

HOMI BHABHA CENTRE FOR SCIENCE EDUCATION (TIFR)

School Science Research & Development (SSRD)

HBCSE's School Science Research & Development program is an integration of the current activities of Integrated Laboratory, Teacher Education and Small Science Curriculum. The program involves the following areas that cater towards *research*, *material development* and *outreach* for students, teachers and teacher educators.

Types of Programs

- Developing innovative experiments
- Developing, designing experimental displays, handouts

Outreach packages

- Conducting regular workshops and training programs for students and teachers in Centre and in-field.
- Reviving of orientation programs for students, teachers within a network of schools (AEES, KV, BVB, etc.)

Material Development

- Developing modules on experiments for school
- Developing teaching learning modules for teachers at school
- Writing books as supplementary material for school
- Developing web based material using the on-line platform
- Developing Kumar Vishwakosh, children's encyclopedia

Research

- Students' conceptions
- Teacher's views

Target groups:

- School Students (Class 5 – 10)
- School Teachers (From KG to PG)
- Student Teachers (D.Ed., B.Ed.)
- Teacher Educators (All Level)

Group of Personnel for School Science Research & Development

Academic + other academic volunteers

- Jayashree Ramadas, Chitra Natarajan, Sugra Chunawala

Scientific and Technical + other scientific and technical volunteers

- Narendra Deshmukh, Vijay Lale, Vinod Sonawane, Meena Kharatmal, Karun Hambir

Project Staff (4)

Annual Teachers Programmes

In the recent past, HBCSE has conducted workshops in teacher education, as and when there have been requests from schools, organisations. These workshops have been for the KV school system, DIET faculty of Bihar, West Bengal, Gujarat, Uttarakhand and so on. HBCSE proposes to have regular workshops for teacher professional development (TPD), capacity building of school teachers/student teachers and/or teacher educators. These workshops would cater to the in-service or pre-service teacher training. It is proposed that these workshops be conducted in HBCSE on a regular basis throughout the year.

The TPD workshops can be of various types that can be announced at different times of the year. The primary responsibility of these workshops would be with the School Science R&D group, however other HBCSE members can be involved in these workshops as required. The table below can be modified as needed it is only indicative.

	Category of events	Period, No. of events, days	Participants	Resource Persons
1.	One day <i>exposure</i> workshops	Jan –to- Dec (10 to 12 workshops) (On Wednesdays)	School teachers/ student-teachers	SSRD
2.	Three days workshops	May -to- June; Sept to Oct (1 or 2 workshop) (Wed to Fri)	Student-teachers	SSRD
3	Five days <i>capacity building / TPD</i> workshops	Jan, April, July, Oct (3 -to- 4 workshops) (Mon to Fri)	School teachers	SSRD
4	Two weeks intensive course <i>refresher workshop</i>	Aug (course)	Teacher Educators	SSRD & HBCSE members
	<i>Field Visits</i>			SSRD & HBCSE members

Themes for Teachers Workshop:

A) Pedagogy	B) Content
1) Inquiry Based Science Learning: <ol style="list-style-type: none"> Science through investigation, Prediction, Observation, Explanation (POE) Engage, Engage, Explore, Explain, Elaborate, & Evaluate (5E model), 2) Teaching Learning Material (TLM): <ol style="list-style-type: none"> Using low cost material, ICT, Audio Visual Learning, 3) Designing activities and experiments 4) Demonstration of experiments 5) Research Readings 6) Nature of Science: History of science 7) Socio-cultural aspects of education: Gender & Science, 8) Textbook Analysis 9) NationalCurriculum Framework, 10)Constructivist pedagogy; Learning & Constructivism, 11)Classroom observation, analysis, lesson study	1) Water 2) Language and Science Learning 3) Habitat 4) Life and its Processes 5) Classification 6) Health and Hygiene 7) Matter 8) Heat, light and Sound 9) Electricity and Magnetism 10) Motion 11) Energy 11) Acid and Base 12) Chemical Equations 13) Our Planet 14) Agriculture 15) Elements, Metal and non Metal

