at a workshop on the Certificate Programme for Teaching of Elementary School Science (CTES), an initiative by the Department of Education in Science and Mathematics, NCERT. designed for both pre-service and in-service teachers. This is intended to be a purely online, interactive course with visual/video contents, where learning materials, assessments, feedback etc. are given online to the learner. They are on topics such as, "How to Design an Educational Game", and "How to Teach Students to Ask Questions". These ideas have been developed based on some classroom tests with children and teachers. [Karen Haydock, M. C. Arunan, G. Nagarjuna, Jyotsna Vijapurkar with other non-HBCSE participants]

Continuous and Comprehensive Evaluation in schools

Examplar material on Continuous and Comprehensive Evaluation (CCE) was developed so as to make it an integral part of the teaching learning process in different curricular areas at the elementary school stage. An HBCSE member was invited to work with the NCERT to evolve and finalise the draft to be tested by teachers in a pilot programme resulted in exemplar material for implementing CCE in Science at the Middle school. [Jyotsna Vijapurkar]

Karnataka SCERT

SCERT, Karnataka is developing Mathematics textbooks at the high school level. A member continued as Chair of the mathematics textbook committee which brought out textbooks for grades 8 and 9. [B. J. Venkatachala]

Andhra Pradesh SCERT

HBCSE continued to work with the Andhra SCERT, which has undertaken a major revision of its school science curriculum and sought guidance at the primary level. Workshops were conducted with textbook writers to design the overall syllabus as well as detailed content for grades 4 and 5 that were appropriate for the cognitive level of students. The consultations helped shape the material more as activity based and inquiry oriented science and social studies lessons than the traditional expository ones. [Jyotsna Vijapurkar]

Collaboration with Maharashtra State agencies

At the elementary school level HBCSE collaborates with three agencies of the Government of Maharashtra: the State Council of Educational Research and Training (SCERT) which prepares the curriculum framework and the syllabus, Balbharati, which produces the textbooks and allied materials, and the Maharashtra Prathamik Shikshan Parishad (MPSP), an autonomous body which has been entrusted the implementation of Sarva Shiksha Abhiyan (SSA) programme in Maharashtra State.

HBCSE members contributed to the revision of the school curriculum and syllabus in order to align with the approach to education represented by the National Curriculum Framework (NCF 2005). Two members worked on the curriculum and syllabus committee for elementary school mathematics and one member was the reviewer for the environmental studies syllabus for SCERT as well as Balbharati. [K. Subramaniam, Aaloka Kanhere and J. Ramadas]

MPSP and Balbharati produced two handbooks for activity-based science, mathematics and work education at the primary and upper primary level, titled "Chala Khelu Karu Shiku", to which several HBCSE members contributed. [N. D. Deshmukh, Aaloka Kanhere, Arun Mavalankar, V. C. Sonawane, P. K. Nawale and J. Ramadas]

National Institute of Open Schooling (NIOS) organized a three-day workshop every month in Pune for the past year to develop Open Educational Resources for Vocational courses of Rural Technology, Hospitality and Hotel management, and ICT. [Narendra Deshmukh]

HBCSE-YCMOU PG Research Programme

HBCSE is the study centre for Yashwantrao Chavan Maharashtra Open University (YCMOU), Nashik, Post Graduation Research Programme (PGRP) in Mumbai. The YCMOU offers post graduation courses in subject communication and educational communication. This collaboration is now over a decade and a total of 25 students were enrolled for M.Sc., M.Com. & M. A, for the academic year 2012-13. This year 5 interactive workshops for students of 2 days each were held. Besides organising these workshops, wherein counsellors guide students, the Centre is involvement in assessing student assignments and providing help to students in formulating their research problems and in developing their research projects. [Sugra Chunawala, Pooja Birwatkar, N.D. Deshmukh, Geeta Battin, Adithi Muralidhar and Nikhat Shaikh]

Other

A 3- Day workshop was conducted at the Muktangan Exploratory Science Centre (MESC), Pune, from April 2-4, 2012 to help MESC use their resources for better practice of science education, in particular on ways to incorporate the teaching and learning of science as inquiry. A pedagogic review done by us in the previous year had highlighted areas where improvement was needed; this

workshop was organised to help implement changes. [Jyotsna Vijapurkar with Pooja Konde and Aisha Kawalkar]

A field project of a Master's student at Azim Premji University, Bangalore on CCE was conducted at HBCSE. The project, included classroom observations and interviews of students, teachers and parents. [Jyotsna Vijapurkar, Santosh Sharma and Indira Vijaysimha, Azim Premji University]

Ramanujan Science and Mathematics Project
The programme by the Employees' Union of Pune Municipal Corporation to give in-service training to High School Teachers mainly from schools situated in the slum areas, in and around Pune Corporation area was organized for the second year. A total of 98 teachers participated in two-day workshop organised every month to help them overcome their teaching difficulties. [A. D. Ghaisas]

Olympiads and Related Activities

The Olympiad effort was supported by the DAE as well as Dept. of Science and Technology, the Ministry of Human Resource Development and the Dept. of Space. Out of the 30 student team members who represented India in the International Olympiads in Physics, Chemistry, Biology, Mathematics, Astronomy and Junior Science, 29 bagged medals and this included 11 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, and Astronomy 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), Proficiency Test (CBSE), 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 and Thailand. 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 15 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 enrolment in the year 2012-13, was about 41000 in Physics, 35,000 in chemistry, 14,300 in biology, 11,800 in astronomy, 25,000 in junior science and 30,000 in mathematics), the second test sees the participation of the top 300 students in each subject except mathematics which has 750 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: Biology, Chemistry, Physics and Junior Science*), M.N. Vahia: National Coordinator (*Astronomy Olympiads*), C.R. Pranesachar and B.J. Venkatachala, Prithwijit De (*Mathematics*); Praveen Pathak (*Physics theory*); S.R. Pathare (*Physics experiment*); I. Das (Sen), S. Narvekar and S. Ladage (*Chemistry*); V. Ghanekar, A. Ronad and R.R. Vartak (Biology), A.P. Sule and A. Ghaisas (*Astronomy and Astrophysics*) and P.K. Joshi and P.K. Nawale (*Junior Science*).]

Orientation-cum-Selection Camps and International Olympiads

Physics

The Physics Olympiad cell conducted OCSC during May 12 - 23, 2012 and the Pre-Departure Training (PDT) for the Indian Team in July 2012. 37 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 Bohr Wheeler Fission Limit, the Stern-Gerlach Experiment and the Space Elevator. A theoretical problem related to the Opera Experiment which stunned the world by announcing that neutrinos travel faster than light was set with assistance of Dr. Praveen Pathak, Prof. Uma Shankar 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 Tartu and Tallin, Estonia in July 2012.

A set of three experiments were designed and developed by Shri Shirish Pathare. These experiments were: (a) Mechanical Black Box: This Mechanical Black Box is a rectangular box which consists of two unequal masses (58.0g and 29.0g) placed at distance L (= 15.0cm) from the midpoint of the box. The task is to determine the masses and the distance L. (b) Two- Dimensional Diffraction Grating: Students were asked to study a two-dimensional diffraction grating pattern. They were asked to determine the grating element and the angle between the two grating elements. (c) Heat – transfer mechanism using tungsten filament bulb: This experiment deals with heat loss mechanisms from a body at different temperature regimes. At low temperature, the heat loss through the tungsten filament in a bulb is due to the conduction and convection mechanisms whereas at high temperatures it is purely due to radiation. The experiment gives students a simple way in which this can be understood. It also involves a rigorous data analysis with some good insights into the heat transfer mechanisms.

Prof. Jayanta K. Bhattacharjee, Director (HRI, Allahabad) 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 2012. The 5 member Indian physics team at the 43nd International Physics Olympiad held at Tartu and Tallin, Estonia in July 2012 won one gold, three silver and one bronze medals. Prof. Patrick Das Gupta (University of Delhi, Delhi) and Dr. M. K. Raghavendra (IISc, Bangalore) were the team Leaders and Shri Shirish Pathare (HBCSE, Mumbai)

was the Scientific Observer.

Chemistry

The Chemistry Olympiad cell conducted OCSC during April 23 – May 3, 2012 and the PDT for the Indian Team in July 2012. 35 students attended the OCSC. The theoretical sessions at OCSC 2012 involved problem solving in areas of chemical thermodynamics, chemical kinetics and quantum mechanics, enzyme catalysis, stereochemistry, carbohydrate chemistry, chemistry of main group elements along with transition elements was also discussed. Stereochemistry and isomerism in coordination compounds and solubility equilibria were also a part of these sessions. The four-member team was selected at the end of the camp to represent India at the International Chemistry Olympiad held at Washington, USA in July 2012.

The experiments that were developed and standardized for experimental examinations at OCSC 2011 covered the following areas: (a) Analysis of copper and zinc contents of the brass sample using complexometric titration, (b) Estimation of ferrous and ferric ions in a mixture, (c) Synthesis of an imine and its reduction using sodium borohydride, (d) Synthesis of a chalcone followed by its epoxidation using hydrogen peroxide, (e) Qualitative organic and (f) Synthesis of a Fe-acetyl acetonato complex. The organic synthesis experiment used TLC technique.

On the basis of camp performance, a team of 4 students was selected. Dr. Prabodh Chobe (BASF India Ltd.) was the chief guest for the OCSC (Chemistry) Valedictory Function. The team underwent pre-departure training camp at HBCSE in July 2012. The 4 member Indian chemistry team at the 44th International Chemistry Olympiad held at Washington, USA in July 2012 won three gold and one silver medals. Prof. Savita Ladage (HBCSE, Mumbai) 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 - 13, 2012 and the PDT for the Indian Team in July 2012. 35 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 Plant Diversity, Anatomy and Physiology, Animal Anatomy and Ecology, Molecular and Cell Biology and Microbiology and Biochemistry. 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 Singapore in July 2012.

On the basis of camp performance, a team of 4 students was selected. Prof. Vidyanand Nanjundiah (IISc, Bangalore) was the chief guest for the OCSC (Biology) Valedictory Function. The team underwent pre-departure training camp at HBCSE in July 2012. The 4 member Indian Biology team at the 23rd International Biology Olympiad held at Singapore in July 2012 won four silver medals. Prof. P. V. Balaji (IIT–Bombay) and Prof. Dharmendra Shah (M. S. University of Baroda, Vadodara) were the team Leaders and Ms. Anupama Ronad, HBCSE, the Scientific Observer.

Junior Science

The Junior Science cell conducted OCSC during May 14 – June 2, 2012 and the PDT for the Indian Team was held from November 21 – 30, 2012. 32 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 Tehran, Iran in December, 2012. Prof. Deepak Mathur (TIFR) was the chief guest for the Junior Science OCSC (Junior Science) Valedictory Function.

The six-member team at the 9th International Junior Science Olympiad held at Tehran, Iran in December 1 -10, 2012 won six silver medals, Dr. Paresh K. Joshi (HBCSE, Mumbai), Mr. Prakash K. Nawale (HBCSE, Mumbai) and Ms. Smita Shyam Marathe (Bhavan's Hazarimal College, Mumbai) were the team Leaders and Prof. Vijay Singh (HBCSE, Mumbai) and Prof. Deepak Mathur (TIFR, Mumbai) were the Scientific Observer.

The International Junior Science Olympiad will be hosted in Pune, India from December 3 – December 12, 2013, where approximately 60 countries are expected to participate. The event will be organized by Homi Bhabha Centre for Science Education. The International Academic Committee for International Junior Science Olympiad 2013 met on six different occasions to formalize the academic tasks for the event. The Organizational work has begun.

Mathematics

The Mathematics Cell conducted IMOTC during April 30 to May 28, 2012 and Pre–Departure Training (PDT) for the Indian team during June 28 to July 07, 2012. A total of 47 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 Mar del Plata, Argentina in July, 2012. Prof. S. G. Dani, TIFR was the chief guest for OCSC (Mathematics) valedictory function.

The six-member team at the International Mathematical Olympiad held at Mar del Plata, Argentina from July 4 – 16, 2012 won two gold and three silver medals and one honorable mention. Prof. B. J. Venkatachala (HBCSE, TIFR, IISc - Bangalore) and Dr. Narasimhan Chari were the team leaders and Prof. S. S. Sane (IIT – Bombay) was the Scientific Observer.

Astronomy Olympiads

The Astronomy Olympiad Cell conducted OCSC during April 27 – May 14, 2012 and Pre-departure training (PDT) for the Indian team in July-August 2012. A total of 30 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 theoretical, 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 Rio De Janeiro and Vassouras cities, Brazil in August 2012. Prof. S. K. Ghosh, Centre Director, NCRA (TIFR) was the chief guest for OCSC (Astronomy) valedictory function.

The five-member team at the 6th International Astronomy and Astrophysics Olympiad held at Rio De Janeiro and Vassouras cities, Brazil in August 2012 won three **gold** and one **silver,** one **bronze** medals. Dr. Aniket Sule (HBCSE) and Dr. Yogesh Wadadekar (TIFR, Pune) were the team Leaders and Prof. Mayank Vahia was the Scientific Observer.

