



## Educating the Educators

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“Multidisciplinary Perspectives in Science and Technology”  
Tenth NIAS-DST Training Programme  
Bangalore, September 25, 2012

# This talk

About HBCSE

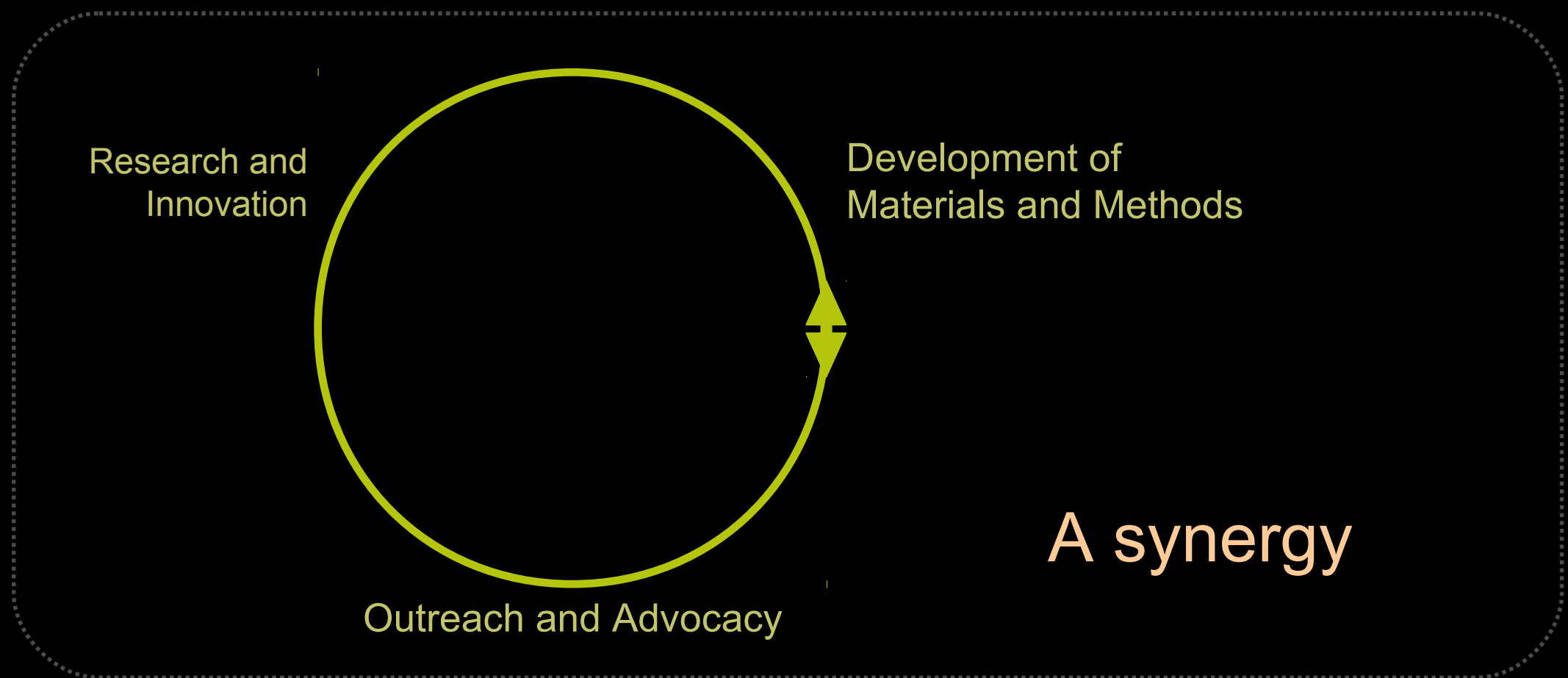
Teacher Education in India

HBCSE'S approach to TE

Role of Research Institutes

# HBCSE's Aim

To improve the quality of science and mathematics education in the country from primary school up to undergraduate level