C) Other Activities:

- Laboratories (Integrated, Mathematics and Olympiads), Library, Exhibitions (History of Science and Gender visits)
- Educational Theory, Practices , Issues, Policies
- Assessment: CCE, Tools, Films, discussions
- Visits to field, Science centers,
- Analysis of teachers expectations and their experiences of the workshops
- Designing and development of Concept Based Objective Tests
- Networking of various Educational Systems and Teachers Associations

1. One day exposure workshops

The one day workshop can be combined with the Wednesday visits to the Centre, particularly of teachers. The workshop would provide a glimpse of the Centre's activities, labs, library, exhibitions along with a few lecture sessions explaining HBCSE's TPD program and what to expect in follow-up programs.

2. Three days workshops

This workshop would cater to student-teachers/teachers. The main emphasis would be on doing hands-on science experiments and science through investigation activities. Since the student-teachers/teachers do not get enough exposure to science experiments, HBCSE would provide them with a good opportunity to gain experience in this regard. These workshops can be scheduled before the beginning of the school term so that it would enable the participants to prepare for their immediate teaching jobs. There may also be sessions on preparing activity based modules where teachers are involved in designing and writing the modules and worksheets/handouts.

List of themes:[Any one]

A) Pedagogy	B) Content: [Any one]
1) Inquiry Based Learning: - POE, 5-E model, 2) TLM- Using low cost material, ICT, Audio Visual Learning, 3) Demonstration of experiments 4) Nature of Science- History of science 5) Socio-cultural aspects of education-"Gender & Science," 6) Textbook Analysis 7) NCF and constructivist approach 8) Classroom observation, analysis (lesson study),	1) Water 2) Language and science learning 3) Habitat 4) Life and its Processes 5) Classification 6) Health and Hygiene 7) Matter 8) Heat, light and Sound 9) Electricity and Magnetism 10) Motion 11) Energy 12) Elements, Metal and non Metal

3. Five day teacher professional development/capacity building workshops

These five days TPD workshops (3 – 4 in a year) can be framed on themes viz., learning & constructivism, assessment, textbook analysis, research readings, learning by doing science, inquiry based science, innovative teaching, socio-cultural aspects of education, etc. There may be a possibility of follow-up workshops for the same group in this type of workshop.

Themes

A) Pedagogy [Select any one from group 1 and 2 with other activities]	B) Content [Any two]
Group 1 1) Inquiry Based Learning:-Science through investigation, POE, 5-E model, 2) Designing activities and experiments 3) NCF, Learning and Constructivism, Constructivist pedagogy	1) Water 2) Language and science learning 3) Habitat 4) Life and its Processes 5) Classification

4) Demonstration of experiments 5) Educational Theory, Practices, Issues, Policies 6) Research Readings or Lesson Study	6) Health and Hygiene 7) Matter 8) Heat, light and Sound 9) Electricity and Magnetism 10) Motion 11) Energy 12) Elements, Metal and non Metal
Group 2 1) Research Readings 2) Textbook Analysis 3) Classroom observation, analysis	

Other Activities:

Laboratory, library, exhibition visits

Assessment: Films, discussions

Analysis of teachers expectations and their experiences of the workshops

4. Two week intensive course in teacher education

This course would focus on teachers or teacher educators who are required to take up professional development as part of their in-service teacher training. HBCSE can follow the MHRD-TPD model of the two week intensive course. This workshop can be conducted only when there is request from government organisations. This can be also seen as a certificate course or refresher course involving collaboration with other organisations, if required.

