

Homi Bhabha Centre for Science Education

Tata Institute of Fundamental Research

Jayashree Ramadas
Centre Director

HBCSE Review

October 19-21, 2014

Edited, November 1, 2014



Tata Institute of Fundamental Research

<p>TIFR Mumbai Campus</p>	<p>School of Mathematics</p>	<p>School of Natural Sciences</p> <ul style="list-style-type: none"> • Department of Astronomy & Astrophysics • Department of Biological Sciences • Department of Chemical Sciences • Department of Condensed Matter Physics & Materials Science • Department of High Energy Physics • Department of Nuclear and Atomic Physics • Department of Theoretical Physics 	<p>School of Technology & Computer Science</p>		
<p>TIFR Centres</p>	<p>Homi Bhabha Centre for Science Education (HBCSE), Mumbai</p>	<p>National Centre for Radio Astrophysics (NCRA), Pune</p>	<p>National Centre for Biological Sciences (NCBS), Bengaluru</p>	<p>International Centre for Theoretical Science (ICTS), Bengaluru</p>	<p>TIFR Centre for Interdisciplinary Sciences (TCIS), Hyderabad</p>
<p>TIFR Field Stations and Facilities</p>	<p>Research Facilities</p> <ul style="list-style-type: none"> • TIFR Balloon Facility, Hyderabad • National Facility for High-Field NMR • Giant Metrewave Radio Telescope (GMRT) • Pelletron Linac Facility 		<p>Field Stations</p> <ul style="list-style-type: none"> • Very High Energy Gamma Ray Astronomy, Pachmarhi/Hanle • India-based Neutrino Observatory • Cosmic Ray Laboratory, Ooty • Gravitation Laboratory, Gauribidanur 		

TIFR Deemed University

Subjects

- Biology
- Chemistry
- Computer and Systems Science
- Mathematics
- Physics
- Science Education



Inspiration from TIFR

- Addressing fundamental questions
 - In local contexts
- Setting high standards
- Ambition to become a leader
 - Nationally
 - Internationally

HBCSE

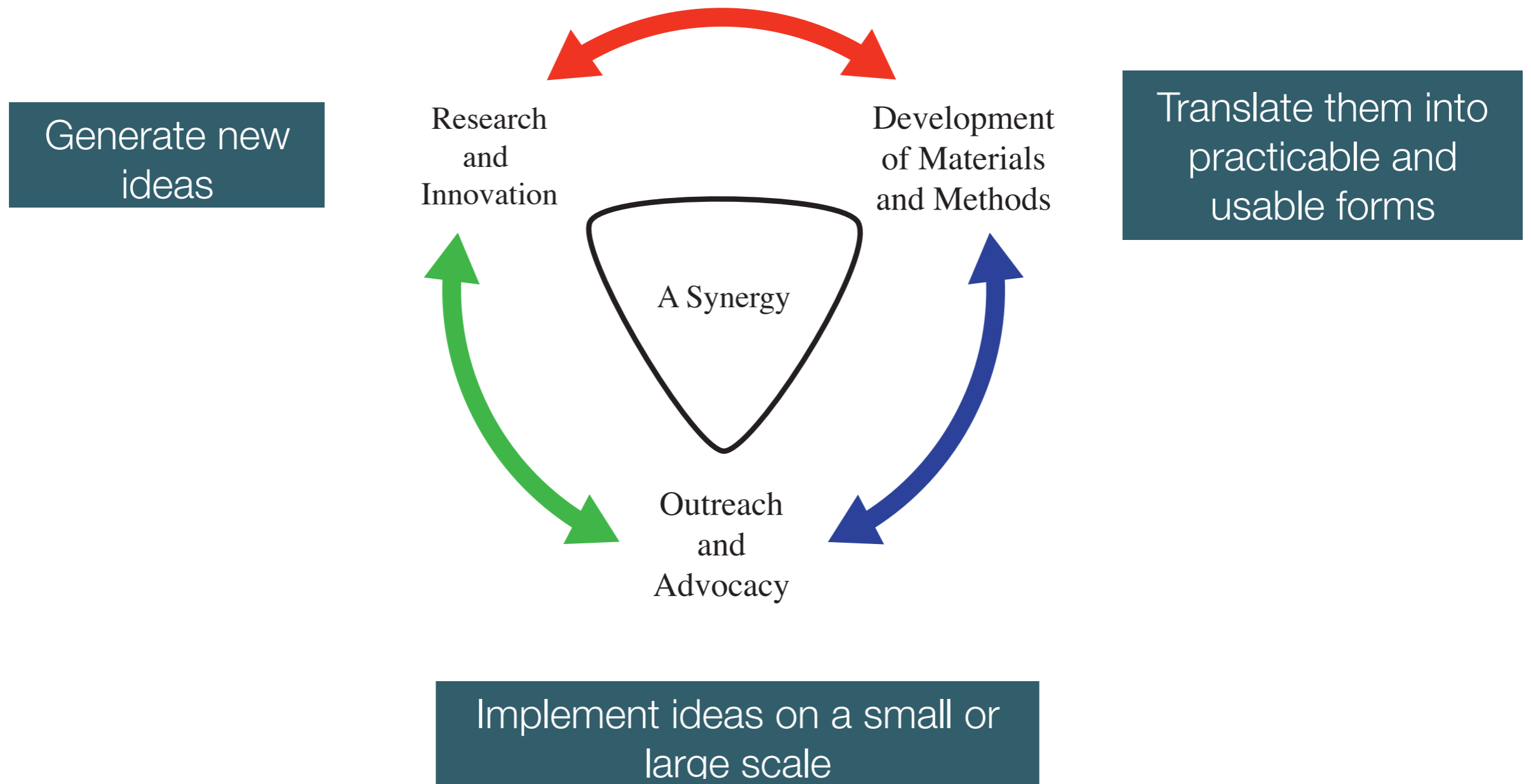
An academic institute with a synergy of research, development and practice