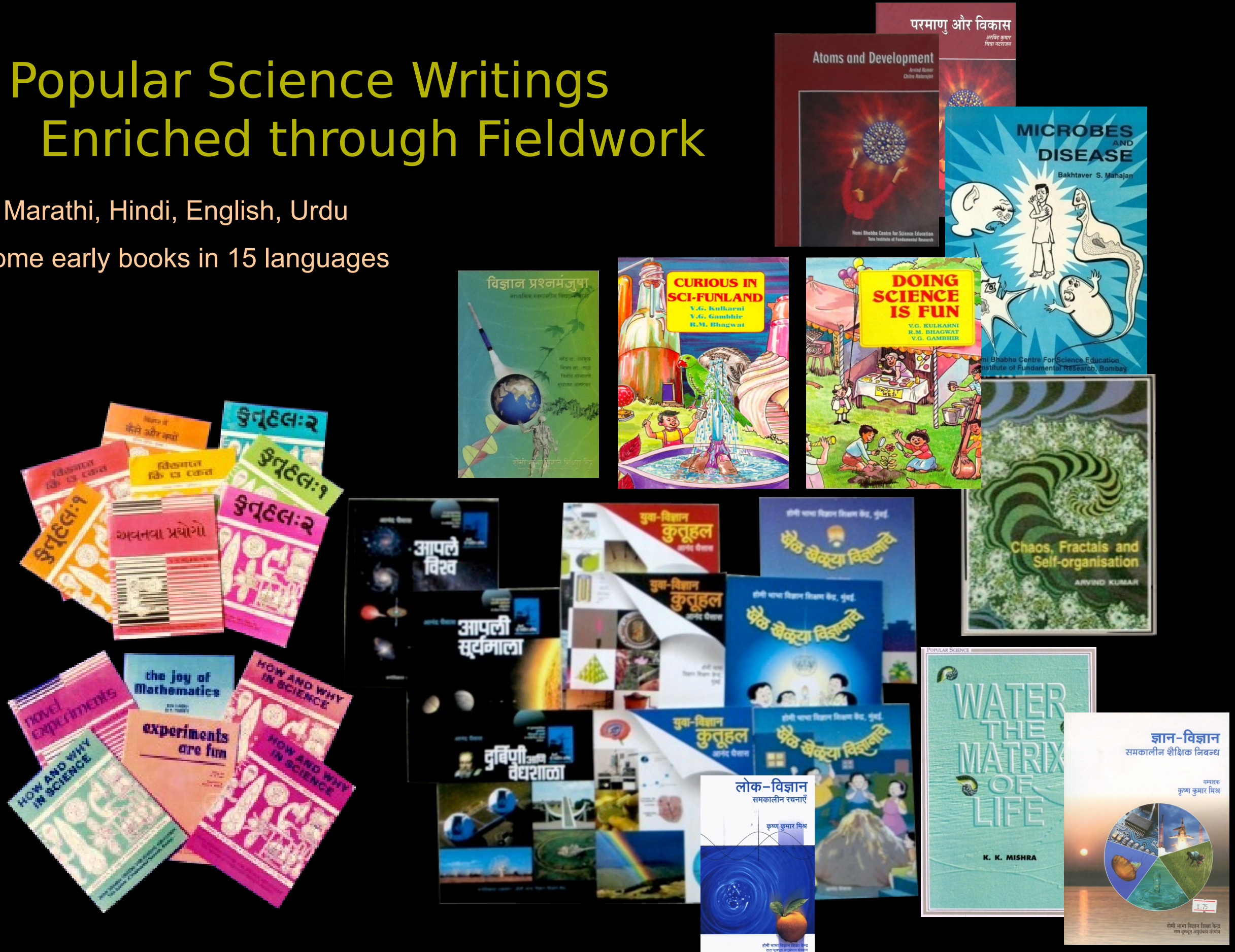
# Specifically we aim to:

- Generate new ideas                      Research and Innovation
- Translate them to useable forms                      Development of materials and methods
- Demonstrate or implement the ideas on a small or large scale                      Outreach and Advocacy



# Popular Science Writings Enriched through Fieldwork

In Marathi, Hindi, English, Urdu  
Some early books in 15 languages





# Curricula Based on Research, Fieldwork and Classroom Trials



- Homi Bhabha Curriculum for Primary Science and Mathematics
- Textbooks, Workbooks and Teacher's books in English, Hindi, Marathi, Urdu

# The epiSTEME series of Conferences

A biennial conference series to review research in Science, Technology and Mathematics Education (STME)



Since 2004

Drawing on philosophy, cognition, history and socio-cultural studies, providing a common forum for researchers from science, technology and mathematics education

- Historical, Philosophical and Socio-cultural Studies of STM: Implications for Education
- Cognitive and Affective Studies of STME
- Curriculum and Pedagogical Studies in STME