Junior Mathematics and Science Olympiad – 2012

The Atomic Energy Educational Society (AEES) and HBCSE continue to collaborate in several

areas. The junior mathematics and science Olympiads, which is the first stepping stone for the National Olympiads, draw some of the best students of the Atomic Energy Schools from all over the country. The camp was conducted in May under the guidance of the Olympiad faculty at HBCSE and the academic unit of AEES. Several members of HBCSE conducted enrichment and problem solving sessions. [Meenakshi Bhattacharya, Arindam Bose, M. Chaudhary, Indrani Das (Sen), Prithwijit De, Vikrant Ghanekar, P. K. Joshi, Alaloka Kanhare, Savita Ladge, Swapna Narvekar, Saptarshi Paul, Anupama Ronad, Ebie Sam, V.C. Sonawane, A. Sule, Rekha Vartak]

Asian Physics Olympiad

India hosted the Asian Physics Olympiad in New Delhi from April 30th to May 8th 2012. The Homi Bhabha Centre for Science Education collaborated with Indian Association of Physics Teachers to make this event an academic success. The International Academic Committee was chaired by Prof. Vijay Singh and ably assisted by Dr. Rajesh Khaparde, Dr. Anwesh Mazumdar, Dr. Praveen Pathak and Shri Shirish Pathare of HBCSE. Two of the challenging theoretical tasks prepared for the students were inspired by Indian Scientists S. Chandrashekhar and S. Pancharatnam. The experimental kits developed for APhO 2012 were distributed to the Leaders of the 21 participating countries as well as to approximately 150 teachers across India at no cost. 155 students participated. The India student team with 8 members bagged 2 Gold, 4 Silver and 2 Bronze Medals.

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 were held in Physics, Chemistry, Biology and Mathematics. A number of faculty members from Nepal, Bangladesh and Sri Lanka participated in the Astronomy and Astrophysics as well as in the Physics Olympiad Exposure camps. A proactive attempt was made to invite faculty from Jammu & Kashmir, Uttaranchal and North-east.

Physics: There were three Resource Generation Camps: two theory camps during Dec 26 – 28, 2012 for 7 participants and during Feb 6 – 11, 2013 for 11 participants; an experiments camp during Jan 14 – 18, 2013 for 25 participants.

Chemistry: There were two Resource Generation Camps, each for 14 participants during September 25 – 29, and September 29 – 31, 2012.

Biology: There were five Resource Generation Camps, each for 5 participants during August 13 – 17, 2012 on Cell Biology; August 30 – 31, 2012 on Plant Science; October 10 – 12, 2012 on Ecology; November 1 – 2, 2012 on Genetics; and December 3 – 4, 2012 on Animal Sciences.

Junior Science: There were three Resource Generation Camps: two for 12 participants on October 14, and November 12, 2012, and one for 15 participants on April 24, 2012.

Astronomy: A Resource Generation Camp was held on November 11, 2012 for 20 participants.

Mathematics: A Resource Generation Camp was held on October 20 – 23, 2012 for 5 participants.

The Madhava Mathematics Competition (MMC) 2013 was organized for undergraduate students in mathematics. Last year (2012), the programme was conducted in 12 regions viz., Pune, Mumbai, Ahmednagar, Nasik, Ahmedabad, Baroda, Nanded, Kolkata, Hyderabad, Ernakulum, Allahabad and

Goa. This year the five more regions were added viz., Varanasi, Indore, Chattisgarh, Bhubaneswar, Almora. Thus, MMC-2013 was conducted in 17 regions under the aegis of NBHM on January 6, 2013. [V. M. Sholapurkar, S. P. College, Pune, J. Ramadas and M. D. Mastakar, HBCSE, Mumbai, Coordinators].

Olympiads 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. About 35 participants attended each of the camps in Biology, Chemistry and Physics during Sept 4 to 6, Nov 25 to 27 and Dec 26 to 28, 2012. The Astronomy exposure camp held during Nov 13-17, 2012 had 70 participants.

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 and participated in the development of assessment resources. [Vijay Singh (Convenor, Physics), Praveen Pathak and Anwesh Mazumdar]

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 [Aniket Sule, Prithwijit De and Vijay Singh]

National Talent Search Examination (NTSE)

NTSE is a prestigious scholarship scheme for meritorious students at Secondary School level instituted by the Govt. of India. An HBCSE member was involved in the review of NTSE and in designing assessment tasks. [Vijay Singh]

Central Board of Secondary Education (CBSE): Proficiency Test in Science and Mathematics

The CBSE has entrusted the academic task of designing the assessment tasks for the High School Proficiency test (PT) for Science and Mathematics to HBCSE. HBCSE faculty have been involved in this task since the inception of PT in 2010. This collaboration between CBSE and HBCSE will soon be formalized by a memorandum of understanding. This year HBCSE members once again designed the assessment tasks. [A. Mazumdar (Convenor), Prithwijit De, Vijay Singh, Swapna Narvekar, Rekha Vartak and Anupama Ronad]

National Initiative on Undergraduate Science (NIUS)

The National Initiative on Undergraduate Science programme was launched in summer 2004. Till date over 800 undergraduate students have been exposed to this programme (under the aegis of an exposure-cum-enrichment camps). The main thrust of the programme is to promote undergraduate research. Development of theoretical and laboratory courses, preparation of lecture notes, R&D in science education/laboratory training and training of students and teachers in experimental science

are other equally important aspects of NIUS programme. The administrative responsibilities of the programme involve co-ordination with scientists and students, organizing nurture camps and purchase of equipments, etc. Another facet of the programme has been to assist college teachers in setting up modest research programs at their own institutions which is further helping in mentoring undergraduate students at local levels.

This year about hundred and fifty undergraduate students were invited to attend the NIUS exposure-cum-enrichment camps. A fair fraction of the students were from non-metropolitan colleges. In these camps, leading scientists and researchers lectured on diverse topics and lecture notes have been prepared for some of these topics. Such lecture notes are useful resources for Curriculum Development at the undergraduate level. Some of the project work carried out by students were of sufficiently high standards and were 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.

NIUS Physics

The NIUS camp for Physics (IX.1) was held at HBCSE from 18th June 2012 - 30th June 2012. Out of 69 students invited, 67 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 Drs. Ajith Kumar B.P. (IUAC, New Delhi), Sudhir Jain (BARC, Mumbai), Subhendra Mohanty (PRL, Ahmedabad), Prasanta Panigrahi (IISER, Kolkata), A.N. Ramprakash (IUCAA, Pune), Vivek Vyas (PRL, Ahmedabad), Latha Warrier (HBCSE, Mumbai), Rajeev Bhalerao (TIFR, Mumbai), Arvind Kumar (HBCSE,Mumbai), D. P. Roy (HBCSE, Mumbai), S. M. Roy (HBCSE, Mumbai), Anwesh Mazumdar (HBCSE, Mumbai), Vijay Singh (HBCSE, Mumbai), Rajesh B. Khaparde (HBCSE, Mumbai) and Praveen Pathak(HBCSE, Mumbai).

The theoretical sessions at the camps were Introduction to Quantum mechanics, Stellar Structure and Stellar Oscillations, Adaptive Optics in Astronomy, Introduction to ExpEyes, Basic Constituents of Matter and their Interactions, Introduction to Quantum Computation Language (QCL), Realizing entangled states in physical systems and application for quantum computation, Thermodynamics for Quarks and Gluons, Introduction to Experimental Physics, Training in Experimental Physics, Dynamical Systems, Dark Matter in Cosmology and Astrophysics, Quantum Foundation and Quantum Information, Electronic Properties of Nanostructures, Connection between solitons and Elliptic functions and Physics Education Research. The short laboratory course at the camp 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, 30 students are currently pursuing NIUS projects. 25 students from previous batches are continuing physics projects at HBCSE and with mentors in Delhi University, Patna Science College, Harishchandra Research Institute (Allahabad), IISER (Kolkata), Physical Research Laboratory, (Ahmedabad), Chennai Mathematical Institute (Chennai), TIFR and BARC. The areas covered are as varied as mentioned above.

Another enrichment course that is conducted as part of NIUS physics is the Summer Course in Experimental Physics. This course is open to undergraduate students and is based on Experimental

Problem Solving approach that has been developed at HBCSE. It encourages students' independent thinking in physics laboratory and foster their procedural understanding. 48 students from the second year B.Sc./BS/ Integrated M.S./ M.Sc. participated in this course held at HBCSE from June 4 - 15, 2012. A three-day preparatory workshop for teachers was conducted prior to this summer course and had participation of eight undergraduate teachers from different parts of India. The workshop involved discussion sessions regarding procedural understanding and experimental problem solving in physics. These teachers then acted as resource persons for the summer course.

NIUS Astronomy Winter School

Like every year, past astronomy Olympiad students were invited to participate in a 2 week winter school at HBCSE, Mumbai from 10 to 21 December 2012. The 20 students, who participated this year were involved in various projects like study of Herbig Ae-Be stars, study of x-ray binaries, solar MHD simulations and open cluster observations using 2mt IGO telescope. (M. N. Vahia - TIFR, A. Sule)

NIUS Chemistry

The NIUS camp for chemistry (IX.1) was held at HBCSE from 21st December to 31st December, 2012. Out of 53 students selected for the camp, 48 attended the camp. All students were from regular B.Sc./BS or integrated M.Sc. courses.

The theoretical sessions at the camp covered core and advanced areas in chemistry. The theoretical sessions were Chemical Thermodynamics, Chromatographic Separation Techniques in Analytical Chemistry, Stereochemistry, Chemical Kinetics and Catalysis, Symmetry Elements in inorganic chemistry, Green Chemistry, Organometallics, Enzyme Catalysis, Soft Condensed Matter, Overview of Computational Chemistry, Designing and Synthesis of Dendritic Materials, and Application of Nanochemistry in Medicine and Latest Innovations in Chemistry and Chemical industries.

The laboratory sessions of NIUS chemistry had activities/experiments related to organic synthesis, TLC technique, analysis of an inorganic complex using different titrations, identification of given unknown compounds using qualitative analysis and separation of mixtures of organic compounds. Some laboratory sessions were group activities and were aimed at understanding the variables involved in experimental studies. We have been conducting laboratory sessions in computational chemistry. This year these laboratory sessions were conducted at the computational laboratory that has been set up at HBCSE and has become functional now. The sessions involved use of Gaussian program to study properties of small molecules. Students were given short computational calculations related to different conformations of molecules such as water, ethane and butane and were expected to determine the energies of their stable structures.

NIUS chemistry camp participants this year visited the chemical plant of the BASF located at Thane-Belapur Road, Mumbai. Students were able to visit various production plants and the Quality Control laboratories and the effluent water treatment plants. *The visit also covered lecture sessions related to safety aspects regarding chemical industries, overview of chemical industries particularly in India and career opportunities in chemistry.*

Towards the end of this camp, 21 students were selected and currently these students are in the process of completing assignments related to the prospective projects. In addition, 24 students from earlier batches of NIUS Chemistry also visited HBCSE to complete their projects and prepare manuscripts for publications and conferences**.**

The resource persons for the camp were Drs. K.G. Akamanchi (ICT), Jayesh Bellare (IIT Mumbai),

S. S. Bhagwat (ICT, Mumbai), M. Balakrishnan (IIT Mumbai), Prabodh Chobe (BASF India Ltd.), Anindya Datta (IIT Mumbai), P. A. Hassan (BARC, Mumbai), Radha Jayaram (ICT, Mumbai), A. Karnik (Univ. of Mumbai), Rajiv Kumar (Tata Innovation Centre, Pune), Dilip Maity (BARC, Mumbai), A. A. Natu (IISER, Pune), S. D. Samant (ICT, Mumbai), R. T. Sane (GNIRD, Mumbai), M.Sunderajan (BARC, Mumbai), Arvind Kumar (HBCSE), Savita Ladage (HBCSE), Ms. Swapna Narvekar (HBCSE) and Ms. Indrani Das (Sen) (HBCSE).

NIUS Biology

The NIUS camp for biology (Batch IX.1) was conducted at HBCSE from 29th Oct 2012 - 2nd Nov 2012. Out of 38 students invited for the camp, 31 students attended the camp. All students for the camp were from regular B.Sc. or integrated M.Sc. courses.

The theoretical sessions at the camp were related to Basic concepts of biology and Biostatistics, Scaling laws in biology, Introduction to DNA Technology , Gene to Genome and Gene mapping, Tools and Techniques for chromosome studies and Response of Protists to environmental stimuli.

The laboratory sessions covered experiments related to Biochemistry, Molecular Biology, Ethology and Genetics.

From this batch, 9 students have been selected to pursue NIUS projects. In addition, 3 students from earlier batches of NIUS Biology are also visiting HBCSE to complete the projects and prepare manuscripts for publications and conferences.