Our Goals

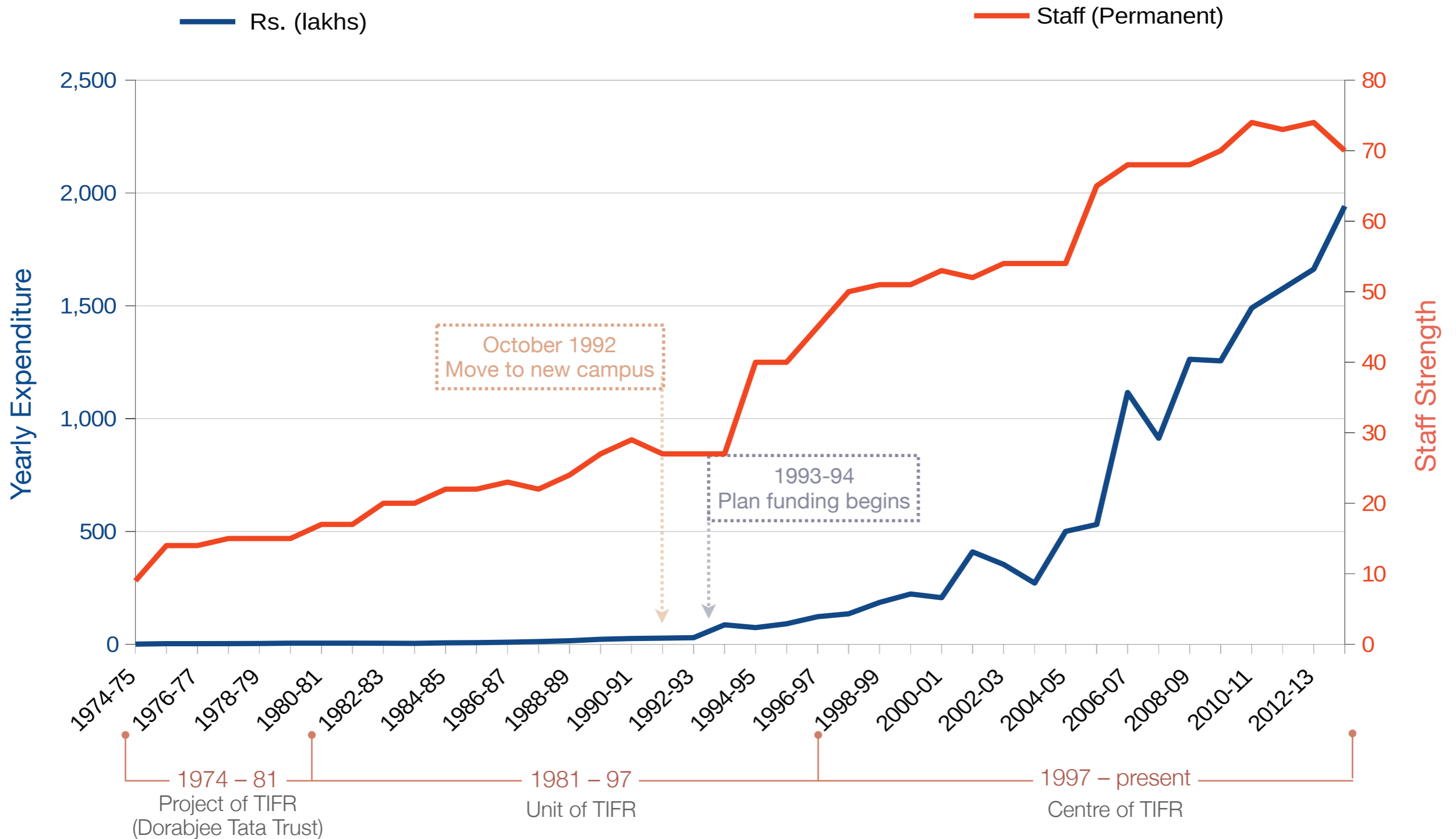
- To carry out world-class research and development
- towards improving the quality of science and mathematics education
- for all students
- from primary school to undergraduate level