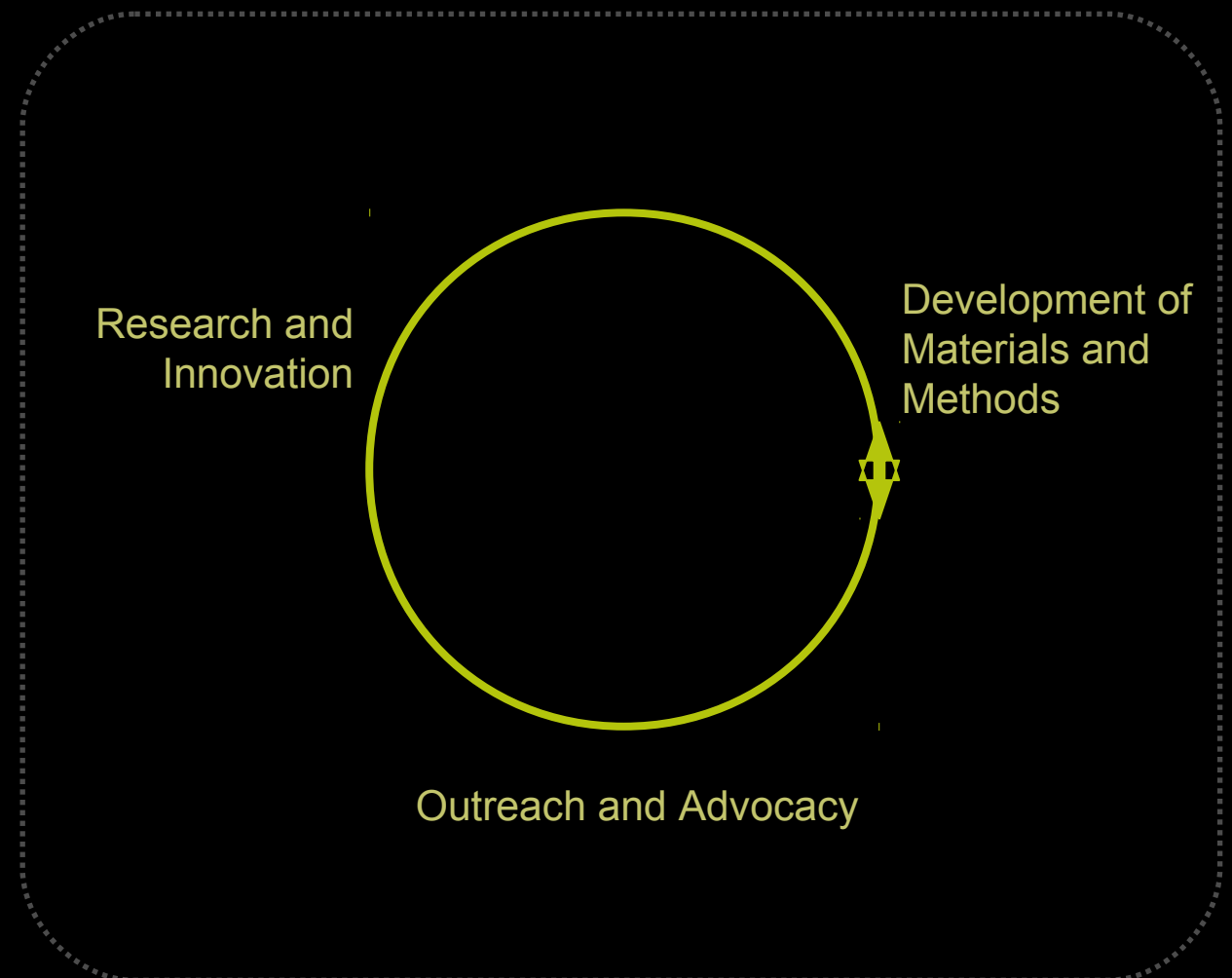
# Programs at higher secondary and college level



- Science and Mathematical Olympiads
  - 5-step process of selection and orientation
  - Experiments, problem sets, pedagogical articles
- National Initiative on Undergraduate Science
  - Extended nurture of selected undergraduates for advanced studies and research in science

# HBCSE's program for teacher professional development, 2012-

- A synergy of research, development and outreach
- 50 teacher educators each in West Bengal and Bihar
- Translating a National consensus from policy level to practice



# Teacher Education: A national need

National need for teacher education to be “... brought into the mainstream of the academic life of the universities on the one hand and of school life and educational developments on the other.”