The resource persons for the camp were Drs. Madan Mohan Chaturvedi (University of Delhi), B. B. Nath (Pune University), Jacintha D'souza (UM-DAE CBS, Mumbai), Ansuman Chattopadhyay (Santiniketan, Kolkata), Vijay Singh (HBCSE), Saptarshi Paul (HBCSE), Rekha Vartak (HBCSE), Ms. Anupama Ronad (HBCSE) and Mr. Vikrant Ghanekar (HBCSE).

Computational Facility

Computational science at the undergraduate level is one of the planned thrust areas of NIUS. For this purpose, a computational laboratory in the classroom setting has recently been installed in the NIUS building at HBCSE. This facility, equipped with thirty high-end computers is being used for student and teacher training purposes. Undergraduate student participants in the NIUS Chemistry winter camp used this facility for a computational chemistry module. At the same time, it is also being used as a high-CPU facility by NIUS Physics students for their research work.

[**Physics:** Vijay Singh, D. P. Roy, S. M. Roy, Rajesh Khaparde, Anwesh Mazumdar, Praveen Pathak; **Chemistry:** Savita Ladage, Swapna Narvekar, Indrani Das (Sen); **Biology:** Rekha Vartak, Anupama Ronad, Vikrant Ghanekar]

NIUS Seminar Series

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.

Teacher Development and Science Popularization

In-service Teacher Professional Development in Elementary Education in Collaboration with

MHRD and SCERTs/DIETs (Bihar & West Bengal)

Capacity Building Workshops

Contact programs with faculty of the District Institutes of Education and Training (DIETs) of Bihar and West Bengal continued with two 2-week capacity building workshops at HBCSE. There were 39 participants from Bihar (August 2012) and 25 from West Bengal (September 2012). Sessions were based on analysis of textbooks and curricular / policy documents, reflections on classroom teaching (live and video recordings), understanding students' thinking, readings of pedagogical research. One of the notable and successful components of the workshop was setting up and completing an investigative science project, done by groups of teacher educators. The emphasis was on creating an interface between elementary school education and teacher education at D.Ed. level. For the West Bengal workshop an online e-learning Moodle platform <https://tpd.hbcse.tifr.res.in> was set up for holding discussions, uploading presentations, resource materials, assignments and project works. Reports of the project are at <http://teacher-ed.hbcse.tifr.res.in/documentation>. Resource materials are to be developed further into a form suitable for dissemination. [K. Subramaniam, Meena Kharatmal, Minakshi Bhattacharya, Kumar Arunachal, Karen Haydock, Sugra Chunawala and J. Ramadas] [Resource persons for the workshops: S. C. Agarkar, Pooja Birwatkar, Arindam Bose, Indrani Das, N. D. Deshmukh, Rajkumar Diwakar, Vikrant Ghanekar, Akshay Gole, K. T. Hambhir, P. K Joshi, Rakesh Joshi, Rajendra Kadam, Aaloka Kanhere, Tuba Khan, Rajesh Khaparde, Ruchi Kumar, A. T. Mavalankar, K. K. Mishra, Adithi Muralidhar, Manoj Nair, Swapna Narvekar, Chitra Natarajan, Shirish Pathare, Prajakt Pande, Praveen Pathak, Jeenath Rahaman, D. P. Roy, Riyazzudin Shaikh, Saurav Shome, Gurinder Singh, Vijay Singh, Himanshu Srivastava, V. C. Sonawane, Shikha Takker and Arsheya Taskeen]

Working Group Meeting

To review interventions in teacher education and development in different parts of the country, a 2-day working group meeting was held at HBCSE in June 2012. The 15 outside participants were from Central Institute of Education, University of Delhi, Tata Institute of Social Sciences, NCERT, Regional Institutes of Education, SCERT Bihar, DIETs West Bengal and Maharashtra, NGOs Eklavya, Vidya Bhavan Society, Digantar and Science Communication Forum. The themes related to restructuring and strengthening of DIETs, teacher professional development in science and mathematics, needs-based resources, and linkages of teacher education with science teaching and research institutes. These formed the foci of discussions. [K. Subramaniam, Meena Kharatmal, Minakshi Bhattacharya, Kumar Arunachal, Karen Haydock, J. Ramadas and others]

Follow-up Visits and Workshops

A one week workshop for DIETs and PTTIs was conducted by DIET Nadia with HBCSE from 17-22 December 2012. Teacher educators who had participated in earlier workshops were mentored to conduct sessions for their peers (59 participants - 23 DIET, 30 PTTI, 6 teachers). Themes of the workshop were related to action research, constructivism, assessment and students' misconceptions.

A week-long workshop for DIETs and PTECs was conducted at SCERT Patna in Bihar from 4-9 March, 2013. Two-day sessions for the older batch of 32 were followed by four days in which a new batch of 10 teacher educators joined the group and were mentored by the former. Themes were related to learning and teaching science and mathematics, constructivism, continuous and comprehensive evaluation, students' thinking, classroom analysis, science through investigation and

textbook analysis based on the National Curriculum Framework 2005 and Bihar Curriculum Framework 2008. [Kumar Arunachal, Minakshi Bhattacharya, N. D. Deshmukh, Rajkumar Diwakar, Karen Haydock, Meena Kharatmal, K. K. Mashood, Jayashree Ramadas, Riyazuddin Shaikh and Vijay Singh]

Teacher Education Conference

Poster and slides on HBCSE's teacher education programs over the years were presented at the "Fourth International Policy Dialogue Forum on Teacher Challenges for Education for All in India" held in New Delhi on May 28-30, 2012. The materials related to HBCSE's perspective on teacher education, resources developed, capacity building program for DIETs, collaborative approaches, project-based learning, inquiry and argumentation in science classrooms and past projects in teacher professional development <http://teacher-ed.hbcse.tifr.res.in/documentation>.
[K. Subramaniam, Meena Kharatmal, Ruchi Kumar, Saurav Shome, Aisha Kawalkar, N. D. Deshmukh and J. Ramadas]

Workshops for DIET faculty from Gujarat

On the request of the State Council of Educational Research and Training, government of Gujarat courses were arranged for teacher educators working in District Institute of Education an Training (DIET) in the state of Gujarat. A week long course was arranged at HBCSE for educators in science while another course was devoted to educators in mathematics. In both these courses an attempt was made to provide inputs in content, pedagogy, experimentation and evaluation to make science and mathematics education in schools meaningful. The five day course in science education included sessions on unified concepts at the elementary school level, continuous comprehensive evaluation, teaching science through investigations, and constructivism, an educational tour and science demonstrations. The feedback received from the teacher educators was encouraging.
[S. C, Agarkar, A. Bose, S. Chunawala, I. Das (Sen), P. De, N. D. Deshmukh, K. T. Hambir, P. K. Joshi, M. Kharatmal, C. Natarajan, S. Narvekar, J. Rahman, J. Ramadas, V.C. Sonawane, K. Subramaniam, A. Sule and S. Takker]

Collaboration with other agencies

A two-day teacher workshop was held at Matushri Rampyaribai Sarda Kanya Vidyalaya, Nashik, in collaboration with and organised by Nashik Education Society during October 17 -18, 2012. A total of 47 Science Teachers participated in this workshop. [N. D. Deshmukh, V. D. Lale, V. C. Sonawane and K. T. Hambir]

Rayat Vidnyan Parishad : Rayat Shikshan Sanstha, Satara, and HBCSE jointly organized a science conference under the aegis of the *Rayat Vidnyan Parishad* on ‘Let’s Understand and Use Constructive Approaches” during March 02-04, 2013 at Satara. More than a thousand science teachers from the schools of the Rayat Shikshan Sanstha around Maharashtra participated in this mega event. An exhibition including projects by students and teachers, HBCSE's demonstration activities titled, Yes, You can do it! and its publications stall were visited by several thousand students and teachers from the vicinity. HBCSE's stalls were special attractions. [N. D. Deshmukh-Coordinator, Jayashree Ramadas, Chitra Natarajan, Sudhakar Agarkar, Savita Ladage, Karun Hambir and Tilottama Shirodkar].

Student programmes

Mumbai Science Teacher Association (MSTA) organized two-day camp at HBCSE on April 19 and 20, 2012 for the recipients of the Homi Bhabha Young Scientist award. More than 98 students of VII Std. participated in this camp. [N. D. Deshmukh-Coordinator, S.C. Agarkar, Rajkumar Diwakar, A.D. Ghaisas, K.T. Hambir, Aloka Kanhere, V.D. Lale, Hema Patil and V.C. Sonawane]

Science activity demonstrations were conducted at the Brihanmumbai Municipal Corporation school at Shivaji Nagar, Govandi, on February 12,14 and 22, 2013 as part of the Doorstep School Programme. [N.D. Deshmukh and P.K. Nawale]

AEES Community Development Programme 2012-13

HBCSE, in collaboration with Atomic Energy Education Society conducts a community development programme every year since 1999 aimed at identifying talented students in the vicinity of Atomic energy projects, from rural or tribal belts, who are socially, educationally and economically disadvantaged and provide them free education and financial support. The programme is currently running in 10 centres around the country (Narora, Kakrapar, Tarapur, Rawatbhata, Kaiga, Managuru, Kalpakkam, Kudankulam, Jaduguda and Narvapahar). Children selected for the programme get free education up to Class XII, a monthly scholarship (rupees 300 for boys and rupees 400 for girls), uniforms and books, as well as, medical benefits. The students are selected for the scholarship on the basis of oral tests developed at HBCSE and written tests developed by AEES. Other selection criteria are also utilised that give weight to socio-economic factors. At each of the 10 sites, 8-16 students are selected and a follow-up of the selected students is also done to assess if they are facing any problems. [Sugra Chunawala, Geeta Battin, Adithi Muralidhar, Bandana Thakur, D.D. Pednekar, V. D. Lale, N.D. Deshmukh,, Pooja Birwatkar, Devashree Prabhu, Rafikh R. Shaikh, Sandhya Rajshekhar and Nikhat Shaikh]

Visits to HBCSE

Over 850 visitors to the Centre during the year included school and college teachers, student teachers and teacher educators from B.Ed. and D.Ed. colleges, students who design science projects for exhibition in their schools or colleges, children from schools and NGO's. There were a few visitors from outside India. Visitors are exposed to hands-on science and mathematics activities. [V. C. Sonawane (Coordinator) and all HBCSE staff]

National Science Day 2013

As every year, the National Science Day was celebrated by having an “open house” that witnessed over 1250 visitors to the Centre. Several new experimental demonstrations and demonstrations of working of gadgets were added, and project staff members were trained for effective demonstrations. Deflection of electron beam with the help of magnet and electromagnet, Robotics education corner, glass blowing, computer corner and botanical garden were a few of the attractions of the day. Some brainstorming activities in mathematics were designed to engage young students. A handout on “Simple science activities” with 13 experiments in science for young students was distributed to all the school students. [V. C. Sonawane (Coordinator) and all HBCSE staff]

Participation in Science Fairs

HBCSE set up a variety of displays and activities at a 'Mega Science Fair' organized by Nehru Science Centre, Mumbai, from 20 to 23 February 2013. Thousands of people visited HBCSE's pavilion during the four day science fair. [K. K. Mishra (Coordinator), V. C. Sonawane, Kumar

Arunachal, Rajkumar Diwakar and Vishakha Bansode]

Navi Mumbai Science Foundation' (NMSF) organised the "Navi Mumbai Science Utsav – 2013" on 9 and 10 February 2013, where school students exhibited their science experiments. HBCSE helped coordinated the exhibitions, and displayed some general science experiments, a poster on ' Introductory Robotics', and experiments in environmental science. [K. K. Mishra (Coordinator), V. C. Sonawane, K. T. Hambir, Rajkumar Diwakar and Vishakha Bansode]

5. Staff List

Academic Members: S. C. Agarkar, S. I. Chunawala, S. Chandrasekharan, P. De, K. Haydock, P. K. Joshi, R. B. Khaparde, S. A. Ladage, A. Mazumdar, K. K. Mishra, G. Nagarjuna, C. Natarajan (*Dean*), C. R. Pranesachar (upto 30/04/2013), J. Ramadas (*Centre Director*), V. A. Singh, K. Subramaniam, A. Sule, R. R. Vartak, B. J. Venkatachala, J. Vijapurkar

Scientific Members: 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, R. S. Patwardhan (upto 02/03/2013), D. D. Pednekar, T. S. Rajashekar, A. Ronad, A. K. Sankhwar, I Ddas (Sen), V. C. Sonawane

Technical Members: 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, P. Birwatkar, A. Jamakhandi, A. Kanhere (upto 04/10/2012), T. Navilarekallu, S. Paul, E. Sam

Research Scholars: F. Ara (up to 31/07/2012). A. Bose, A. R. Dhakulkar, G. Date, R, D'Souza, S. Ghumare, A. M. Kawalkar (upto 31/01/2013), R. Kumar, K. K. Mashood, Rosemary V., P. Pande, A. Raveendran, J. Rehaman, B. J. Ramrao, R. Shaikh, A. Shrivastava, S. Shome, H. Srivastav, S. Thakar, G. Singh