HBCSE

An academic institute with a synergy of research, development and practice



Expenditure and Staff Strength



Expenditure – 2013-2014

Non-Plan (₹) : 1,122.41 lakh

Plan (₹) : 274.25 lakh

Misc. Grants (₹) : 545.00 lakh

Total (₹) : 1,941.66 lakh

Non-Plan Expenditure

Salaries (₹) : 766.10 lakh

Operation & Main. (₹) : 356.31 lakh

Total (₹) : 1,122.41 lakh

Expenditure
In US Dollars



Non-Plan

1.8
million

+

Plan

0.4
million

+

Misc

0.9
million

=

Total

3.1
million

Staff Strength - Now and Projected

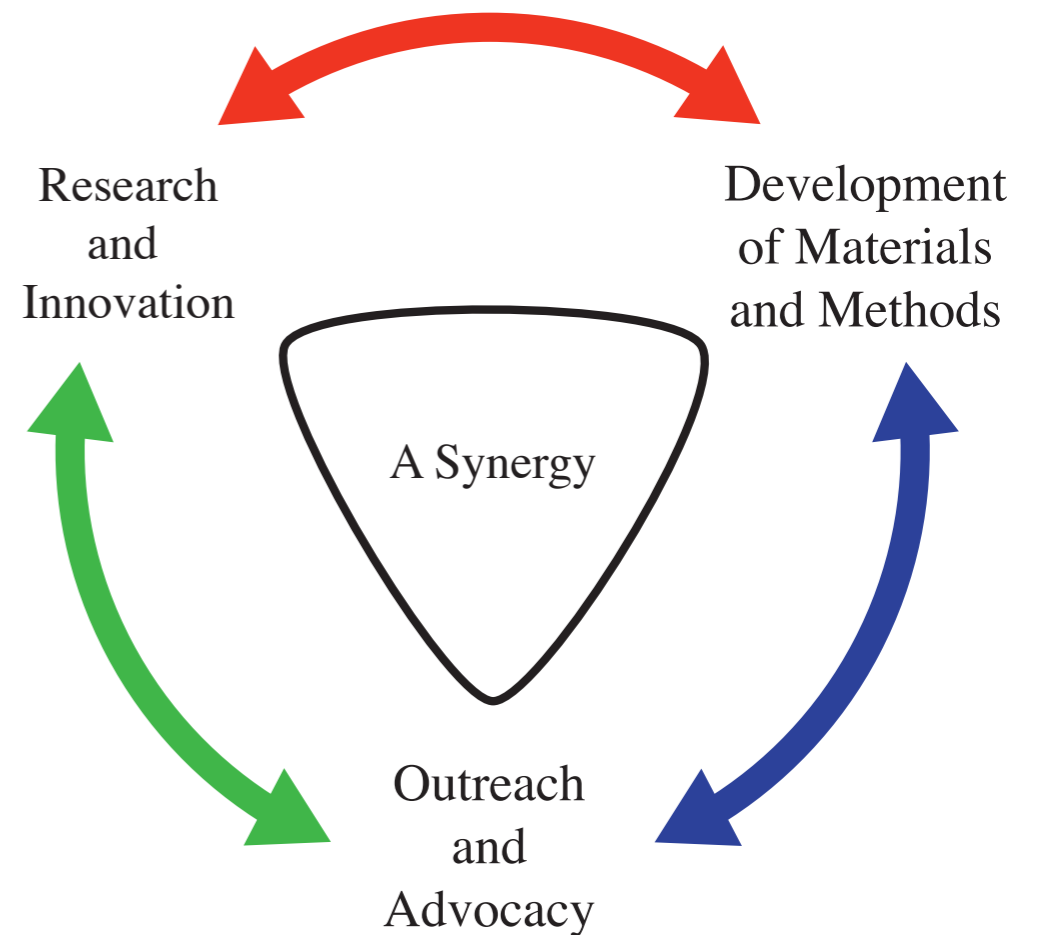
		Category	No. of members	Projected nos.	
Permanent	Faculty	18	Total 69	25	Total 82
	Scientific Staff	18		22	
	Administrative & Auxiliary	26		28	
	Technical Staff	7		7	
Temporary	Research Scholars	15	Total 63	25	Total 86
	Visiting Fellows	1		5	
	Project Fellows	6		8	
	Project Assistants	30		35	
	Organisation/Technical Trainees	11		13	
		Total	132	168	

HBCSE

An academic institute with a synergy of research, development and practice

Our Goals

- To carry out world-class research and development
- towards improving the quality of science and mathematics education
- for all students
- from primary school to undergraduate level



Approach to Goals

- Improving the quality of science and mathematics education – How?
 - influence students, teachers and policy
 - build expertise, resources and opinion conducive to good education at all levels

Indian Education

- A vast, diverse system with
- Sharp inequalities

	Schools/Colleges	Students	Teachers
Elementary ¹	~14.5 lakh	~2000 lakh	~73.5 lakh
Secondary ²	~2.3 lakh	~373 lakh	~14.4 lakh
Higher Secondary ²	~1 lakh	~223 lakh	~5.5 lakh
College ³	~.36 lakh ⁴	~200 lakh ⁵	~13.4 lakh
Teacher Education ⁶	790 ⁷		