Themes [Any three/four]

A) Pedagogy	B) Content [Any four]
1) Inquiry Based Science Learning: Science through investigation, POE, Five E model, 2) Teaching Learning Material (TLM): Using low cost material, ICT, Audio Visual Learning, 3) Designing activities and experiments 4) Demonstration of experiments 5) Research Readings 6) Nature of Science: History of science 7) Socio-cultural aspects of education: Gender and Science 8) Textbook Analysis 9) National Curriculum Framework, 10) Constructivist pedagogy- Learning and Constructivism, 11) Classroom observation, analysis (Lesson Study)	1) Water 2) Language & Science Learning 3) Habitat 4) Life and its Processes 5) Classification 6) Health and Hygiene 7) Matter 8) Heat, light and Sound 9) Electricity and Magnetism 10) Motion 11) Energy 11) Acid and Base 12) Chemical Equations 13) Our Planet 14) Agriculture 15) Elements, Metal & non Metal

Other Activities: [All]

- Lab, library, exhibition visits
- Educational Theory, Practices, Issues, Policies
- Assessment: Films, discussions
- Visits to field, science centre, science excursion
- Analysis of teachers expectations and their experiences of the workshops

Assessment of the 3 day, 5 day and two week workshops:

The participants would assess the workshops. There could be an analysis of their expectations from the workshop prior to its initiation followed by a feedback at its conclusion.

Logistics:

HBCSE can prepare a calendar of events of TPD workshops and announce these on our websites, and through posters in nearby teacher education colleges, DIETs and schools. HBCSE's members would be the resource persons for these workshops and HBCSE will provide resources, materials, lecture rooms and labs for activities to the participants. The participants can pay a nominal fee for the workshops (except for the one day exposure or visit).

Outcomes of these workshops:

It would be better if the outcomes of the workshops are thought out well in advance. To name a few, one can see a possibility of research in science teacher education or science learning, through the project based workshop. A need analysis survey or educational data can be conducted through the exposure workshop, field visits. Worksheets, modules, videos made during or for the workshops can lead to research and material development at HBCSE.

Tentative Schedule for Student's Visit, Teacher's Education Programme, and Teacher Professional Development Programme

Many school students, student-teachers, practicing teachers and teacher educators, parent and policy makers request HBCSE to arrange visit, seminar, orientation workshop and teacher education and teacher professional development programmes at HBCSE or in-field.

We propose to organize short and extended residential workshops at HBCSE and in-field in collaboration between teachers and teacher educators. These workshops would be for professional development of in-service teachers and would involve sessions on: science through investigation, lesson study, research readings, textbook analysis, assessment, action research project, NCF, social issues in education, ICT in education, introduction to learning resources, hands-on and constructivist approach, as well as subject content and enrichment session. Here we have prepared the models of tentative schedules based on past experience and finding of current researches on teacher education (pre and in-service).

Tentative schedule

1a. Half day visit programme for students and student-teacher

Time	Session
9.00 – 9.30	Introduction to HBCSE
9.30 – 11.30	Inquiry Based Science Learning (Yes, You Can Do It!)
11.30 – 1.00	Fun of Mathematics
1.00 – 1.30	Visit to HOS / GS exhibition/ Publication Cell

Number of students: 40 (with 2-4 teachers)

Day: 2nd week of Wednesday (every month)

Monthly: At least two visits (considering the number of schools and B. Ed & D. Ed colleges request we receive during academic year: June to March)

Duration: Morning 9.00 to 1.30 pm.

Objective: School students are eager and enthusiastic to observe new demonstration/activities, and would like hands-on activities. Thus group of students can be provided collaborative task. If there are more than 40 students we can have 2 batches and one batch does the science activities while the other does maths activities. The introduction and conclusion can be common. The visit to the exhibitions should be a guided one. There may be a lecture session if possible.

Outcome: Apart from science discrimination this student visit will give inputs into:

- Students questions/doubts,
- Students ideas/notions,
- Students difficulties about subject knowledge
- Classroom interaction, situation

From these students visit/interaction we may understand difficulties in curriculum transaction, interaction between student and teacher, etc. It may be useful for material development, material testing and research. It may also useful for research; it will provide new ideas for research. We have to collect students' observations, questions and feedback after their visit through feedback form or report or by taking their interview. We have to ask students to drop their questions/doubt in question box which we are keeping in Integrated Laboratory.