*Raja Ramanna Fellows:*Arvind Kumar, D.P. Roy, H.C. Pradhan, S.M. Roy

Administration: S. V. Amin, M. B. Bamne, S. N. Burli, S. K. Desai, M. B. Deshmukh, M. D. Gaitonde (SAO), A. W. Joshi (up to 31/01/2012), R. S. Korgaonkar, M. D. Mastakar, M. M. Mastakar, D. R. Mhapsekar, H. M. Mandlik, C. S. Pawar, V. N. Purohit (up to 31/01/2012), S. L. Rasam, V. P. Raul, M. G. Shinde, R. A. Shrotri, T. S. Shirodkar, M. S. Thakur. G. A. Tawate

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 is (a) reviewer for Indian Educational Review, NCERT, *National Council of Educational Research and Training, New Delhi, India (b)* Executive *Council Member of the Peoples Council of Education for the year 2012-2015.* **N. D. Deshmukh** *is (a)* nominated as Executive Committee Member of Asian Association of Biology Education (AABE) (b) Asian Journal of Biology Education (AJBE) Editorial Board Member (c) Member, executive committee of

All India Association for Educational Research (d) Joint Secretary of Maharashtra Association for Educational Research. (e) listed a member of visiting team for inspection of B.Ed and D.Ed. by Western Region Committee of National Council for Teacher Educator **A. D. Ghaisas** was (a) Member of coordination committee for Government of Assam to design and implement the Mobile Laboratory project in Assam. **S. Ladage** is (a) Co-opted member of International Steering Committee for International Chemistry Olympiad, 2012-2013 (b)Vice president, West Zone, Association of Chemistry Teachers (ACT) (2010-) **A. Mazumdar** (a) member of the Committee for National Innovation Scholarships under the Office of Adviser to Prime Minister on Public Information, Infrastructure and Innovations, (b) member of the International Astronomical Union. (c) the convener of the Joint Board of Paper Setters for the Proficiency Test in Science and Mathematics held by the Central Board of Secondary Education in July 2012. Eight other HBCSE staff members and three external members were part of the joint board. **K. K. Mishra** (a) Member, Vigyan Parishad Prayag, Allahabad (b) Member, Advisory Board of Vigyan Ganga, a science journal of Banaras Hindu University (BHU), Varanasi, (c) Member (Editorial Board) Vigyan Prakash, a quarterly science magazine brought out by the World Hindi Foundation, Oswego, New York, USA. (d) Joint Secretary, Peoples Council of Education, Allahabad. **G. Nagarjuna** (a) Member, Institutional Advisory Board, Central Institute of Educational Technology, NCERT, New Delhi. (b) Associate Editor, International Journal of Conceptual Structures and Smart Applications (IJCSSA), an Official Publication of the Information Resources Management Association, (c) Reviewer, Science & Education, Springer (d) Chair, Free Software Foundation of India (e) Member, Board of Software Freedom Law Centre of India, New Delhi (f) Member, Advisory Board, K.J. Somaiya College of Engineering, Mumbai (g) Member, Web Server Committee, National Board of Higher Mathematics (h) Convener, epiSTEME-5 conference, 7-11 January 2013, Mumbai (i) General Chair, 20th International Conference on Conceptual Structures, 10-12 January 2013 Mumbai. **S. Narvekar** (a) Executive Council Member, Association of Chemistry Teachers (ACT) (2010-). **C. Natarajan** (a) Member, Editorial Board of International Journal of Technology and Design Education, Springer, Netherlands (b) Editorial Board, Design and Technology Education: An International Journal, Trentham Books Ltd., UK (c) Member *of Executive* Council *of the Indian Physics Association (d)* Member *of the NCERT Establishment Committee(e)* Chair *of the committee formed by the National Steering Committee for Olympiads to review first stage of Olympiad selection.* **J. Ramadas** (a) Member, IUPAP International Commission on Physics Education (ICPE) for the period 2011-13 (b) reviewer for the International Journal of Science Education (Taylor and Francis) (c) Member, Central Advisory Board on Education (CABE) Committee for developing a framework and processes of the National Mission on Teachers and Teaching (d) Member, Committee of Experts to oversee and mentor programmes of the National Council for Science & Technology Communication (NCSTC), Department of Science and Technology (e) Member, Consultation group for the Justice J. S. Verma Commission on Teacher Education appointed by the Hon'ble Supreme Court (f) Member, National Advisory Committee and National Scientific Committee for the Kishore Vaigyanik Protsahan Yojana (KVPY), DST (g) Member, Expert Committee for the "Rajat Jayanti Vigyan Sancharak Fellowship" of Department of Science and Technology (NCSTC Division) (h) Member, Governing Council of the Atomic Energy Education Society (AEES). **V. Singh** *(*a) Adjunct Professor and Member Academic Advisory Committee, UM DAE CBS (University of Mumbai – Department of Atomic Energy Centre for Excellence in Basic Sciences) (January 2011 -) (b) Adjunct Professor, IIT Bombay (January 2011 -) (c) Chair, Physics Question Bank Committee, Kishore Vaigyanik Protsahan Yojana (KVPY) (d) Member, Examination Board for Proficiency Test, Central Board of Secondary Education (CBSE), (e) Panel of Judges: Aditya Birla Scholarships (f) Panel of Judges: Times Scholar (g) Member, Academic Committee for Scholastic Aptitude Test (SAT), National Talent Search Examination (NTSE), Member, Review Committee on National Talent Search Examination (NTSE) (h) Scientific Observer in IJSO – December 1-12, 2012 (Tehran, Iran) (i)Faculty Selection Committee for: Mumbai University and

NCERT. **K. Subramaniam** (a) Member, International Programme Committee for ICME-12 (International Congress of Mathematics Education), (b) India representative to the International Commission for Mathematics Instruction, (c) Member, editorial board and Reviewer for the mathematics education journal "At Right Angles: Mathematical Reflections." (d) Member, Steering Committee for the National Initiative in Mathematics Education (NIME 2011-2012) (e) Chair, Curriculum and Syllabus Committee (Class 1 to 8) for Mathematics of the Maharashtra State (f) Member, Advisory Board, International Sourcebooks in mathematics and science education, Information Age Publishing (g) Member, Plenary Panel on Opportunities to learn in mathematics education, PME-36 conference, Taipei, Taiwan. **A. Sule** (a) Regional Coordinator (Asia-Pacific) for the International Olympiad in Astronomy and Astrophysics (IOAA), (b) Chair, Academic Committee, 8th Asia-Pacific Astronomy Olympiad, Cox's Bazaar, Bangladesh (c) Member, Project Approval committee for NCSTC Ramanujam – Chandrasekhar centenary celebrations (DST) (d) Member, Coordination committee for National Entrance Screening Test 2012 as well as 2013.

7. Visits

S. C. Agarkar visited Kyoto-Sangyo Universty at Kyoto in Japan, to meet researchers in science and mathematics education. **S. Chunawala** visited *Singapore and Kuala Lumpur, Malaysia in connection with the SED project.* **A. Mazumdar** visited (a) University of Cologne, Germany from 16 May to 16 June for collaborative work on asteroseismology of solar-type stars. (b) Catholic University of Leuven, Belgium from 29 May to 2 June for collaborative work on asteroseismology of beta Cephei stars. **C. *Natarajan*** *visited Singapore and Kuala Lumpur, Malaysia in connection with the SED project.* **J. Ramadas** visited World Conference on Physics Education at Istanbul, Turkey, July 2-6, 2012 with R. B. Khaparde and K. K. Mashood. **D. P. Roy** visited Universidad Autonoma National Mexico in Mexico city and the PASCOS 2012 symposium in Merida (30 May to 8 June 2012). **V. C. Sonawane** visited Association of Science Educators' (ASE) Conference 2013, held at University of Reading, London (U.K) during 2nd January to 5th January 2013. The theme of the conference was "Constructing the future of Science Education". ASE is the largest conference for science educators in Europe. Participated and carried one hour lecture demonstration session on "School Science Experimentation" on 3rd January 2013. **A. Sule** visited (a) International Astronomical Union General Assembly (IAU – GA) at Beijing, China from 25th to 31st August 2012. (b) Organisation of 8th Asia-Pacific Astronomy Olympiad held at Cox's Bazaar, Dhaka from 25th November to 4th December 2012.

8. Awards

K. K. Mishra

- Shatabdi Samman of Vigyan Parishad Prayag in its Centenary Year (2012-2013) for science communication.

V. Singh

- The *Navbharat Times* UDAAN Awards was presented on June 26, 2012 by the Hon'ble Chief Minister of Maharashtra Shri Prithviraj Chauhan at the Taj President Hotel, Mumbai.

9. Invited Talks

S. C. Agarkar

- Experiences of developing supporting instructional material in science, International Conference on Use of ICT for Teacher Education, Hotel Patliputra, Patna, June 14, 2012.

- Role of Non-Governmental Organizations in Education, People's Education Seminar, HBCSE, Mumbai, October 11, 2012.
- Developing digital resources for school science and mathematics in regional language: An Indian Experience, Fourth Asian Conference on Education, Hotel Ramada, Osaka, Japan, October 27, 2012.

S. Chunawala

- Science and Science Education Through the Lens of Diversity, review talk at international conference epiSTEME 5, HBCSE, Mumbai, 7-11 January 2013.

A. Mazumdar

- "Acoustic glitches in solar-type stars", 5th Workshop of the Kepler Asteroseismic Science Consortium: Extending the Kepler Mission: New Horizons in Asteroseismology, Balatonalmadi, Hungary, 18-22 June, 2012
- "Internal seismic diagnostics of stars", IAU General Assembly Special Session 13: High-precision tests of stellar physics from high-precision photometry, Beijing, China, 27-31 August, 2012

K. K. Mishra

- Role of Newspapers in Creating Scientific Temper, International Conference on Role of Communication Media in Creating Scientific Temper, jointly organized by National Institute of Science Communication and Information Resources (CSIR-NISCAIR), Vigyan Prasar (DST), National Council of Science and Technology Communication (NCSTC- DST), and National Council of Science Museums (NCSM) at Pusa, New Delhi May 29 to 30, 2012

G. Nagarjuna

- "Let us run studios instead of classrooms!" at Engaging Science: Dialogues Across Disciplines, IISER, Mohali, March 31, April 1 2012.
- "Changing the Development Paradigm: ICT for Social Justice and Well-Being" on May 31, 2012, Tata Institute of Social Sciences, Mumbai
- "Constructionism vs Instructionism" Keynote Address, DigiAge Learning: New Dimensions, Changed Perspectives, A UGC Sponsored National Seminar, July 27, 2012., St. Teresa's Institute of Education, Santa Cruz.

C. Natarajan

- Science Education across India: What differs and Why, at TARC Symposium 2012 on Innovative Science Education for Students of Diverse Backgrounds: Strategies, Approaches and Assessment, at Tunku Abdul Rahaman College, Kuala Lumpur, Malaysia, September 27, 2012.
- An activity based programme on issues at the interface of science technology and society, in Third Peoples Education Congress organised by People Council of Education with Gujarat Vidyapith And Lok Bharati Vidyapith, at Ahmedabad, 19-23 November 2012.

H. C. Pradhan

- Designing a Mathematics Curriculum for All - Lead Talk, Curriculum Group for Middle School Mathematics, State Council of Educational Research and Training, Government of Maharashtra, Pune, May 24, 2012.

J. Ramadas

- "Is Science Teaching an Art or Science? "Boundaries" Talk at Indian Institute of Technology,

Indore, August 9, 2012.

- “Educating the Educators, Multidisciplinary Perspectives in Science and Technology”, Tenth NIAS-DST Training Programme, National Institute of Advanced Study, Bangalore, September 25, 2012.
- “Innovation in Science Education: Case of the "Small Science" Curriculum”, TWAS Regional Prize for the Development of Scientific Educational Material, TWAS-ROCASA Meeting on Science Education for Innovation, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, November 16, 2012.

D. P. Roy

- SUSY Dark matter in Nonuniversal Gaugino Mass Models”, PASCOS 2012, Merida, Mexico, June 5, 2012.
- “Collider Search for the Charged Higgs Boson”, Symposium on Higgs and New Physics, SINP, Kolkata, August 21, 2013.
- “Standard Model & Beyond at the Large Hadron Collider”, National Conference on Theoretical Physics, Tezpur University, February 11, 2013.
- “Determination of the Third Neutrino-Mixing Angle and its Implications”, National Conference on High Energy Physics and Cosmology, Guwahati University, February 13, 2013.
- “Dark Matter in SUGRA Models with Universal and Nonuniversal Gaugino Masses”, Edinburgh – Delhi Particle Physics Symposium, New Delhi, February 16, 2013.
- “Probing the Neutrino Mass Hierarchy and the CP Violating Phase in the Foreseeable Future Experiments”, Program on CP Violation in Elementary particles and Composite Systems, Mahabaleshwar, February 19, 2013.
- “Why LHC?”, Seminar on Advances in Quantum Theory, Hyderabad University, February 26, 2013.

V. Singh

- Energy, Momentum and Angular Momentum in Electromagnetism", Physics Department, DAV College, Siwan, Bihar, November 6, 2012.
- “Why do Physics Education Research?” Allahabad University, November 2, 2012.