- Only 30% students reach Class 10
- 50% failure at Class 10

¹ DISE flash report 2013-14 of Elementary education in India

² DISE flash report 2013-14 of Secondary education in India

³ AISES 2012-13

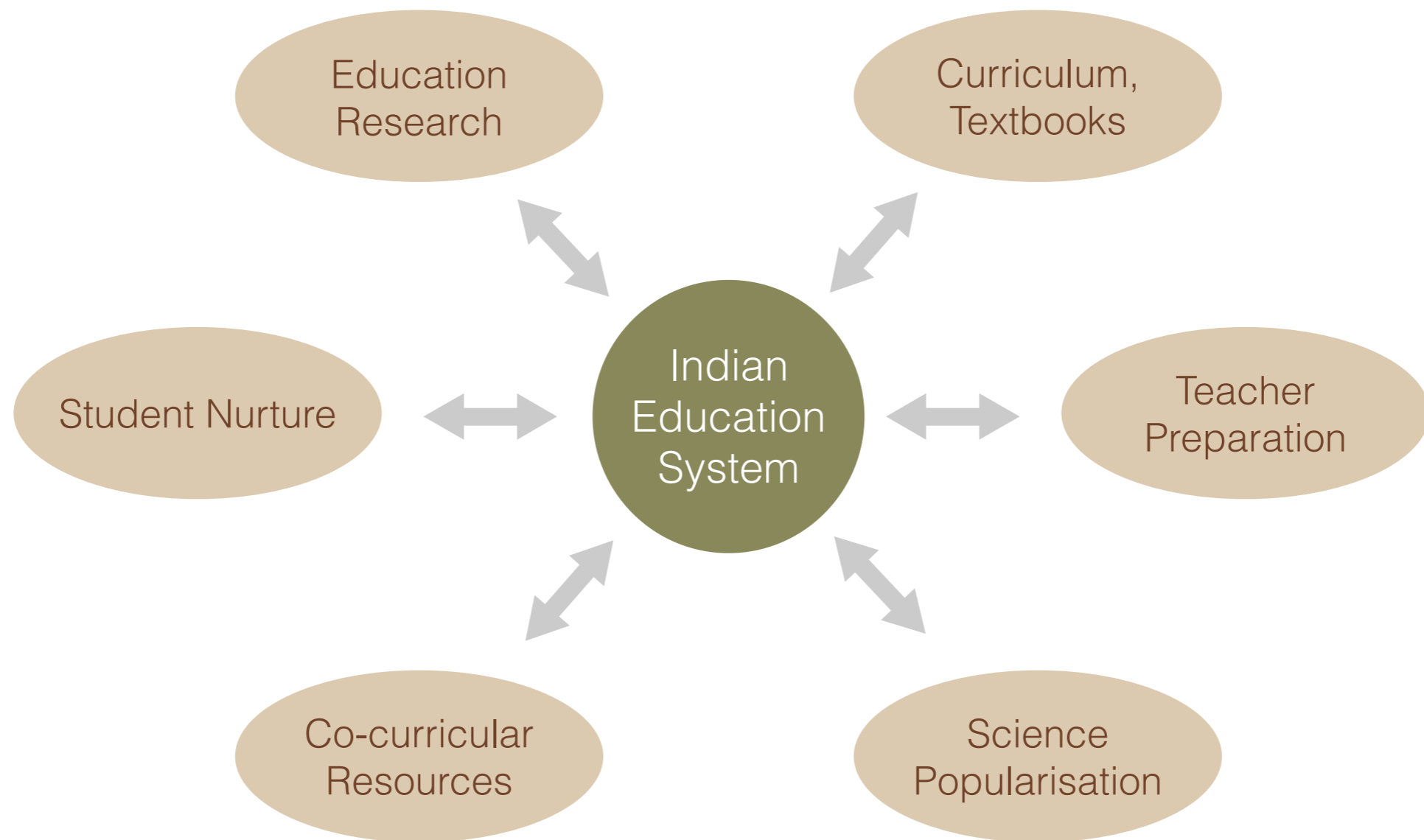
⁴ Total number of colleges in India

⁵ Enrolment on undergraduate colleges

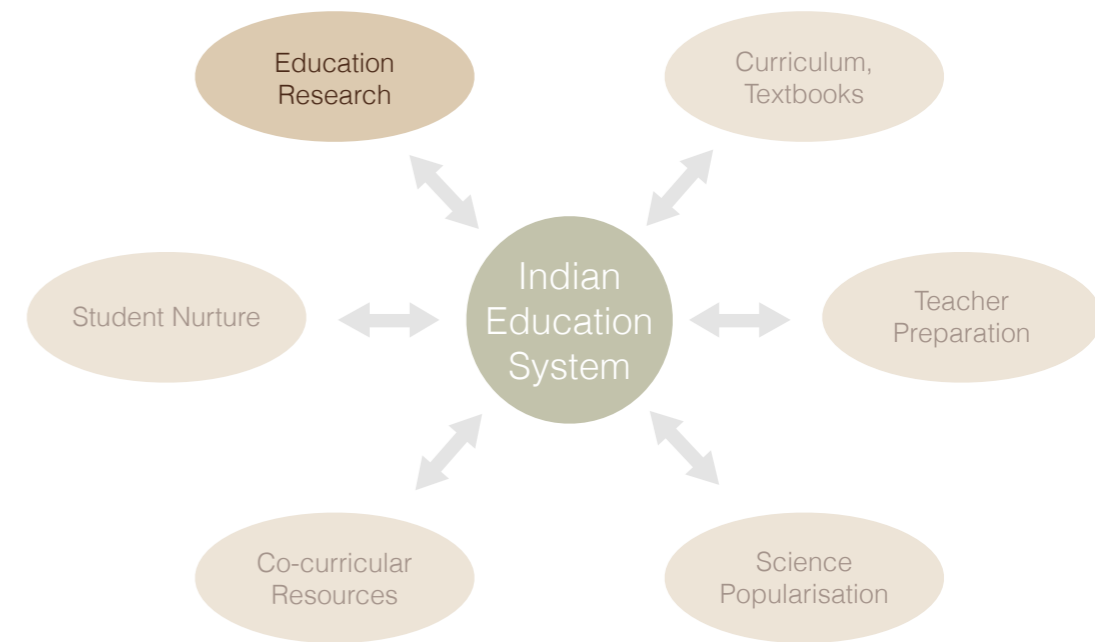
⁶ <http://teindia.nic.in/>

⁷ Government Institutions

The National Scene



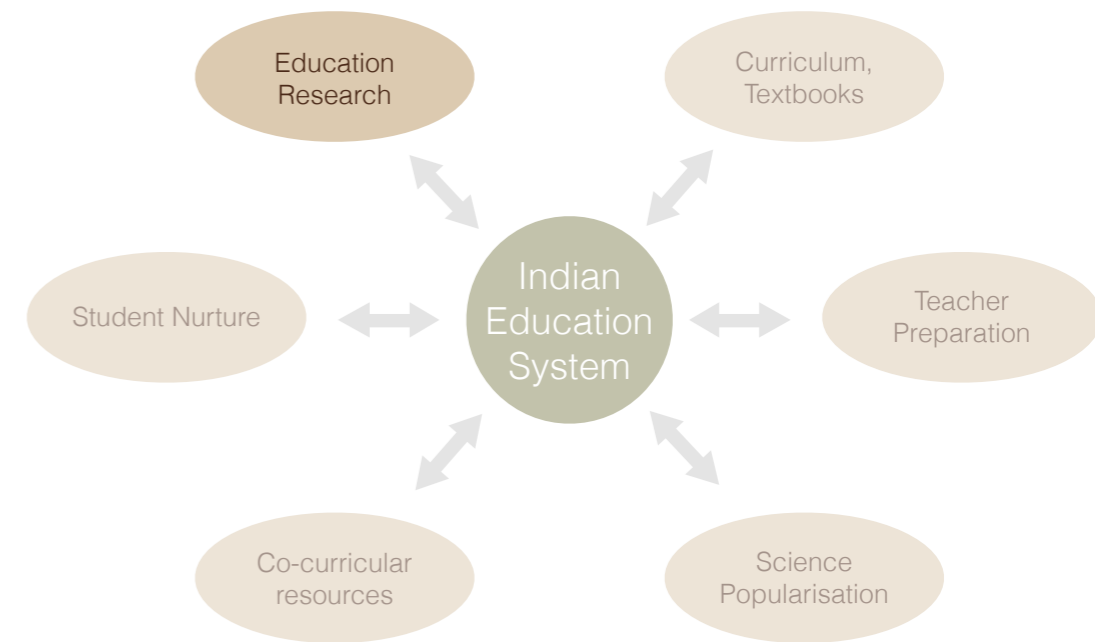
Education Research



Achievements

- Incubated research in science and mathematics education in India