Kothari Commission, 1964-66



# Centrally-Sponsored Scheme of Restructuring and Reorganization of Teacher Education 1987

- . Setting up of District Institutes of Education and Training (DIETs)
- . Strengthening of Secondary Teacher Education Institutions into Colleges of Teacher Education (CTEs) and Institutes of Advanced Study in Education (IASEs)
- . Strengthening of State Councils of Educational Research and Training (SCERTs)
- . To link elementary teacher education with higher education system

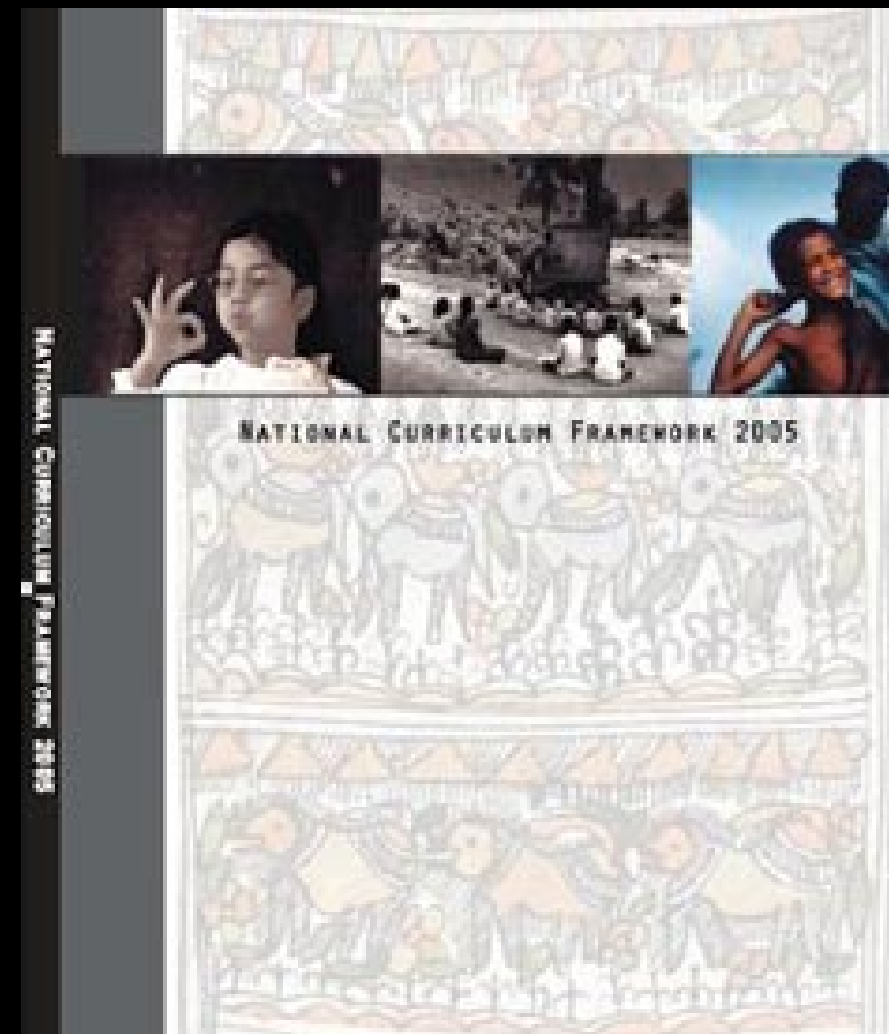
# National Curriculum Framework

## NCF 2005

For the first time, a large number of university based academics and professionals from across disciplines have contributed

Often without an official or institutional mandate

On teaching of science: contributions from HBCSE and Eklavya



# National Mission on Teachers and Teaching 2012

“The teacher is at the core of the education system... a National Mission for teachers aimed at improving teacher education and faculty development...”

President of India, Address to both the Houses of Parliament on March 12, 2012.