Subramaniam, K.

- “Mathematics Education Research: A Perspective”, Invited talk at the NCERT National Meet on Year of Mathematics , December 2012.

A. Sule

- “The genius problem”, National Conference on “Responses to Changing Educational Paradigms”, HBCSE, Mumbai, October 11, 2012.
- “Use of CCD to determine stellar magnitudes”, National Seminar on “Application of Electronics in Astronomy and Astrophysics”, KTHM College, Nashik, March 26, 2013.

10. Conference Organised by the School / Dept. / Group

Asian Physics Olympiad, New Delhi, 30 April to 8 May, 2012

India hosted the Asian Physics Olympiad with 155 students from 21 participating countries. *HBCSE collaborated with Indian Association of Physics Teachers to make this event an academic success. HBCSE members chaired and served on the International Academic Committee.*

epiSTEME – *5, HBCSE, Mumbai, 7 to 11 January 2013*
The International conference epiSTEME-5, fifth in a series of biennial International Conferences on *Science, Technology and Mathematics Education (STME) drew about 150 researchers from 17 countries to share recent research on education in science, technology and mathematics the world over. There were four main strands of this year's conference where 8 leading scholars from USA, Taiwan, Japan and India presented reviews of the state of the art, complemented by about 55 research papers and posters. (Convenor: G Nagarjuna)*

20th *International Conference on Conceptual Structures, HBCSE, Mumbai, 10 to 12, January 2013*
Co-located with epiSTEME-5, HBCSE hosted the annual conference ICCS-20, which aims at representation and analysis of conceptual knowledge for research and business. The ICCS this year focused on STEM education. One plenary speaker from each of the conferences ICCS-20 and epiSTEME-5 addressed the common plenary session. (Co-convenor: G. Nagarjuna)

2-Day *Seminar on Responding to Changing Educational Paradigms, HBCSE, 11-12 October 2012*
The deliberations at the two day seminar were aimed to document thoughts and actions for a *possible way forward on this theme, and consisted of ten presentations-cum-discussion sessions by eminent social and educational reformers, and a panel discussion.* (Convenor: V D Lale)

3rd National Workshop on Development of Educational E-Materials in Hindi, HBCSE with Vigyan Parishad Prayag, 2-4 November 2012
The Hindi Cell of HBCSE organized the biennial event under the auspices of Vigyan Parishad Prayag, which aims at developing educational materials for students and teachers of Indian schools and colleges of +2 levels. About 60 participating experts from 7 different States of the country took part in it. (Coordinators: K. K. Mishra, V. A. Singh).

V. G. Kulkarni Memorial Lecture, HBCSE, August 27, 2012
HBCSE organizes every August-September a lecture in memory of Shri V. G. Kulkarni, its founder director. The eleventh memorial lecture was on *"* Communicating Science: From the Cutting Edge to Your Doorstep*"*, by Dr. G. P. Phondke, Ex-Director National Institute of Science Communication.

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

K. Subramaniam, J. Ramadas and others, Teacher Professional Development in the District Institutes of Education and Taining (DIETs) of Bihar and West Bengal, Ministry of Human Resource Development, 2011-13.

S. Chunawala with C. Natarajan, Science Education for Diversity (SED) project; European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 244717. This project led by a research group from the University of Exeter, UK includes five partners, the Netherlands, Turkey, Lebanon, India and Malaysia; 2009-12.

G. Nagarjuna with M. C. Arunan, DST Project under Cognitive Science Research Initiative "Developing Simple Model Systems and Experimental Paradigms in Cognitive Sciences for Undergraduate Science Education", 2010-13.

12. Publications

In Journals

Aurigemma, J., Chandrasekharan, S., Newstetter, W., & Nersessian, N.J. (2013). Turning experiments into objects: The cognitive processes involved in the design of a lab-on-a-chip device. *Journal of Engineering Education*. ***102*****,** 117–140.

Babu S. D. (2011). Coastal accumulation in Tamil Nadu. *Economic and Political Weekly*, ***XLVI*** (48), 12-13.

Banerjee, R., & Subramaniam, K. (2013). Evolution of a teaching approach for beginning algebra. *Educational Studies in Mathematics*. ***80*****,** 351–367.

Bose, A. (2011). Knowing the world better through mathematics: Bringing together 'Critical Mathematics Education' and 'Everyday Mathematics'. *Mathematics Teacher*, ***47***(3&4), 169-185.

Chandrasekharan, S., Binsted, G., Ayres, F., Higgins, L., & Welsh, T.N. (2012). Factors that affect action possibility judgments: Recent experience with the action and the current body state. *The Quarterly Journal of Experimental Psychology,* ***65***(5), 976-993.

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Ghaisas, A.D. (2013, March 1). Newton 40 markancha tar Einstein 10 markancha. *Lokaprabha Weekly, Special issue on Science Education*, Indian Express Publications.

Haydock, K. (2011, November). Maan lo ki tum bahri ho (in Hindi), *Chakmak*, 88-90

Haydock, K. (2011-12). Inka vikas kaise hua? (in Hindi), *Chakmak*, (a) Bhag 1, pp. 36-37, November 2011; (b) Bhag 2, pp. 34-35, December 2011; (c) Bhag 3, pp. 37-39, January 2012; (d) Bhag 4, pp. 22-23, February 2012.

Haydock, K. (2011, November). Numerous **articles illustrated in *Chakmak*, pp. 4, 5, 6, 148-151, 163**

Mishra K. K. (2012, Feb- April). Human Genome Project and its significance, *Avadh-Archana*, 40-44.

Mishra K. K. (2012, November). Growing role of e-learning in 21st Century, *Avishkar*, 17-22.

Mishra K. K. (2013, January). A report on national workshop on development of educational e-materials in Hindi, *Avishkar*, 46-47.

Mishra K. K.(2013, February). Discovery of Higgs Boson, A great achievement of science, *Vigyan Ganga*, ***3***(5), 37-40.

Mishra K. K. (2013, January). Water: A Wonder Substance, *Vigyan*, A Special Issue on Water, 5-9.

Pradhan, H. C. (2013, Feb-March). Shikshanachi Navi Vat (in Marathi), Sahitya Vishwa, Special Diwali Issue 2012; *Loksatta.*

Pradhan, H.C. (2013, March 1). An extensive interview on science education, *Lokprabha* (Marathi weekly), Special National Science Day Issue, 12-19.

Vijapurkar, J. (2012, Oct-Nov). Samazlay Na...? (Translation by publisher of 'Did you understand...? *Shaikshanik Sandarbh*, *No. **77,*** 3.

Vijapurkar, J. (2012, August). Did you understand...? *J. Teacher Plus,**10***(8), 44.

Vijapurkar, J. (2012, June-July). Vignyan vargaat mulanna samjoon ghetana (Translation by publisher of 'Listening to children's voices in the science classroom' learning curve, April 2009 issue) *Shaikshanik Sandarbh **76***, 29.

NIUS Project of College Students

Panchali Nag [St. Xavier's College Kolkata]; Seismic Modelling of CoRoT star; Mentor: Anwesh Mazumdar [HBCSE]

Tushar Shrotiya [IISER Pune]; Asteroseismic analysis of solar type stars; Mentor: Anwesh Mazumdar [HBCSE]

Akshay Subramaniam [IIT Madras]; Asteroseismic analysis of solar type stars; Mentor: Anwesh Mazumdar [HBCSE]

Saumya [St. Stephens College, Delhi]; Landau Theory of Phase transitions, (report received in 2012); Mentor: Vijay Singh [HBCSE]

Shilpi Singh [Centre for Excellence in Basic Sciences (UM-DAE)]; Approximate approaches to the one dimensional finite potential well; Mentor:Vijay Singh [HBCSE] and Praveen Pathak [HBCSE]

Sakshi Jain [IIT Mumbai]; Square Quantum Conservation through non-destructive discrimination of highly entangled multipartite state; Mentor: Prof. Prasanta Panigrahi [IISER Kolkata] and Vijay Singh [HBCSE]

Rishab Ramani [IIT Madras]; Quantum Systems and Disorders; Mentor: Vijay Singh [HBCSE]

Rahul Makhijani [IIT Mumbai]; An Approach to Photoluminescence Spectra of InAs quantum dots; Mentor: Vijay Singh [HBCSE] and Praveen Pathak [HBCSE]

Viraj B. Deshpande [IIT Mumbai]; Seismic Dignostics For B CEPHET Stars; Mentor: Anwesh Mazumdar [HBCSE]

Jishnu Bhattacharya [IIT Kanpur]; Asteroseismic Analysis Of Solar Type Stars; Mentor: Anwesh Mazumdar [HBCSE]

Aashay Patil [IISER Pune]; Analysis of the Opera Results And Its Implications On Theory; Mentors: Subhendra Mohanty [Physical Research Laboratory, Ahmedabad] and D. P. Roy [HBCSE]

Suraj Chawla [IISER Pune]; Analysis of Dark Matter Detection And Opera Neutrino Experiments; Mentors: Subhendra Mohanty [Physical Research Laboratory, Ahmedabad] and D. P. Roy [HBCSE]

Chiranjit Mitra [IISER Kolkata]; Atmospheric Neutrino; Mentor: D. P. Roy [HBCSE]

Sukhdeep Singh [IIT Mumbai]; Dark Matter in Galaxy; Mentor: Jayaram Chenglure [NCRA Pune]

Manu Mannattil [IIT Kanpur]; Gas Outflows From Galaxies; Mentors: Biman Nath [Raman Research Institute, Bangalore] and Anwesh Mazumdar [HBCSE]

Anindya Sengupta [IISER Kolkata]; Dynamic Aspects of Axisymmetric Accretion; Mentor: Arnab Kumar Ray [Jaypee University of Engineering and Technology] and Anwesh Mazumdar [HBCSE]
Soumyajit Bose [IIT Kanpur]; Dynamic Aspects in Accretion Processes; Mentor: Arnab Kumar Ray [Jaypee University of Engineering and Technology] and Anwesh Mazumdar [HBCSE]

Saurav Sarma [Cotton College, Guwahati]; a) Understanding the Electronic Structure of substituted Benzene & Coronene Molecules Implications towards Molecular Electronics; b) Theoretical study of electronic transmission through conjugated molecules and molecular diode; c) Hydrogen Storage on TiMgn cluster; Mentor: Chiranjib Majumdar [BARC]

Shashank Pant [IISER Kolkata]; Investigation of liquid state properties by Molecular Dynamics simulation code (report writing in progress); Mentor: Nihar Chaudhury [BARC]

Vinay Bharadwaj [The National Degree College, Basavangudi, Bengaluru]; Study of head group areas of non-ionics and their dependence on various parameters such as ethoxylation, chain length and salt concentrations; Mentor: S S Bhagwat [ICT]

Sangamesh Sarangamath [IISER Pune]; Micellization in a mixture of solvents; Mentors: Radha Jayaram [ICT, Mumbai] and Savita Ladage [HBCSE]

Shukla Sarkar [IISER Kolkata]; Metal ion extraction using non-ionic surfactant using foam formation technique; Mentors: P.A.Hassan [BARC] and Indrani Das (Sen) [HBCSE]

Manish Kumar (IIRBS, Kottayam); Synthesis of polyaniline for optical pH sensing; Mentor: Shilpa Sawant [BARC]

Bidisha Baidya [Cotton College, Guwahati]; Metal ion extraction based on cloud point technique; Mentors: P.A. Hassan [BARC] and Indrani Das (Sen) [HBCSE]

Laxman Vamshi Kandala [Hyderabad Central University, Hyderabad]; Effect of substituent present on aniline derivative on azo synthesis and on its λmax; Mentora: Lakshmy Ravishankar [Vaze College] and Savita Ladage [HBCSE]

Tejas Joshi [KET's VG Vaze College]; Mumbai Kinetic study involved in the synthesis of dihydropyrimidones, Mentor: Lakshmy Ravishankar [Vaze College, Mumbai]

Kaushik Talukdar [Cotton College, Gauhati]; Synthesis of Dihydropyrimidinones using urea / thiourea, (ratio same, catalysts varying); Mentor: Lakshmy Ravishankar [Vaze College, Mumbai]

Pankaj Ghildiyal [St. Stephen's College, Delhi]; Synthesis and characterization of Titanium-dioxide nanostructures for application in dye-sensitized solar cells; Mentor: Deepa Khushalani [TIFR]

Apurba Nandi [Jadavpur University, Kolkata]; The role of steric factor on bimolecular nucleophilic substitution reaction (SN_2): A Theoretical approach; Mentor: Dilip Maity [BARC]