- Generated ideas that entered curricular discourse
- epiSTEME conferences
 - established presence in the international community
 - seeded research in the country
- Graduate school and Ph.D. program in Science Education
- SER part of Olympiads and NIUS

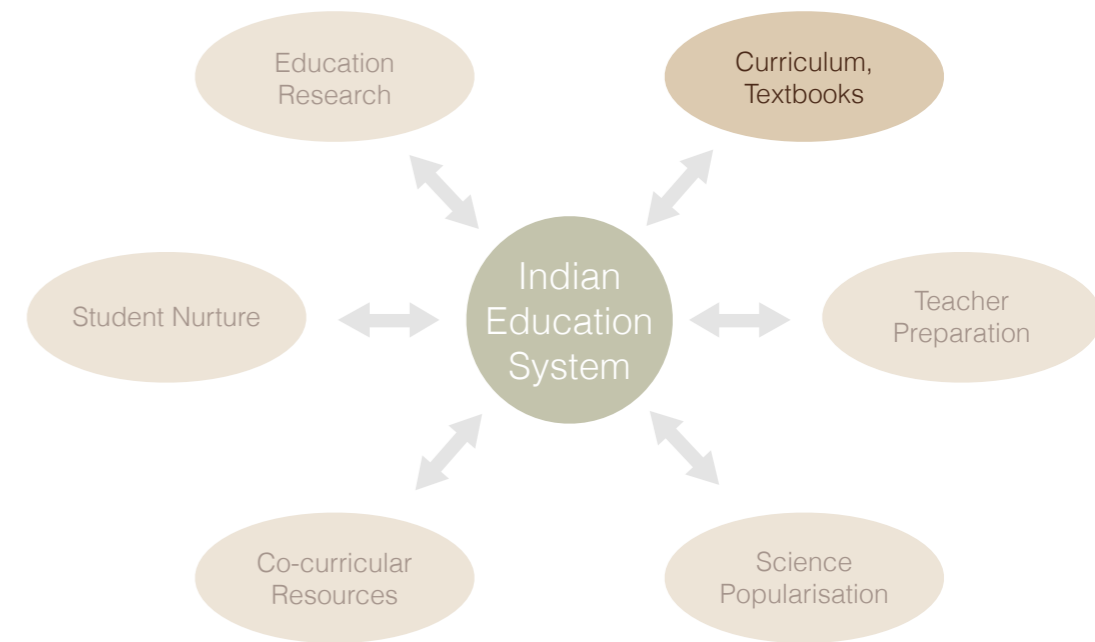
Education Research



Challenges

- Professional recognition in the education and science teaching communities
- Growing science education research in the country
 - in institutes of educational research
 - in UG science departments
- Higher impact publications
- Effect on practice