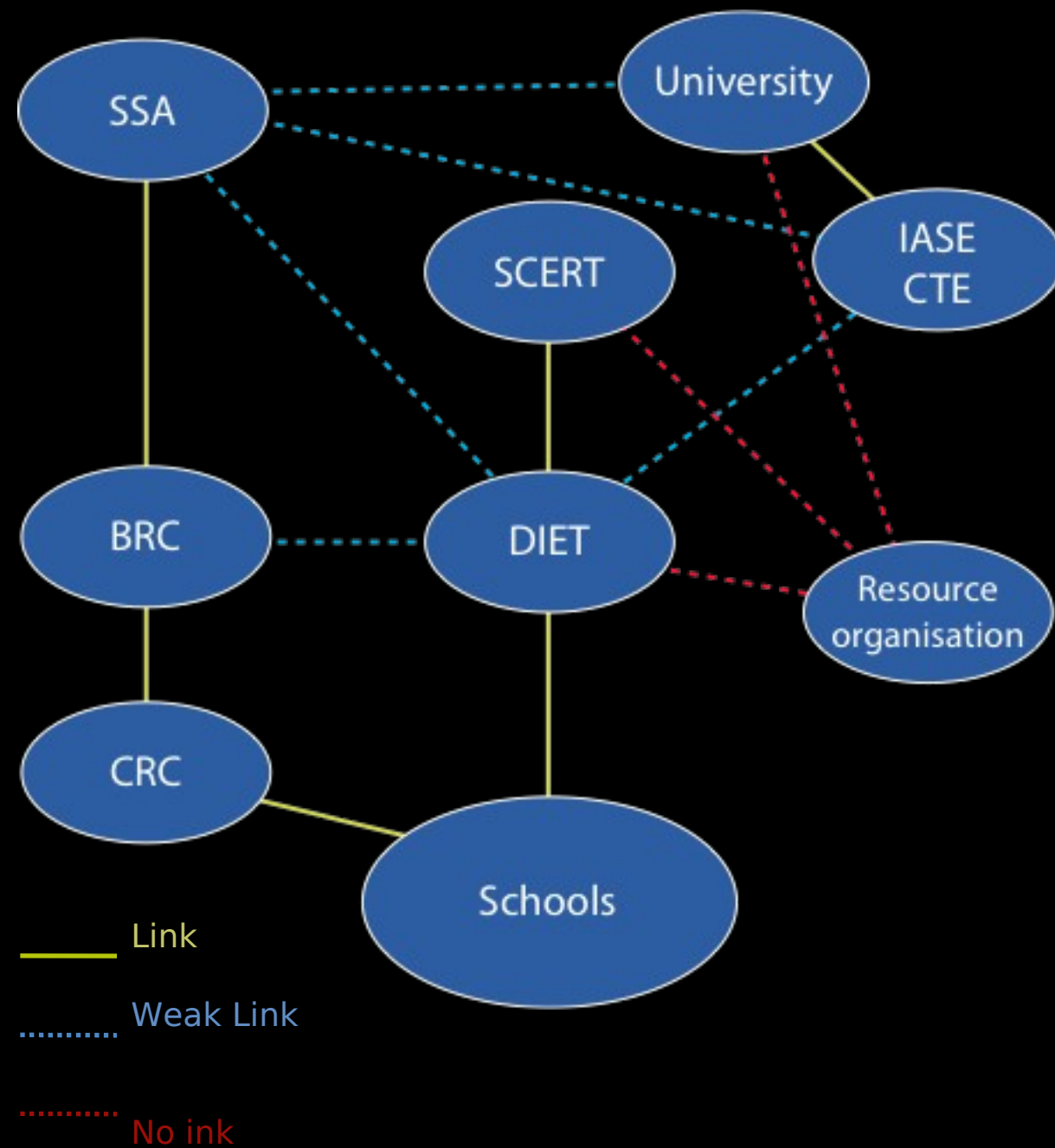
# Scale of the problem

- 5.3 million teachers at elementary and secondary level
- 772,000 teachers with no teaching certification
- 250,000 teachers are under-qualified
- 1.26 million teaching positions are vacant
- 12 states have adequate teacher education capacity
- 8 states with very high number of untrained teachers are: Assam, Bihar, Chattisgarh, J&K, Jharkhand, Orissa, UP and West Bengal
- Implementing RTE requires appointment of 0.52 million teachers in addition to existing vacancies of 1.26 million

Sources: Report on the International Conference in Issues in In-Service Development of Elementary Teachers, Bhubaneshwar, October 2010

National Mission on Teachers and Teaching, 2012.

# In-service teacher education: Institutional structures



- Top-down transmission model
- Fund-driven not need-driven
- Dispersing “reforms”
- No continuity in time

Source:

<http://www.vidyabhavansociety-seminar.org/announcement2009.htm>

MHRD, 2009



# DIETs: Basic Infrastructure

Basic infrastructure development

Buildings, Electricity, Water, Toilets, etc.