13. Lectures / Lecture Courses Given Elsewhere

S. C. Agarkar

1. Contribution of India to Mathematics, Annual Programme of the Mathematics Teachers' Association of Mumbai, Amar Hind Mandal, Dadar, Mumbai, April 7, 2012.
2. Essential Features of Scientific thinking, Inaugural Session of Summer Camp, Nerurkar High School, Dombivali, Dist. Thane, April 9, 2012.
3. Special Features of the Knowledge Society, Valedictory Function of the Science Fair, Ashoka International School, Nashik, July 18, w2012.
4. India's Contribution to the Development of Mathematics, National Mathematics Year, DAV Public School, Thane, July 27, 2012.
5. Simple Ideas that Changed the World, Inaugural Address at the National Level Science Meet, DAV public School, Airoli, Navi Mumbai, August 31, 2012.
6. Practical Use of Open Educational Resources in Classroom Interaction, Shivaji Shikshan Sanstha, Amravati, September 15, 2012.
7. Ozone Depletion: Problem and Solution, Department of Chemistry, Sant Gadge Baba Amravati University, Amravati, September 15, 2012.
8. Learning from International Science Exhibitions, Seminar for District Science Teachers' Association, New English School, Akola, September 17, 2012.
9. India’s progress in Science and Technology, Shivaji Science College, Akola, September 17, 2012.
10. Importance of Peer Interaction in School Education, PVDT College of Education, Churchgate Mumbai, September 26, 2012.
11. Influence of Science and Technology on Human Life, Valedictory Function of Khoj, a Science Festival, DAV Public School, Panvel, Navi Mumbai, October 2, 2012.
12. Role of Mathematics in the Development of Chemistry, Enrichment Camp for Talented Students, Delhi Public School, Nerul, Navi Mumbai October 19, 2012.
13. Information Revolution and its Influence on Knowledge Management, Teachers' Seminar on Use of Computer for School Education, Maharishi Parshuram College of Engineering, Velnehwar, Dist. Ratnagiri, December 1, 2012.
14. Open Educational Resources for Schools in Science and Mathematics, Teachers' Seminar on Use of Computers in School Education, Maharishi Parshuram College of Engineering, Velneshwar, Dist. Ratnagiri, December 2, 2012.
15. Right brain development through mathematics education, Graduate Function of Universal Concept in Mental Mathematics Systems, Gadkari Rangayatan, Thane, December 8, 2012.
16. Recent changes in school education, Bal Shivaji High School, Akola
17. Science education in 21st century, High School, Pusad, January 17, 2013.
18. Use of ICT in school education, Teachers Seminar at Maharishi Parshuram College of Engineering, Velneshwar, January 20, 2013.
19. Math stories: Anecdotes from the lives of mathematicians, International Children's Science and Mathematics Festival, Hotel Subway, Visakhapatnam, November 11, 2012.
20. Conducting research in learning hurdles and remedial measures in Mathematics, National Seminar on Recent Trends in Research in Mathematics, Bandodkar Science College, Thane, December 8, 2012

21. Vivekananda on science education, National Seminar on Vivekananda's Thoughts on Education in the Contexts of Human Development, Sarojini Naidu Government Girls College for post graduate studies, Shivaji Nagar, Bhopal, February 2, 2013.
22. Science Education as field of research, Special Lecture at the National Conference on Research in Education, Centre for Advanced Study in Education, M.S.University of Baroda, Vadodara, March 2013.
23. Developing digital resources to support school science and mathematics education, Episteme 5, HBCSE, Mumbai.

A. Bose

1. "Mathematics outside classrooms", talk at National Seminar on Mathematics as part of the "National Year of Mathematics", organised by the NCERT Delhi and SCERT Chhattisgarh in Raipur, Sept 2012.

S. Chunawala

1. Qualitative Research Designs, In Training and Research as part of an ICSSR Sponsored 7-Day Workshop on Research Methodology in Social Sciences, K. J. Somaiya Comprehensive College of Education, Mumbai, December 1-8, 2012
2. Science Communication in Indian Languages by the Homi Bhabha Centre for Science Education; at the National Meet of Science Communicators in Indian Languages, jointly organised by Vigyan Prasar (DST, Govt. of India) and Vigyan Parishad Prasar (Allahabad), at Allahabad, 13-15 December 2012.
3. Looking at Science through the Lens of Diversity - Views of Indian Students and Teachers, poster co-authored by Sugra Chunawala, Pooja Birwatkar, Adithi Muralidhar and Chitra Natarajan, at international conference epiSTEME 5, HBCSE, Mumbai, 7-11 January 2013.
4. Qualitative Research Documentation, as part of a certificate course in Research Methodology and Computer Application, organised by K J Somaiya College of Science and Commerce, Feb 27, 2013.

I. Das (Sen)

1. The periodic table and acid-base chemistry, AEES JSO programme, May 2012
2. Projects in science : Discussion session, TPD workshops, Bihar ,September 2013 (with S. Narvekar)
3. Laboratory Activity sessions- Experiments in Acid-base chemistry, TPD workshops, West Bengal (September 2013) and Gujarat (March 2013) (with S. Narvekar)
4. Experiments in school chemistry, one day workshop conducted for teachers from different schools in Thane District, September 2012 (with S. Narvekar)

P. De

1. Taught a course on Discrete Mathematics to second year mathematics students at the UM-DAE Centre for Excellence in Basic Sciences, Mumbai, Aug-Dec, 2012
2. 'Mathematical problem solving to school teachers' at a workshop organised by BASE at Nehru Science Centre, Mumbai., September, 2012
3. Session on Geometry for Teacher Educators from Gujarat. This was a part of the Teachers' Professional Development programme held at HBCSE, February, 2013.

N. D. Deshmukh

1. Use of OER for School Science and Mathematics Education, *Shri Shivaji Education* Society, Amravati, September 15, 2012.
2. 'Students Misconception', Department of Chemistry, SGM Amravati University, Amravati,

September 16, 2012.
3. ‘Resources for Science Exhibition’, Akola District Science Teachers seminar, New English School Akola, September 17, 2012.
4. ‘New Paradigm shift in Education’, G. D. B.Ed college, Pusad, October 05, 2012.
5. ‘Acitivity Based Science teaching’, Pusad Nagar Palika Primary Teacher Workshop, Nagar Parishad Hall, Pusad, October 05, 2012.
6. ‘Use of Open Educational Resources in Classroom Teaching’, Dr P K High School, Kundal, Palus, Sangali, on January 02, 2013.
7. 'Misconception in Biology', Rayat Vidnyan Parishad conference on Let us understand constructivism held at Y. C. College, Satara, March, 2013.

A. D. Ghaisas

1. "Astronomy: Past, Present and Future in Indian Context" Jansewa Samiti, Sathe College, 75th Anniversary program, Vile Parle, Mumbai. 14 August 2012.
2. "Mysteries of the Solar System:Smaller bodies", Jansewa Samiti, 75th Anniversary program, Sathe College, Vile Parle, Mumbai.16 September 2012.
3. "Observational Astronomy", Part of “Basic Course in Astronomy”, Centre for Extra Mural Studies, Mumbai University, Mumbai, November 2012.
4. "Observational Astronomy", Part of “Advanced Course in Astronomy”, Centre for Extra Mural Studies, Mumbai University, Mumbai, December 2012.
5. "Transit of Venus", TOV awareness program, at Trichanapalli Science Centre, organized by Vigyan Prasar, May 2012.
6. "Transit of Venus", TOV Awareness Program, at three different villages near Khodad, GMRT, Narayangaon, 4,5 and 6th June 2012.

K. Haydock

1. Problems in Teaching and Learning about Evolution, TISS, November 2012
2. Science, Ethics, and Evolution, Centre for Excellence in Basic Sciences, Februrary, 2013
3. Assessment and Teaching Ideas, DIET Nadia, December 2012
4. *Evolution* - a workshop for Class VIII students from Anushaktinagar Atomic Energy Schools, HBCSE, 7-8 June 2012
5. *Workshop on Small Science* - for 12 teachers of Classes I to V (and also for one class of students, in preparation), Sri Sri Ravishankar Vidya Mandir, Mulund, July, 2012
6. *Evolution* - was invited to conduct a 2-day workshop on evolution for teachers, Eklavya, Indore, June, 2012
7. Science, Art, and Society, *Engaging Science: Dialogues across disciplines*, IISER Mohali, 2012
8. Teaching Evolution, IISER Pune, 31 August 2012
9. Teaching and Learning about Evolution, Invited Talk for “Global Trends in Biological Sciences” at Jhunjuhnwala College, Ghatkopar, Mumbai, 15 September, 2102
10. Evolution, invited talk at Chandibai Himathmal Mansukhani College, Kharghar, November, 2012
11. Science Education and Technology: Content vs Method, invited talk at the Educational Technology Inter-Disciplinary Programme at IIT Bombay, 5 November 2012

S. Ladage

1. Learning chemistry through problem solving, National Convention of Chemistry Teachers (NCCT-2012), Guwahati University, Guwahati, November 2012.
2. What is this field of Chemistry Education?, Refresher courses for Teachers, University of Mumbai, October 2012 and , Amravati University, December 2012

3. Misconceptions in Chemistry, Rayat Science Conference on Science Education in collaboration with HBCSE, Satara , March 2013.
4. Fascinating story of the Periodic Table, Inspire programme, Satara, Jan 2013

A. Mazumdar

1. Electricity, Magnetism and Optics taught a course, at UM-DAE CBS, Mumbai during Jan-April 2013.

K. K. *Mishra*

1. Development of E-learning Portal for Science Communication, In: National Workshop on Science Communication in Hindi through Digital Media, jointly organized by Vigyan Prasar (DST) and Indira Gandhi National Open University (IGNOU), New Delhi, March 28-29, 2012.
2. Water- A Chemical Wonder, INSPIRE (DST) program for Bihar State held at Jagdam College (J. P. University) Chapra (Bihar), 16 July 2012.
3. The *Journey of Chemical Science, INSPIRE (DST) program for Bihar State held at Jagdam College (J. P. University) Chapra (Bihar), 17 July 2012.*
4. Presentation on HBCSE's innovative e-learning portal at 3*rd National Workshop on Development of Educational E-materials in Hindi,* November 2 to 4, 2012.
5. *Role of Peoples Council of Education in Science Communication a talk given at the National Meet of Science Communicators in Indian Languages. The Program was organized by Vigyan Prasar (DST) under the auspices of Vigyan Parishad Prayag during December13-15, 2012.*

G. Nagarjuna

1. "CUBE: Collaboration, Research, Education and Networking" Keynote Address, Biology Workshop, August 8, 2012, CHM College.
2. "Computer Graphics for Simulating Thought and Data Visualization" Invited Talk, October 15, 2012, Usha Mittal Institute of Technology, SNDT university.
3. "Open Linked Data and Open Access Initiative: Its implications for empowering society", a series of two talks, PG Diploma in Digital Library & Information Management (PGDLIM), 29th October 2012, Tata Institute of Social Sciences, Mumbai.
4. "Networking and Organizing Open Educational Resources: An Introduction to metaStudio", Resource person for Training Program on E-Learning for Teacher Educators of DIET, CTE, IASE, and SCERT, 24th and 25th January 2013, Regional Institute of Education, NCERT, Mysore.

S. Naik

1. (with Candal, M., Oslund, J. & Moss, P.) Analyzing video records of mathematics teaching practice to support teachers' learning. Presented in the annual meeting of AERA 2013 at San Francisco, USA. (2013)

S. Narvekar

1. Chemical Kinetics and equilibrium, AEES JSO programme, May 2012
2. International Chemistry Olympiad: An Introduction, National Convention of Chemistry Teachers (NCCT-2012), Guwahati University, Guwahati, November 2012.

C. Natarajan

1. Diversity in the living world and education, Post Graduate Trained Teachers' Orientation Programme organised by Atomic Energy Education Society, Atomic Energy Central School, Tarapur, May 7, 2012
2. Thinking about Energy and Systems, at National Level Seminar on Environmental Re-engineering Series -3, Sustainable Energy for All organised by Pillay College of Education and Research, at Pillay College of Education and Research, New Panvel, October 19, 2012
3. Moderator and Chair of Panel Discussion on Planning learning through projects – What is learned & how can it be assessed, at Teachers' Conference on Project based Science Learning organised as part of Science Utsav 2013 by Navi Mumbai Science Foundation (NMSF), at the Gujarat Samaj Bhavan, Vashi, Navi Mumbai, 9 February 2013.
4. The 5-E model for a constructivist approach to teaching-learning in science, in the Science Conference for Teachers on Let's understand and use constructivist approach, jointly organised by Rayat Shikshan Sanstha and HBCSE, at Yashwantrao Chavan Institute of Science, Satara, March 4, 2013.
5. Systems Thinking, INSPIRE Science Camp 2012, Sir P. T. Sarvajanik College of science, Athwalines, Surat, November 30, 2013

P. Pathak

1. Statistical Mechanics course in Centre for Excellence in Basic Sciences, Mumbai, Jan- April 2012 (Tutor).
2. Statistical Mechanics course in Centre for Excellence in Basic Sciences, Mumbai, Jan- April 2013 (Co-Instructor).
3. 3 lectures on science experiments in Samayak Welfare Society, Hatta (Damoh), M.P. Dec 02/03, 2012.
4. Lecture on career opportunities in science, Jawahar Navodaya Vidhyala, Hatta (Damoh) Dec. 03, 2012.