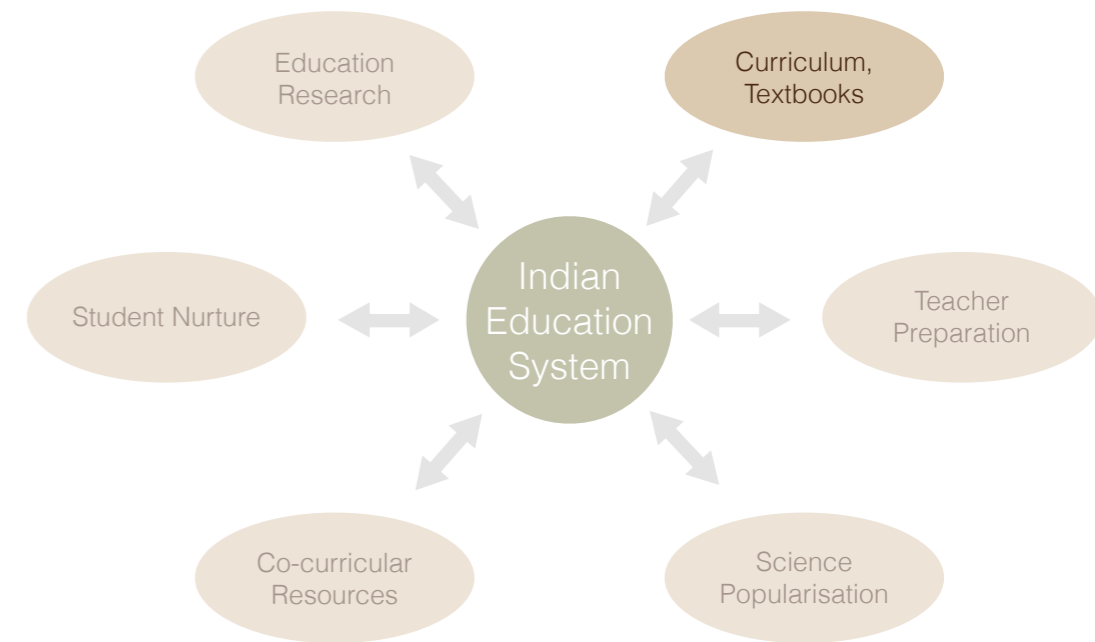
Curricula, Textbooks



Achievements

- Developed curricula and text books which have been seen as models
 - Primary '*Small Science*' and '*Maths for Every Child*'
 - Higher Secondary '*Foundation Curriculum*'
- Influenced curricular frameworks at National and State levels
- Contributed to textbooks of NCERT, IGNOU, CBSE, Maharashtra Govt., etc...

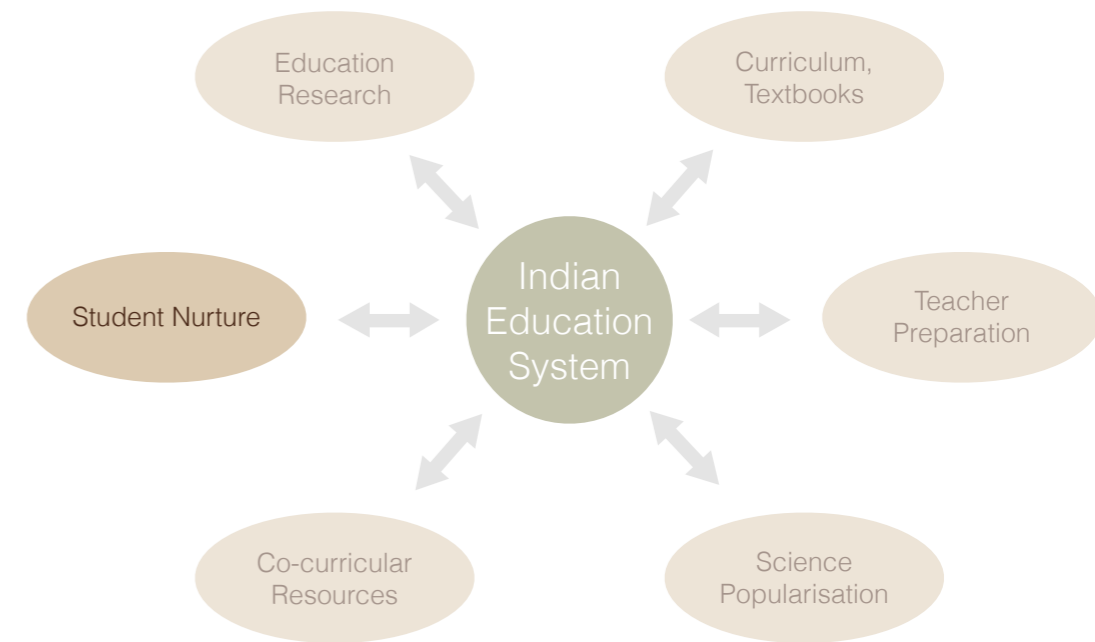
Curricula, Textbooks



Challenges

- Systematic adoption by a group of schools
- Publishing
 - a niche market, geographically distributed
 - timely supply to schools
 - accessibility and affordability of books
- Teacher support and empowerment
- Building capacities, transferring processes to State System