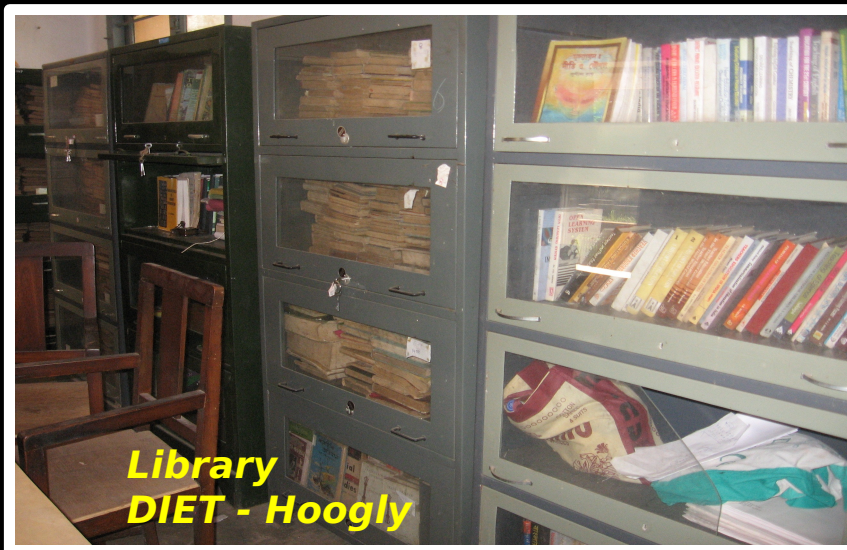




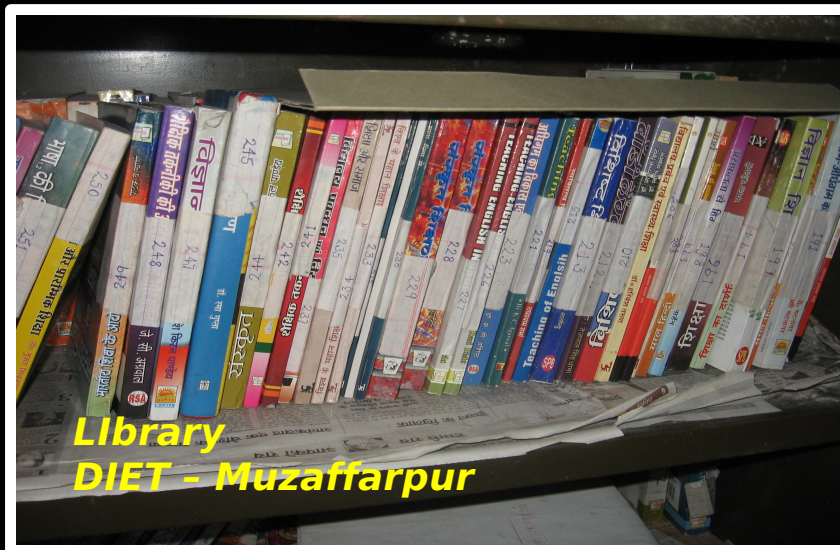
# DIETs: Libraries

Resource materials in local language for libraries

A culture of usage



Library  
DIET - Hoogly



Library  
DIET - Muzaffarpur



Library  
DIET - Gaya

# DIETs: Laboratories

Resource enhancement  
of laboratory

A culture of usage





# Other Requirements

Recruitment process to fill up vacant faculty positions in science and mathematics

Placement cell for passing out student-teachers at respectable (UGC scale) salaries

Links between universities, teacher education institutes and schools in the neighbourhood

Continuous school-based teacher professional development

Support and fund a research culture in education through teacher forums, seminars, magazines and journals

# A vision of teacher education

## NCFTE 2010

- Dialogical exploration rather than didactic instruction
- Reflective practice rather than fixed knowledge base