S. Pathare

1. Doing Experiments in Physics, Motivational Bridging Course at Nanded, June 2012.
2. Doing Experiments in Physics, Acharya Marathe College, Mumbai, 22nd January 2012.
3. Doing Experiments in Physics, INSPIRE Program at National College, Bangalore, 25 – 28 October 2012.
4. IDoing Experiments in Physics, NPSIRE Program at V.V.S.F.G. College for Women, 24th December 2012.
5. Doing Experiments in Physics, BJB College, Bhubaneswar, January 2013

H. C. Pradhan

1. Research Methodology for Education – Seminar for New Ph.D. Students in Education, Navrachana University, Vadodara, September 7, 2012.
2. Qualitative and Mixed Methods in Educational Research – Course on Research Methodology for Teacher Educators, K J Somaiya College of Education, Mumbai, December 8, 2012.
3. Physics Education in India and Abroad – An Overview, Dr S P Pandya Memorial Lecture, Indian Physics Association, Sarvajanik College, Surat (January 27, 2012)
4. History of Science and its Significance in Science Teaching – School of Education, Navrachana University (March 23, 2012)
5. Energy – Explore, Harness and Conserve – Inaugural Address, Workshop on Development of the Manual for NCSC 2012, Central Univrsity, Tezpur (May 2,2012)

J. Rahaman

1. An Analysis of Students' Representation of Area and Perimeter. 35th *Conference of the Mathematics Education Research Group of Australasia*, Singapore: MERGA.
2. An Analysis of Students' Strategies for Area Measurement and its Curricular Implications, Poster presented in *35th Conference of the Mathematics Education Research Group of Australasia*, Singapore: MERGA.
3. An Analysis of Students' Representation of Area and Perimeter. Western Regional Conference of the *National Initiative on Mathematics Education (NIME – 2011-12),* IISER, Pune.

J. Ramadas

1. "Project-based learning and environmental studies in NCF-2005", Inaugural talk at Science Utsav, Navi Mumbai Science Foundation, Vashi, Navi Mumbai, 9 February, 2013.
2. Constructivism and the National Curriculum Framework (in Marathi), Invited talk jointly organised by Rayat Shikshan Sanstha and HBCSE, at Yashwantrao Chavan Institute of Science, Satara, March 2, 2013.
3. Constructivism and the National Curriculum Framework (in Hindi), Workshop for teacher educators from DIETs and PTECs at SCERT, Patna, March 4, 2013.

A. Raveendran

1. Towards *an understanding of socio-scientific issues as means to achieve critical scientific literacy, a***t international conference** *epiSTEME 5, at HBCSE, Mumbai, 9 January 2013.*

D. P. Roy

1. "Why LHC?", Colloquium lectures at Delhi University, 6 July 2012, SOA University, Bhubaneshwar, 3 Dec 2012 and SINP, Kolkata, 13 March 2013.
2. "Basic Constituents of Matter and their Interactions" lecture given at the DST INSPIRE camp at KIIT, Bhubaneshwar, 3-7 Oct 2012.
3. "SUSY Dark Matter", Department of Physical Science Symposium, IISER, Kolkata, 16 March 2013.

A. Sharma

1. Students *with disabilities and their aspirations in sciences, a***t international conference** *epiSTEME 5, at HBCSE, Mumbai, 9 January 2013.*
2. Marching towards inclusive education: Are we prepared for inclusive science education? a**t international conference** *epiSTEME 5, at HBCSE, Mumbai, 9 January 2013.*

S. Shome

1. Teachers' views about school projects: Relation between students' learning and assessment of learning. In Teachers' Conference on Project Based Learning organised by Navi Mumbai Science Foundation and Shree Gujarati Samaj held on 9 February, 2013.
2. Teacher-educators doing science experiments: constructivism in action. In Regional Seminar on Philosophy of Education organised by Azim Premji University at IIHMR, Raipur on 31 Oct 2012. (Presented via skype)
3. Teacher professional development model for project based learning. Slide presented at the Fourth International Policy Dialogue Forum on Teacher Challenges for Education for All in India held in New Delhi on May 29-30, 2012.

V. Singh

1. Centre for Excellence in Basic Sciences, University of Mumbai: *Statistical Mechanics*, Undergraduate Course, Mumbai University, Semester, January to April, 2013.
2. IIT Bombay, *Advanced Solid State Physics,* January – April 2012 *Semiconductor Physics,*

July – Nov 2012
3. Scaling Laws, at 3rd National Workshop on *Development of Educational E-materials in Hindi,* November 2 to 4, 2012.

V. C. Sonawane
1. School Science Experimentation at Association of Science Education (ASE) Conference 2013 "Constructing the future of Science Education", University of Reading, London (U.K), January 3, 2013

A. Sule
1. Astronomy and Astrophysics-1 (Stellar Astrophysics) with Prof. S. M. Chitre, UM- DAE CBS, Course P803 (Semester 8), weekly contact hours-4.5, January- April 2012
2. Communicating Astronomy in Vernacular language",Talk in Special Session 14 (Communicating Astronomy with Public),International Astronomical Union General Assembly, 26 to 31 August 2012, Beijing, China
3. "South Asian Regional Astronomy Network" Poster presentation in Special Session 11 (IAU Office for Astronomy Developement) International Astronomical Union General Assembly, 26 to 31 August 2012, Beijing, China.
4. "Distance measurement in the universe" Krittika Astronomy Club, IIT(Bombay), Mumbai 8th September 2012.
5. Classical Mechanics with Prof. Arvind Kumar and Prof. G. Shaw UM – DAE CBS, Course P301 (Semester 3), weekly contact hours: 1.5, October 2012.
6. "Astronomical Coordinate System" – Pre-departure training camp for International Earth Science Olympiad TIFR, Mumbai, October 2012.
7. "Distance measurement in the universe" 8th Asia Pacific Astronomy Olympiad Cox's Bazaar Bangladesh 30th November 2012.
8. "Using Geogebra to teach algebra", Teacher Professional Developement workshop for Gujrat DIET faculty,1 Lecture and 1 lab session at HBCSE, Mumbai, February 2013.

S. Takker
1. Teacher Anticipation and Reflection as tools for Teacher Learning, Research Paper presented at Mathematics Education Research Group of Australasia: MERGA, Singapore, July 2012
2. Using Students' Algebraic Thinking to Support Teacher Learning, Short Oral Communication at Mathematics Education Research Group of Australasia: MERGA, Singapore, July 2012
3. *Towards conceptualising a Teaching Sequence to promote Early Algebraic Thinking: Generalisation and Proving, National Conference on Mathematics, NCERT, Delhi, December 2012*

J. Vijapurkar
1. Teaching Science as inquiry, a series of workshops and presentations at Muktangan Exploratory Science Centre, Pune, April 2-4 2012 (with Aisha Kawalkar and Pooja Konde)

14. Lectures by Visitors

Anirudha Dhanawade *(The University of Manchester, Art History and Visual Studies, Faculty Member)* Particle Physics in Potsdamer Platz: Scientific Revolution and the European Avant-Garde, 1900-1930, April 2, 2012

Marsha Ivins *(An American Astronaut - a veteran of five space flights, through American Center of the U.S Consulate, Mumbai)* Interactions on Space travel with students and faculty, April 24, 2012

Shamin Padalkar *(Postdoctoral Fellow at the Department of Psychological and Brain Sciences, University of California, Santa Barbara CA, USA)* Improving Representational Competence in Chemistry with Model-Based Feedback, June 21, 2012

Jim Iley *(Director, Science and Education at the Royal Society of Chemistry since February 2010)* Learn Chemistry'? The Royal Society of Chemistry supporting Education, June 28, 2012

Billie Eilam *(University of Haifa, Israel)* Inquiry, self-regulated learning, and complex ecosystems:A research-based integrated pedagogy, July 19, 2012

Pratik Goel *(PhD student in Chemistry at the University of Waterloo)* Chemistry with Computers: From Research to Teaching, August 13, 2012

Senthil Babu *(Short term visitor HBCSE)* The Rule of Memory: Learning Mathematics in Nineteenth Century South India, August 22 , 2013.

Walter Bender *(Founder of Sugar Labs, and an architect of the Sugar)* Sugar platform and its adoption, August 28, 2012

Aneshkumar Maharaj *(University of KwaZulu-Natal, S. Africa)* Maths e-learning and Assessment: A South African Context, October 4, 2012

Viraj Kumar *(NIIT University)* Enhancing Traditional Classes with Online Courseware, October 19, 2012

Tugrul Hakioglu *(Prof., Director, Institute of Theoretical and Applied Physics (ITAP), Turkey)* Science Education in Turkey and the role of ITAP, November 8, 2012

Sahana Murthy *(Assistant Professor at the Educational Technology Inter-Disciplinary Programme at IIT Bombay)*. Interactive visualizations to develop scientific abilities, November 22, 2012

Dean Zollman *(Head of the Department of Physics and William and Joan Porter Professor at Kansas State University)* A First Attempt at Non-Intrusive Medical Imaging: Alexander Graham Bell and the Assassination of US President Garfield, December 10, 2012

Dilip Kumar Sinha *(Academician in the field of mathematics)* Developing Educational Sciences: An Exploratory Enterprise, December 13, 2012

Shri S B Mhetre *(Teacher Fellow at HBCSE)* About 25 interesting experiments useful for the teaching of science at primary and upper primary levels of schooling (Demonstrations), January 3, 2013

Renato Marcone *(State University of Sao Paulo, Brazil)* Mathematics Education, Post-Colonial Theory and Inclusion: the invention of "disability" by the normal, January 31, 2013

Veena Gowda *(Practising women's rights lawyer in the High Court of Bombay Family Court and other trial courts)* Dealing with sexual harassment at the workplace: What the Law requires, May

10, 2013

Olympiads Valedictory and Infosys Lectures

P. Chobe *(Chemistry Olympiad Valedictory function)* Innovations in Chemical Industry, May 3, 2012
S. K. Ghosh *(Astronomy Olympiad Valedictory function)* Excitements of Career in Astronomy, May 12, 2012
J. K. Bhattacharjee *(Physics Olympiad Valedictory function)* Extremum Principles, May 23, 2012
V. Nanjundiah *(Biology Olympiad Valedictory function)* Symmetry and Beauty in the Living World, June 13, 2013
Bhanu. P. Das *(Infosys Awards function)* Atomic clocks and the 2012 Physics Nobel Prize, December 22, 2012
Charusita. Chakravarty *(Infosys Awards function)* Water: How well do we know H_2O?, December 22, 2013

NIUS Seminars

Ponnadurai Ramasami *(Chair, Computational Chemistry, University of Mauritius)* Computational Chemistry at the University of Mauritius: Past, Present and Future, March 12, 2013
S. M. Chitre *(CBS, Mumbai)*Frontiers of Astronomy and Astrophysics, March 13, 2013
Jayanta K. Bhattacharjee *(Director, HRI, Allahabad)* Oscillators: Old and New, March 19, 2013

Play
Sushma Deshpande *(on occasion of International Women's Day)* "Vhay Mee Savitribai" (Marathi), March 19, 2013

15. Graduate Courses

Introduction to Qualitative Research *(Sugra Chunawala)*
Quantitative Methods in Education Research *(K Subramaniam)*
Science teaching – a practical course *(Karen Haydock)*
History of Systematic Ideas *(G. Nagarjuna)*
Introduction to Philosophy of Science *(Arvind Kumar)*
Introduction to Cognitive Science *(Sanjay Chandrasekharan)*
Readings in Science, Technology & Mathematics Education (STME) Research *(G. Nagarjuna)*
Practical Science communication *(Aniket Sule)*
A reading course on Sociology of Science *(G. Nagarjuna)*

16. Ph.D. Theses (Degree awarded by TIFR: Deemed University)

Farhat Ara: *Investigating Students', Teachers' and Designers' Ideas about Design and Developing Design Activities for Indian Middle School Students (Science Education; Supervisor: Sugra Chunawala*)

Degree from other Institutions

Narendra D. Deshmukh: A *study of students' misconceptions in biology at secondary school level and development of remedial research based material. (Supervisor: Veena M. Deshmukh*) University of Mumbai

17. Popular Science Lectures

S. C. Agarkar

1. Science in Indian Toys, Workshop on Scientific Toys for School Students, Yadnyavalkya, Kalyan, Dist. Thane, April 21, 2012.
2. Laymen's Contribution to Science and Technology, Inaugural Address at the Science Festival, Ashoka International School, Nashik, July 17, 2012.
3. Scientists who overcome their obstacles, A session for students at Bal Shivaji Vidyalaya, Akola, January 16, 2)13.
4. Importance of knowledge, Valedictory address at the state level science quiz, Bal Shivaji Vidyalaya, Akola, January 16, 2013.
5. Seven great scientists, Dnyanoday English Medium School, Pusad, January 17, 2013
6. Technocrats that changed the world scenario, Session for engineering students of Maharishi Parshuram College of Engineering, Velneshwar, January 20, 2013.
7. From Newton to Hawkin, a legacy of scientific research, Sharda Vihar, Bhopal, February 3, 2013.
8. Madame Curie, an Iron lady in scientific research, Sarojini Naidu Girls College, Shivaji Nagar, Bhopal, February 3, 2013.
9. Ramanujan, the Genius, Joshi Bedekar Arts and Commerce College, Thane, February, 8, 2013.