Student Nurture



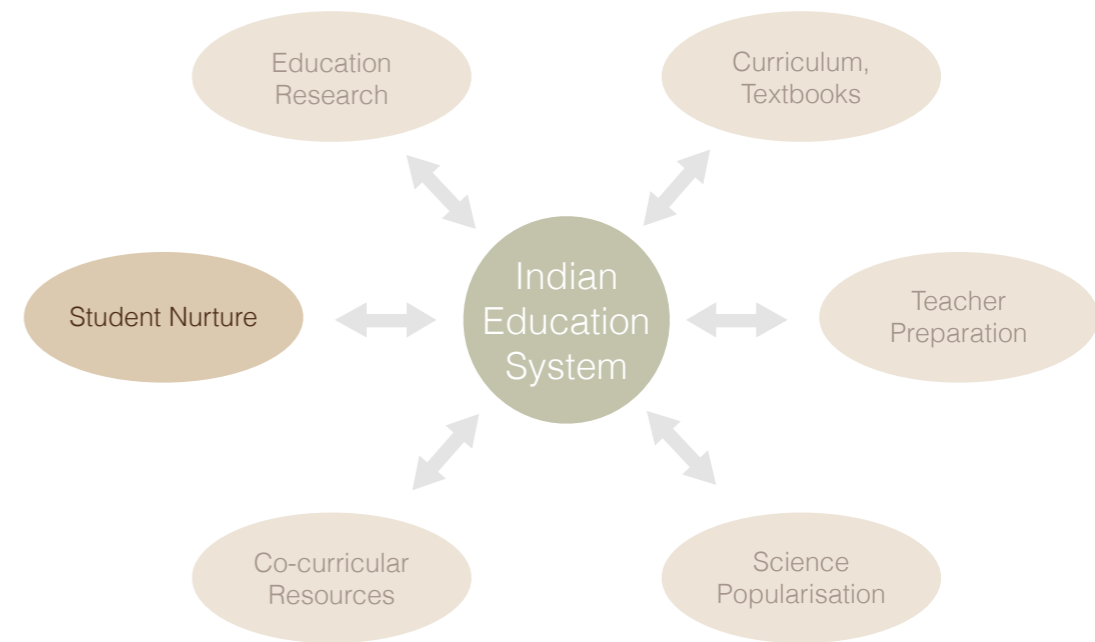
Achievements

- Led the growth of science Olympiads in the country
- A public commitment and responsibility
- Consistently good Indian performance at the international Olympiads
- Contribution of teachers to Olympiads and NIUS
- Pioneered undergraduate research in the country
- Initiated lab development in new UG institutes

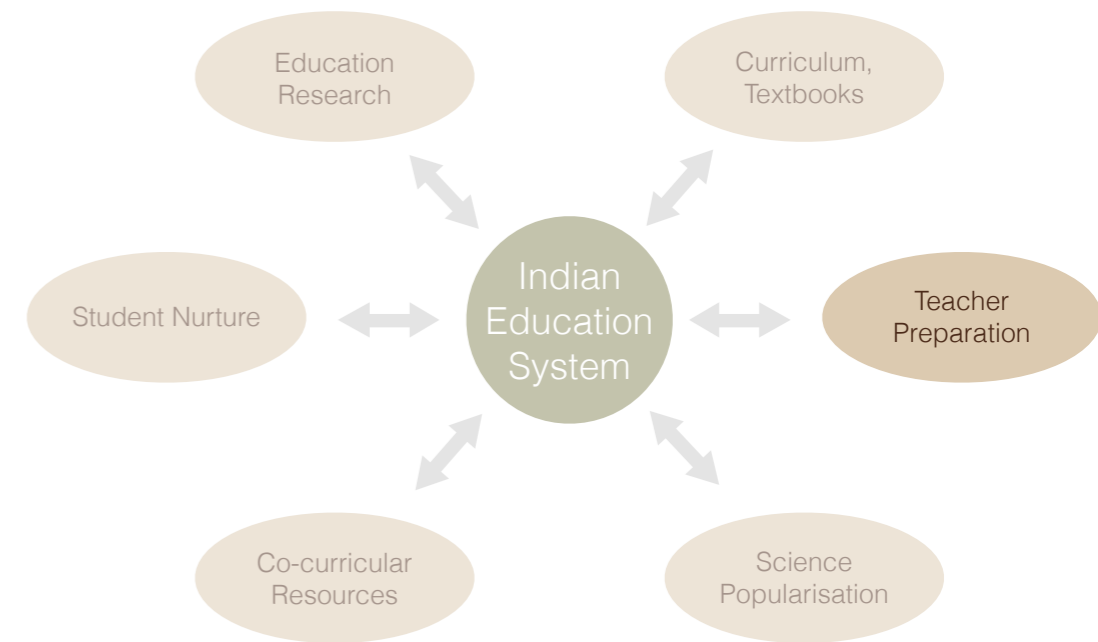
Student Nurture

Challenges

- High profile, high responsibility
- Heavy organisational load
- Development and dissemination of ideas and resources
- Teacher support and empowerment
- Research possibilities