National Curriculum Framework  
for Teacher Education

*Towards Preparing Professional  
and Humane Teacher*

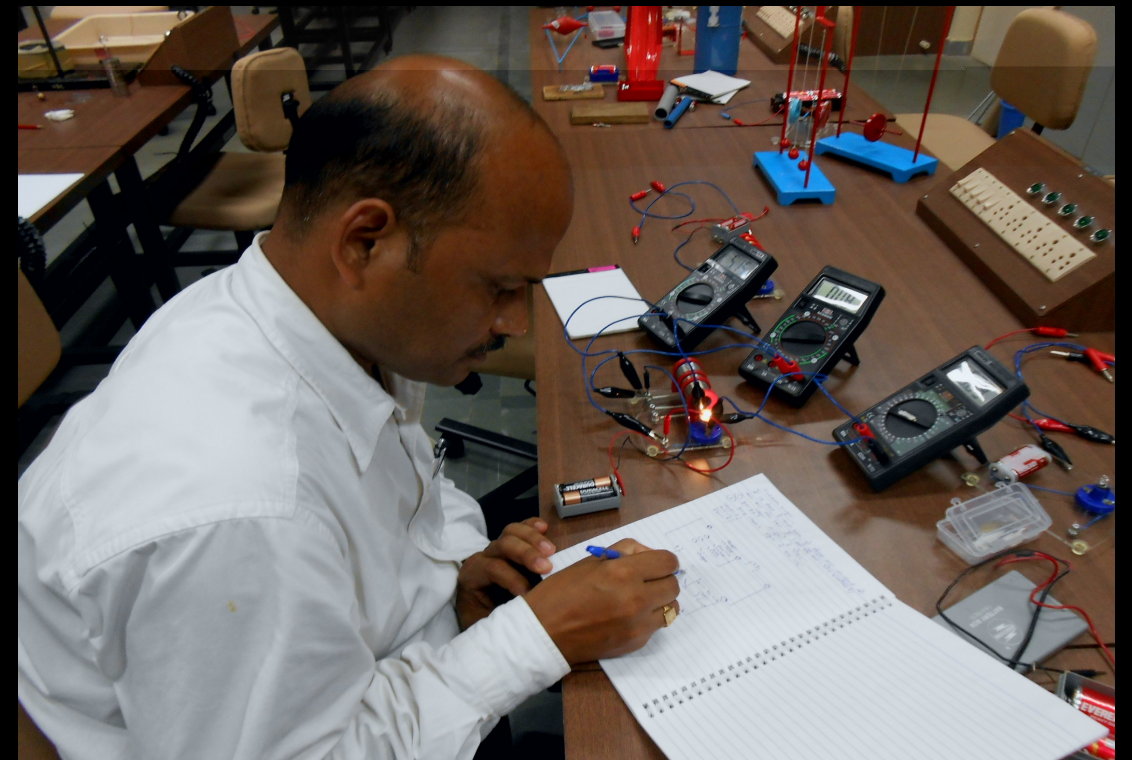


National Council for Teacher Education  
New Delhi

# Reflective Practices in Teacher Education

## Science Through Investigations

- Engaging in scientific process:  
inquiry, hypothesis, experiment, analysis,  
communication



*TPD Workshop for Bihar DIET faculty, HBCSE, August 2012*

# Investigative Projects : Topics

Lactobacillus population in curd

Bullock cart as a simple machine

Variables affecting time period of a pendulum

Distinguishing virtual and real images

Splitting and recombination of visible spectrum

Household electricity: choice of materials in electric fuse, bulb filament, heater; earthing in plugs

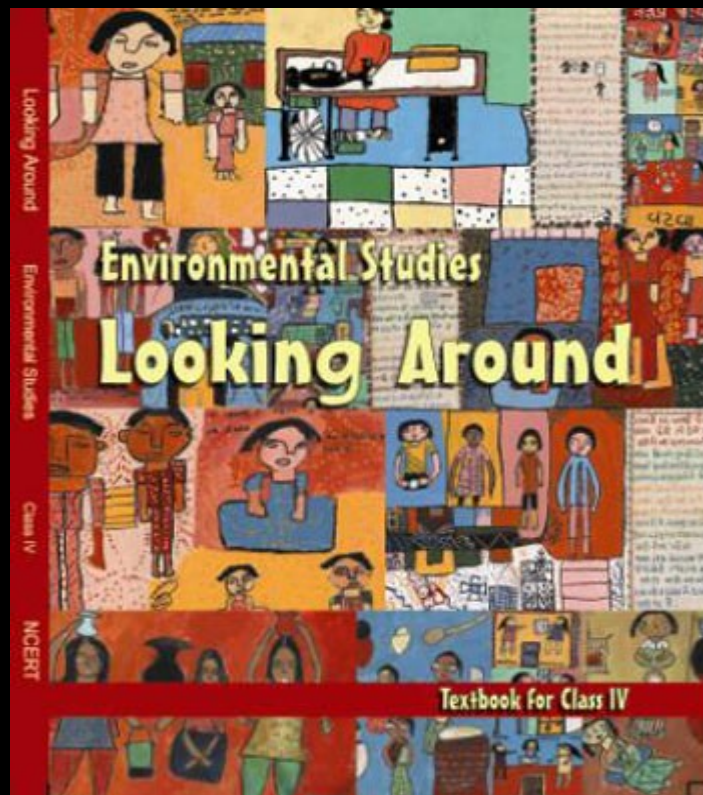
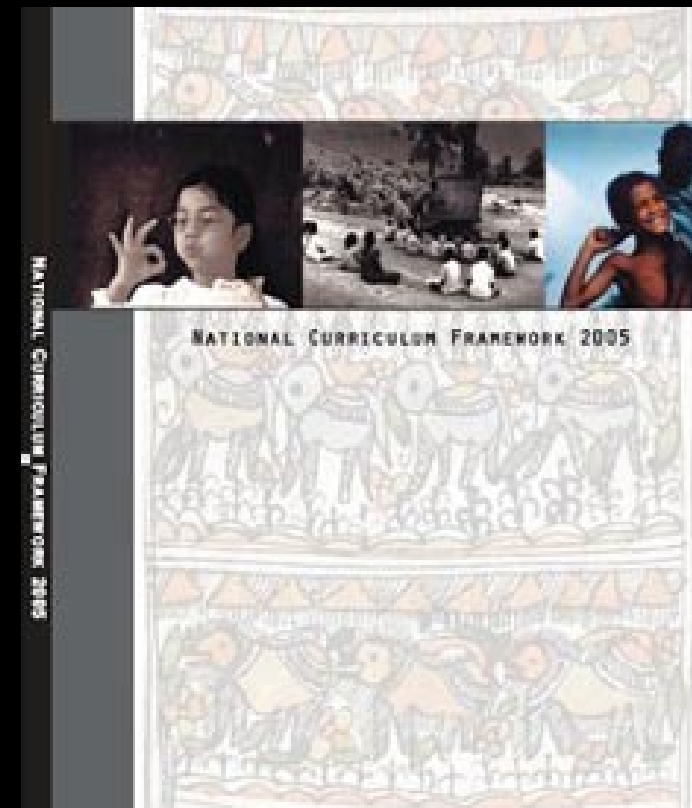