N. D. Deshmukh

1. 'INSPIRE AWARD', Dahisar High School, Dahisar, on August 4, 2012.
2. 'Teaching and Learning Science', Satara District Science Teachers Association Annual meeting on August 10, 2012.
3. 'Eco club and Environment Conservation', Rayat Dhebewadi High School, Dhebewadi, Satara, on August 11, 2012.
4. 'Science, Society and Science Exhibition', Rahuri Taluka Science Exhibition, Shirdi, on August 12, 2012.
5. 'Role of Science Exhibition', DAV Public School, Airoli, on August 31, 2012.
6. 'Balshree Award', Balbhavn, Charni Road, on September 26, 2012.
7. 'Olympiad Examinations and its Preparation', Dhanajibai High School, Pusad, October 05, 2012.
8. 'How to prepare for Olympiad Examination', Palus Taluka Vidnyan Pradarshan at Dr P K High School, Kundal, Palus, Sangali, on January 02, 2013.

A. Mazumdar

1. "Stars and planets around them", Indian Institute of Geomagnetism, Panvel, 28 February, 2013
2. Night Sky Observation session and astronomy orientation session held in Navy Children's School, Navy Nagar, Mumbai on 22 February, 2013.

K. K. Mishra

1. Human Genome Project and its Significance, Avadh-Archana, p.40-44, February-April, 2012
2. Growing Role of e-learning in 21st Century, Avishkar, p.17-22, November 2012.
3. A Report on National Workshop on Development of Educational E-materials in Hindi, Avishkar, p.46-47, January 2013.

4. Discovery of Higgs Boson, A Great Achievement of Science, Vigyan Ganga, p.37-40, Vol.3, No.5, February 2013.
5. Water: A Wonder Substance, Vigyan, A Special Issue on Water, p.5-9, January 2013.

G. Nagarjuna

1. "How to build everyThing from anyThing?: An Introduction to mathematical thinking" Popular talk, 39th Javaharlal Nehru National Science, Mathematics and Environment Education, (JNNSMEE), organized by NCERT, 3rd December 2012, Silvassa, Dadra and Nagar Haveli.

H. C. Pradhan

1. Seeking New Pathways in Teaching Mathematics and Science – Dnyan-Vidnyan Utsav, Jidnyasa Trust, Thane (January 3, 2012)
2. Science and Us - Inaugural Address, Western India Science Festival, Nehru Science Centre, Worli, Mumbai (January 19,2012)
3. Can We Not Teach Science Effectively? – Key-note Address, Workshop for Science Teachers, Navi Mumbai Science Foundation, Vashi, Navi Mumbai (February 5,2012)
4. Preparing projects for National Children's Science Congress(NCSC) – Regional Workshop of Teachers for NCSC 2012, Jidnyasa Trust, Thane (July 29, 2012)
5. History of Numbers – Mathematics Teachers' Seminar, Marathi Vidnyan Parishad, Chunabhatti, Mumbai (August 3, 2012)
6. New Ways of Teaching School Mathematics – Teachers' Workshop on New Methods in Teaching, Ekvira Vidyalay, Kandivali, Mumbai (August 25, 2012)
7. The Symbiotic Relationship between Science and Mathematics – Talent Nurture Program for Higher Secondary School Students, Delhi Public School, Nerul, Navi Mumbai (November 5,2012)
8. Preparing for Science and Mathematics Teaching in the New Age – South Kokan and Goa Teachers' Seminar, Lokmanya Tilak High School, Kavle, Goa (November 25, 2012)
9. Face to Face with Scientists – National Children's Science Congress 2012, Benares Hindu University, Varanasi (December 27 and 28,2012)
10. Excitement of Learning Science and Mathematics – Rashtra Katha Shibir (Camp on the Story of the Nation, attended by over ten thousand students from all over India), Pransla, Rajkot (January 5,2013)

V. Singh

1. 20 lectures on the Olympiad Program in different parts of the Country.
2. Chief Guest and Keynote Speaker during the following INSPIRE Camp Talks:
3. June 16, 2012: "*Scaling Laws in Nature*" in JP University, December 24, 2012: "*Shapes and Sizes in Nature*" in VVSFG College for Women, Bangalore, January 14, 2013: "*Extrasolar Planets*" in Patna Women's College
4. Seminar on CBSE Reforms: Chief Guest and Speaker "Careers in Science", Central Public School, Chhapra, November 4, 2012.
5. The talks "Ramanujam and Numbers" and "Scaling Laws in Nature" [Aakriytiya Avam Aakar: Knva Inke Anek Prakar] were presented in Hindi at: The Workshop on "Emerging Trends in Mathematics", November 5-6, 2012.
6. "Why Should You Choose a Career in Science?", Canossa Convent, Mumbai, Feb 13, 2013.

V. C. Sonawane

1. " Hands On Science" At 'Omkar school' Aurangabad, Date: 26th February 2013
2. " Experiments in Electricity and Magnetism" at Neora English School forMarathi Vidnyan

Parishad, students and science teachers, Gadhingalaj, District: Kolahapur: Date: 22nd December 2012

A. Sule

1. "Positional Astronomy" (English) Transit of Venus workshop organised by Vigyan Prasar at M. P. Birla Institute of Fundamental Research, Bangalore 22nd May 2012.
2. "The Higg's Particle" (English) SIES College, Mumbai, 12th July 2012.
3. "Careers in Science" (English) Three lectures at different locations organised by Marathi Vigyan Parishad, Thane unit, 14th and 15th September 2012.
4. "Introduction to Astrophysics" (English) D. Y. Patil International School, Worli, Mumbai, 25th September 2012.
5. Meet the scientist: Questions and Answer programme (English) Marathi Vigyan Parishad, Mumbai, 11th November 2012.
6. "Telescopes of the Future" (English) 8th Asia – Pacific Astronomy Olympiad, Cox's Bazaar, Bangladesh, 2nd December 2012.
7. "Career in Science" (English) , SMG English School, Diva, 12th July 2012.
8. "Astronomy Today" (English)INSPIRE camp, Rajur, dist. Ahmadnagar, Maharashtra, 6th Jaunuary 2013.
9. "Telescopes of the future" (English) Rotary Club Chembur West 29th January 2013.

A. D. Ghaisas

1. Overnight star observation Camp for Father Agnel Multipurpose School: *with P. Adekar, S. Chopde,* Shelu: for students of 7th and 8th class: 120 student participants, February 2013.
2. Inspire Camp at Latur: Three days; 439 participants, Demonstrations of Science Experiments, Mathematics Laboratory, slide lecture on Introduction to Astronomy Olympiad and Astronomy Observation at night. 19,20,21 January 2013.
3. Inspire Camp at Khalsa College, Mumbai: 128 participants, One day; Demonstrations of Science Experiments, Slide lecture on Introduction to Astronomy Olympiad. 22nd January 2013.
4. Inspire Camp at Gogate Joglekar College, Ratnagiri with *S. Chopde,* Three days; 200 student participants, Demonstrations of Science Experiments, Mathematics Laboratory activity, slide lectures on Introduction to Astronomy Olympiad, Physics Olympiad, Common errors in Mathematical clculations at SSC level and how to overcome them and Overnight sky observation, Observations through Telescopes. 25,26,27 October 2012.
5. Inspire Camp at Shri Pancham Khemraj Mahavidyalay, Savantwadi: Three days; 200 student participants, Demonstrations of Science Experiments, Mathematics Laboratory activity, slide lecture on Introduction to Astronomy Olympiad and Sky Observation at night with Telescopes. 16,17,18 January 2013.
6. Science and Mathematics Education motivation Camp at Dalawai High school *with P.K.Nawale, P. Adekar, S. Chopde, S. B. Mhetre* Chiplun, Organized by Manav Navanirman Sankalp, Three days; 400 students of class 8th, 9th and 10th Class participated in the camp, October 2012.
7. "Carawan", a hands on Science Camp, for children from slum areas in Mumbai, organized by Navnirmiti, one day each at various schools at Aarey Colony, Boriwali, Bhandup, Kanjur Marg, Powai and Vikroli. 1st and 2nd week of May 2012.
8. Science Motivation camp for Young Scientists for the Gold and Silver Medal winners, Two days, 80 students participated in the camp, HBCSE, Mumbai, April 2012.
9. Science day celebrations, *with P. Adekar, S. Chopde, P. Gedam,* GMRT, Khodad, Narayangaon, 3 days, more than 8,000 visitors each day, Exhibition of Science experiments, Mathematics Laboratory activities and night sky observation with telescopes, 27th, 28th

February and 1st March 2013.

10. Astronomy Awareness program for the event of Transit of Venus, Trichanapalli, organised by Vigyan Prasar, at Trichanapalli Science Center, 3 days, 180 Resource Persons (High school Teachers and Amateur Astronomers) were trained for daytime astronomy and how to conduct sessions of observing the Transit of Venus event, 25,26,27 May 2012.
11. Observational and Astro-photography Camp for the event of Transit of Venus, GMRT, Khodad, Narayangaon. more than 100 students and their parents from nearby villages participated in the observations of TOV under my guidance, Orientation on 5th June and actual observations on 6th June, 2012.
12. Conducting and Judging "Inter IIT Messier Marathon", *with P. Adekar, S. Chopde, S. Shirodkar,* at GMRT, Teams from IITs from various parts of the country participated in the competition, December 2012.
13. Astronomy and Nature Camp for St. Xavier's boys school, at Mahabaleshwar, 3 days; 120 students participated in the camp, Introduction to Observational Astronomy, Astronomy Quiz, Powers of Ten, Nature walk, Mathematics activities were conducted, November 2012.
14. Summer camp at Bombay Mothers and Children care Center, *with P. Adekar***,** at Rajgurunagar, for the students from nearby rural schools. 270 students of ages 5 to 15 participated in the camp. Demonstrations of Experiments, Hands-on-science activities, Mathematics activities and Night Sky observations were conducted. April 2012.
15. "Stimulus" Camp with *P. Gedam,* at Abhinav Vidyalaya, Dombivli, 2 days, orientation of about 50 student volunteers for the exhibition on one day and on the next day exhibition of experiments was held. around 2000 students from schools from Dombivali and Kalyan visited the exhibition. December 2012.
16. "Newton 40 markancha tar Einstein 10 markancha", Lokaprabha Weekly, Special issue on Science Education, Indian Express Publications, March 1, 2013.

18. Radio and TV programmes

A. D. Ghaisas

1. Interviewed on AIR Mumbai, *Asmita Vahini*, on "Discovery of the Higgs' particle" on July 6, 2012.

K. K. Mishra

1. *Bharatiya Vaigyaniko a Amit Sansmaran*, AIR, Mumbai, June 13, 2012
2. *Mangal Grah par Jeevan ki Sambhavanayen*, AIR, Mumbai, September 21, 2012
3. *Saur Ourja Chalit Upkaran*, AIR, Mumbai, January 7, 2013.

H. C. Pradhan

1. Discussion on the Book of Knowledge 'Srishti Vidnyan Gatha' – under the feature Amritvel, Sahyadri Channel, Door Darshan, Mumbai (in Marathi, with Shreeram Geet, March 30, 2012)

A. Sule

1. Interviewed on DD Sahyadri about "discovery of the Higgs' particle" on July 5, 2012.
2. Interviewed on IBN Lokmat about "100th successful launch by ISRO" on September 9, 2012.
3. Interviewed on DD Sahyadri about "100th successful launch by ISRO" on September 10, 2012.

19. Lectures by HBCSE/ TIFR members

K. Haydock *(HBCSE)* Eugenics and Caste: some quotes from The Annihilation of Caste (1936) by BR Ambedkar, April 2012

J.N.Kayarkar *(Registrar, TIFR)*Emotional Intelligence and Performance, July 24, 2012

Mashood K K, Rajesh B Khaparde & Gurinder Singh *(HBCSE)* presentation on the World Conference on Physics Education – 2012, September 13, 2012

Anwesh Mazumdar *(HBCSE)* CBSE Proficiency Test and HBCSE's role in it, March 21

K. K. Mishra *(HBCSE) Role of Communication Media in Creating Scientific Temper: A Case Study,* June 14, 2012.

G. Nagarjuna *(HBCSE)* Gnowledge lab and metaStudio Initiatives, February 21

Jaikumar Radhakrishnan (*School of Technology and Computer Science, TIFR)* Endre Szemeredi's Random Structures and Algorithms, May 21

Aniket Sule *(HBCSE)* Errors of Astronomical Proportions, October 18, 2012

Vijay Singh *(HBCSE)* "Scaling Laws in Nature" [Aakriytiya Evam Aakar: Kyon Inke Anek Prakar] in Hindi at: World Hindi Divas, TIFR, January 10, 2013