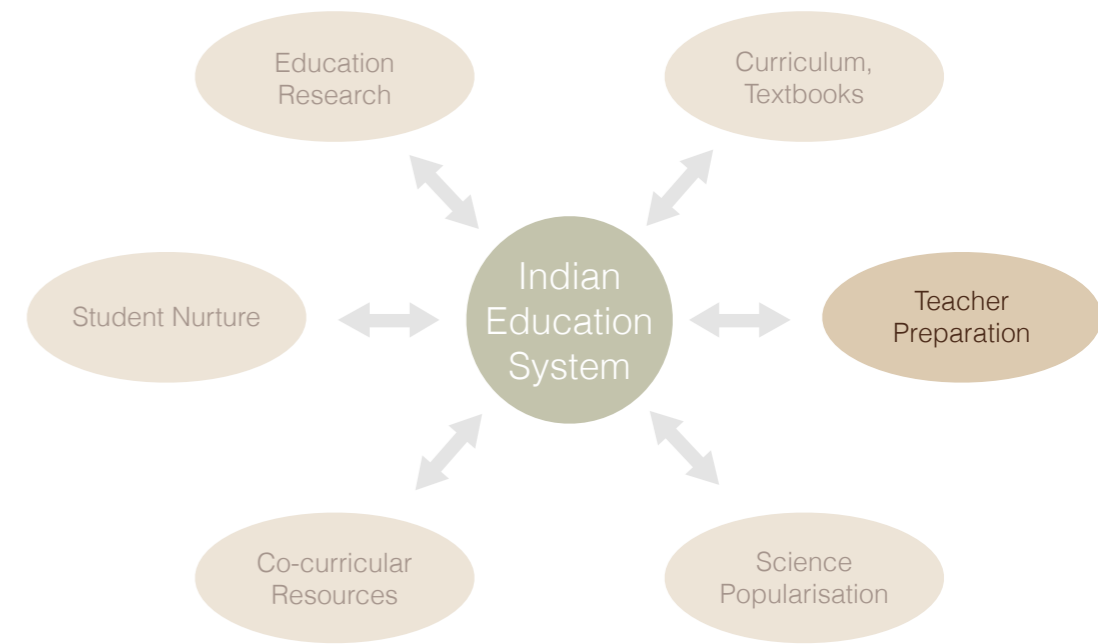
Teacher Preparation



Achievements

- In-service programs at school level
- Models of teacher professional development
- Olympiad program
 - initiated and supported national teachers associations
 - teacher participation in selection and training
 - Olympiad and NIUS yearly exposure camps

Teacher Preparation

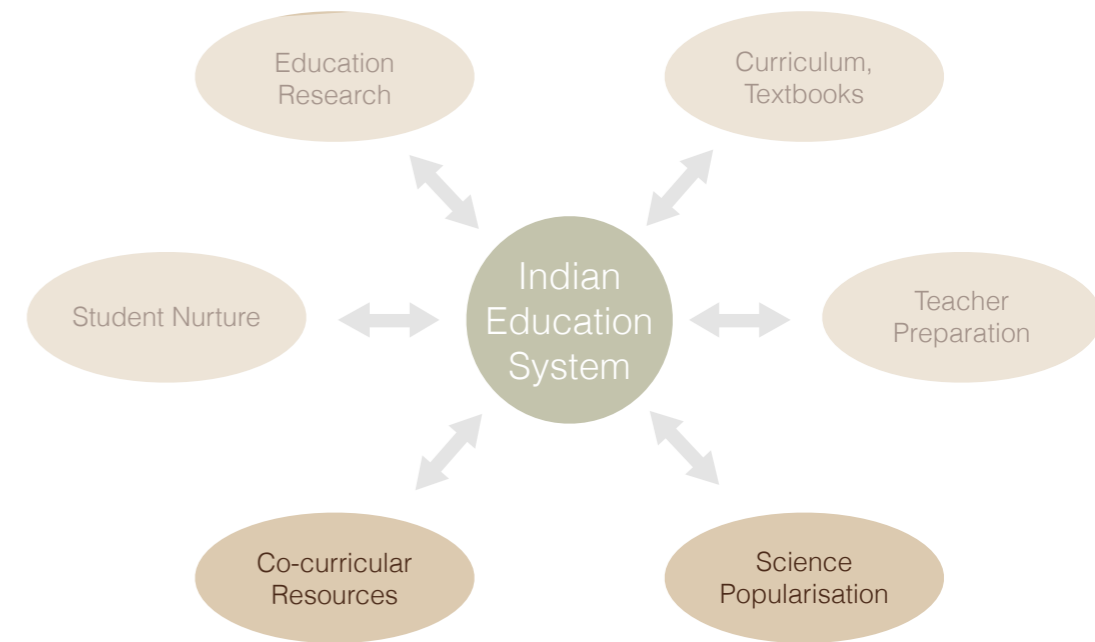


Challenges

- Explicit structures and regular schedules at school level
- Documenting learning; dynamic designs
- Modules for wider dissemination
- Influencing large-scale State-run programs at school and college levels

Co-curricular resources

Science popularisation



Achievements

- Steady production of books, lab modules, popular articles, posters, exhibitions, curated CDs of FOSS
- Websites
 - eHindi
 - MathEdu
 - metaStudio
 - OER4S
 - NROER
 - SmallScience
- Problem sets of national Olympiads

Challenges

- Maintaining rate of development
- Dissemination through State media
- Exploring the research potential

The Core Challenge

Defining an identity

- Who are we?
- How does the country view us?
- How do scientists view us? Popular perception
 - a burden of low expectations
 - assigned duties, spare-time research
- Incomprehension of the whole

Road map

Building a professional identity

Early TIFR Model

- Identify peer groups and peer institutes world-wide
- Send young+ faculty and SOs for training and sabbaticals
- Seek post-doctoral fellows
- Eligibility for faculty fellowships of DST, UGC, MHRD
- Use TIFR's visiting faculty schemes
- Systematise information on journals and conferences

Road map (contd.)

Contact with practice - Some possibilities

- Teaching agreements with 1 school, 1 college, 1 TE Institute
 - Direct teaching, mentorship, collaboration
- Work in Indian languages
- B.Sc.Ed. / M.Sc.Ed. programs
- Long-term institutional collaborations in development of educational materials at school, college and popular levels
 - with government and/or not-for-profit organisation(s)

More centres in the country!



Thanks to all HBCSE
members - Past and
Present

HBCSE was housed at the second floor of the Nana Chowk
municipal secondary school between 1975 and 1992.