Resource Person: 4-6 RPs

Or

1b. One day visit programme for student-teacher

Time	Session
9.00 – 9.30	Introduction about HBCSE
9.30 – 11.30	NCF, Learning and Constructivism)
11.30 – 1.00	Inquiry Based Science Learning (POE or Yes, You Can Do It!)
2.00 – 3.30	Fun of Mathematics
3.30 – 4.30	Ask your question/quiz/Puzzle session or Design an activity/quiz/teaching aid
4.30 – 5.00	Visit to HOS /GS exhibition / Publication Cell

Number of student-teachers: 45-55 (with 2-4 teacher educators)

Day: 2nd week of Wednesday (every month)

Monthly: At least one visit

Duration: Morning 9.00 to 1.30 pm.

Objective: Inputs for Material development and Research.

From these student-teachers visit/interaction we may understand difficulties pre-service teacher education syllabus, teaching methods, role of learning resources and action research, curriculum transaction, interaction between student-teacher and teacher educator, etc. It may be useful for TPD: material development, material testing and research. We have to conduct student-teacher interview for understanding more about their perception of this profession and expectations. We can also collect their observations, questions and feedback after their visit through feedback form or questions.

Resource Person: 4-6 Rps

1c. One day workshop/seminar for Student teachers/In-service teachers

Time	Session
09.00 – 09.30	Introduction about HBCSE
09.30 – 10.30	NCF, Learning and Constructivism
10.30 - 12.00	Role of activities/experiments in school science
12.00 – 01.00	Fun of Mathematics
02.00 – 04.30	Inquiry Based Science Learning (Yes, You Can Do It!)
04.30 – 05.00	Visit to HOS & GS exhibition and library & Publication Cell
05.00 – 05.30	Feedback/discussion

Number of Teachers: 35-45

Day: Wednesday

Monthly: At least one per months

Duration: Morning 9.00 to 5.30

Objective: During classroom teaching teacher face various difficulties; they need some solution/s, remedies, guidance about new approaches/methods/trends/research in education. Also for science exhibition, school competitions and examinations they require support. So to provide this guidance and support as well as introduction to new trends in educational pedagogical, sessions on subject content, and enrichment session will be useful. (We may also plan *theme based seminar* or workshop).

Outcome:

This one day teacher workshop/seminar will provide:

- Nature of students questions/doubts, students ideas/notions,
- Teacher difficulties during curriculum transaction
- Actual classroom, school problems/issues, situation

This may be useful for testing material, new method and research. It may also useful for material development and research in areas of teacher education.

Resource Person: 4-6 Rps

2. Three days workshop/seminar for practicing science teachers

Day/Time	09:00 – 9:30	09:30 - 10:30	11.00-12.00	12:00 - 13:00	14:00 – 15:45	16.00-17.00	17:00 - 17:30
Day 1	Need Assessment	Introduction & Inauguration	NCF/SCF	Nature of Science	Hands-on or Science through investigation	Role of ICT in Education	Discussion Session (Movie clips/ different issues)
Day 2	Feedback	Concept map	Trends in education	Socio-cultural issues in education		Learning Resources	
Day 3	Feedback	Unifying Concepts in Science	Students conceptions	Assessment & evaluation		Feedback & Valedictory	

Number of Teachers: 35-45

Day: Any three days of a week

Monthly: At least 2-3 in one year

Duration: Morning 9.00 to 5.30

Objective: During classroom teaching teacher face various difficulties; they need some solution/s, remedies, guidance about new approaches/methods/trends/research. For science exhibition, various school competitions and examinations they require some support. So to provide a guidance and support, session on pedagogical aspects, subject content, and enrichment session will be useful. (We may also plan *theme based** seminar or workshop.)

Outcome: This three days teacher workshop/orientation will provide:

- Nature of students questions/doubts, students ideas/notions,
- Teacher difficulties during curriculum transaction
- Actual classroom, school problems/issues, situation

This may be useful for testing material, new method and research. It may also useful for material development and TPD research.