# Reflective Practices in Teacher Education

## Textbook Analysis

Reading policy documents

Review textbooks in the light of policy



# Reflective Practices in Teacher Education

Classroom teaching video analysis

Reflection on the teaching process

A tool for self-improvement



*TPD Workshop for Bihar DIET faculty, HBCSE, August 2012*

# Reflective Practices in Teacher Education

- **Research Readings**

- Research in Science & Maths education (translated into local language)

- संदर्भ, शिक्षा विमर्श, शैक्षणिक संदर्भ इत्यदि से चुने गए लेख

- शिक्षा और बाल साहित्य, गाँधी की नयी तालीम : कृष्ण कुमार

- अलीपुर गाँव में शिक्षा : पद्मा एम. सारंगपानी

- समझ में मदद के लिए भौतिक शास्त्र कैसे पढाएं : विजय वर्मा

- रटंत से अर्थ निर्माण तक : ए.के. जलालुद्दीन

विज्ञान की कक्षा में बच्चों की आवाज़ : ज्योत्स्ना विजापूरकर

प्रारंभिक गणित : सीखने, सिखाने का एक परिप्रेक्ष्य : के. सुब्रमण्यम



# Education : A National Concern

## Higher Education

Crucial contributor to national self-sufficiency, besides a tool for finding suitable employment

India, one of the world's largest HE Sectors: 350 universities, 16,000 colleges, 4.5 lakh teachers impart education to 1 crore students

## Yet..

India remains at the bottom of all global rankings with regard to educational outcomes

Gross enrolment rate around 14; public expenditure per student extremely low.

*Why? The reasons lead us deeper to Elementary and Secondary Education.*

*Source: "A welcome report on Higher Education" Economic and Political Weekly, August 1, 2009 Vol XLIVM No. 31"*

# School Education in need of Scientific Parentage

Addressing a distorted view of science forming  
at middle school level

Countering rote learning

Introducing activity, activating labs

# Intervention from Research Institutes: Why?

Active practitioners of scientific method

A mandate to disseminate knowledge and methods

Institutional strength

Staying Power

Possibility of long-term engagement

Nation-wide trust in their impartial perspective



# Intervention from Research Institutes: How?

## Creating local models of Scientist-Teacher engagement

Building a community of teacher and teacher educators

Mentorship Programs for teachers and teacher educators

Lab internship/ short courses/ workshops

Simple components of research work (sample collection, measurement, long time observation) by student groups led by teacher

# Intervention from Research Institutes: How?

## Creating local models of Scientist-Teacher engagement

Organising popular lectures weekly targeting teacher-student groups of nearby schools

Writing popular articles in local languages

School textbook analysis: establishing link with institutional research work, to be conveyed to teacher- student groups during public institutional visits

e.g. science of flight, radioactivity, batteries, agriculture, conservation of environment, nuclear energy, basic electricity and electronics

Making schools comfortable with technology use

Video/poster/pamphlet documenting research work of the institute meant for local schools and colleges

# Precedents

## India

IISc High School Science Teachers Training Program (HTTP)

Scientist-Student Interaction Program (SSIP) by KCSTE

TIFR Centre for Interdisciplinary Sciences (TCIS), Hyderabad (planned)

## Abroad

Cold Spring Harbor Laboratory, New York

École supérieure de physique et de chimie industrielles de la ville de Paris

Okinawa Institute, Japan

Mathematical Circles in Russia, Eastern Europe

Project SEED: A part of Caltech Precollege Science Initiative

# Teacher Education: A National Mission

It's our mission.

Let's all contribute to it.

Thanks

TPD Team at HBCSE

Kumar Arunachal

Rajkumar Diwakar

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