Resource Person: 6-8 Rps

3. Five days workshop for teacher educators

Day/Time	09:00 – 9:30	09:30 - 11:00	11:30 - 13:00	14:00 – 16:00	17:00 - 17:30
Day 1 Mon	Need Assessment	Introduction & Inauguration	NCF/SCF or Constructivist approach	Science Through investigation and Presentation	Discussion Session
Day 2 Tues	Feedback	Nature of Science	Role of ICT in Education		(Movie clips/different issues)
Day 3 Wed		Unifying Concepts in Science	Concept map		
Day 4 Thu		Socio cultural issues in education	Assessment and evaluation		
Day 5 Fri		Action research or research in SE	Learning resources		Workshop report presentation

Number of Teachers: 35-45

Day: Five days

Monthly: At least 2 in one year

Duration: Morning 9.00 to 5.30

Objective: During classroom teaching teacher educators face various difficulties; they need some solution/s, remedies, guidance about new approaches/methods/trends/research. So to provide a guidance and support, session on pedagogical aspects, use of learning resources, role of TLM, action research, subject content, and enrichment session will be useful. Teacher educator also organize short-term in-service teacher education programme, they also conduct action research

project and workshop on how to prepare TLM for practicing teachers.

We may also plan *theme based** seminar or workshop.

Outcome: This five days teacher educator workshop/orientation will provide:

- Nature of students questions/doubts, students ideas/notions,
- Students-teacher difficulties during curriculum transaction
- Actual classroom, school problems/issues, situation

This may be useful for intensive testing of TPD material, new method and research. It may also be useful for material development and TPD research.

Resource Person: 6-8 Rps

4. Two weeks workshop for teacher educators

Day/Time	09:00 – 09:30	09:30 - 11:00	11:30 - 13:00	14:00 – 16:00	17:00 - 17:30
Day 1, Mon	Need Assessment	Introduction & Inauguration	NCF/SCF	Science through investigation Presentation	Discussion Session (Movie clips/different issues)
Day 2, Tues	Feedback & Discussion	Nature of Science	Role of ICT in Education		
Day 3, Wed		Unifying Concepts in Science	Concept map		
Day 4, Thu		Nature of Science	Design & Technology		
Day 5, Fri		Role of language	Students conceptions		
Day 6, Sat	School Visit or Other institute visit (Such as NSC, NP, National park)				
Day 7, Sun	Free time: sightseeing				
Day 8, Mon	Feedback & Discussion	Research in SE	Assessment & evaluation	Research reading or textbook analysis	Discussion Session (Movie clips/different issues)
Day 9, Tues		Research in SE	Socio cultural issues in education		
Day 10 Wed		Lesson study	Assessment & evaluation		
Day 11, Thu		Lesson study	Assessment & evaluation	Presentation	
Day 12, Fri		Scientific method	Socio cultural issues in education	Workshop Report Presentation	

Number of Teachers: 35-45

Day: Two weeks (12 days)

Monthly: At least 1 or 2 in one year (depends on accommodation availability at HBCSE)

Duration: Morning 9.00 to 5.30

Objective: During classroom teaching teacher educators face various difficulties; they need some solution/s, remedies, guidance about new approaches/methods/trends/research. So to provide a guidance and support, session on pedagogical aspects, use of learning resources, role of TLM, action research, subject content, and enrichment session will be useful. Teacher educator also

organize short-term in-service teacher education programme, they also conduct action research project and workshop on how to prepare TLM for practicing teachers.

Outcome: This 12 days teacher educator workshop/orientation will provide:

- Nature of students questions/doubts, students ideas/notions,
- Students-teacher difficulties during curriculum transaction
- Actual classroom, school problems/issues, situation

This may be useful for intensive testing of TPD material, new method and research. It may also be useful for material development and TPD research. This 12 days interaction with teacher-educators may be useful for designing activities, development of material and resources in collaboration. It will be also useful to try out lesson study, textbook analysis, research reading and various new pedagogical approaches.

Resource Person: 10-12 RPs + Invited Experts/Resource Person