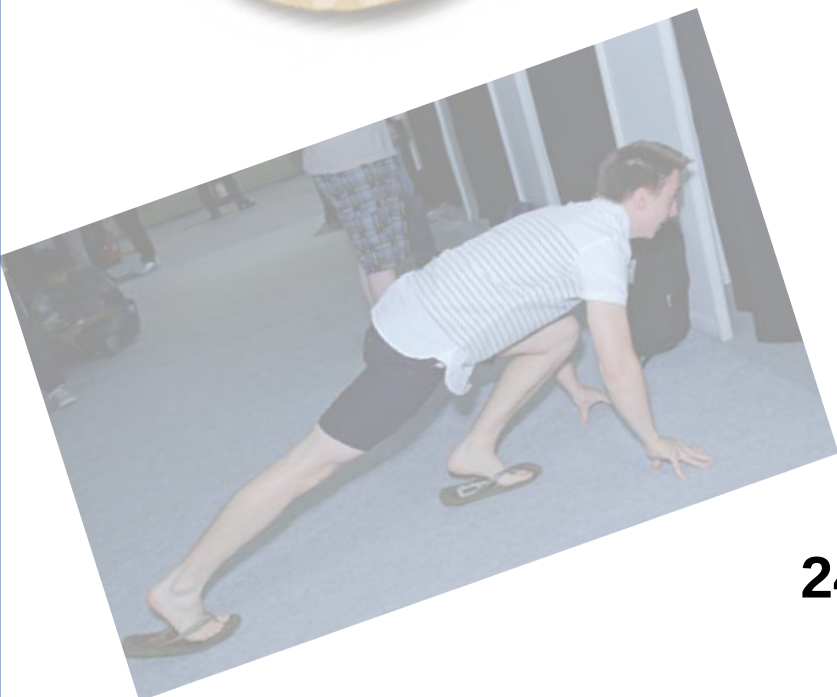


Olympiads and NIUS



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HBCSE
24 November 2016

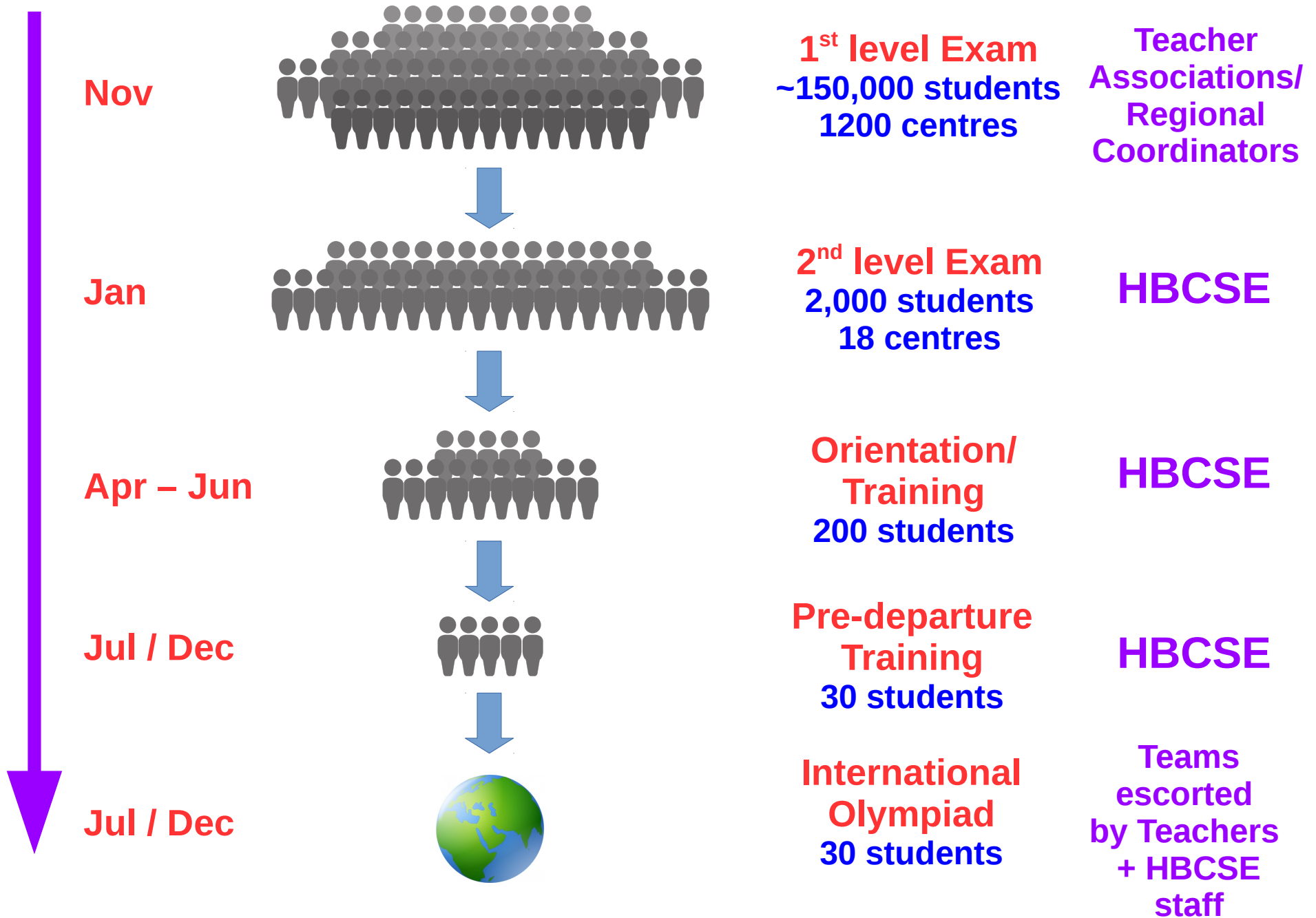
Olympiad Programme

- National programme in six subjects:

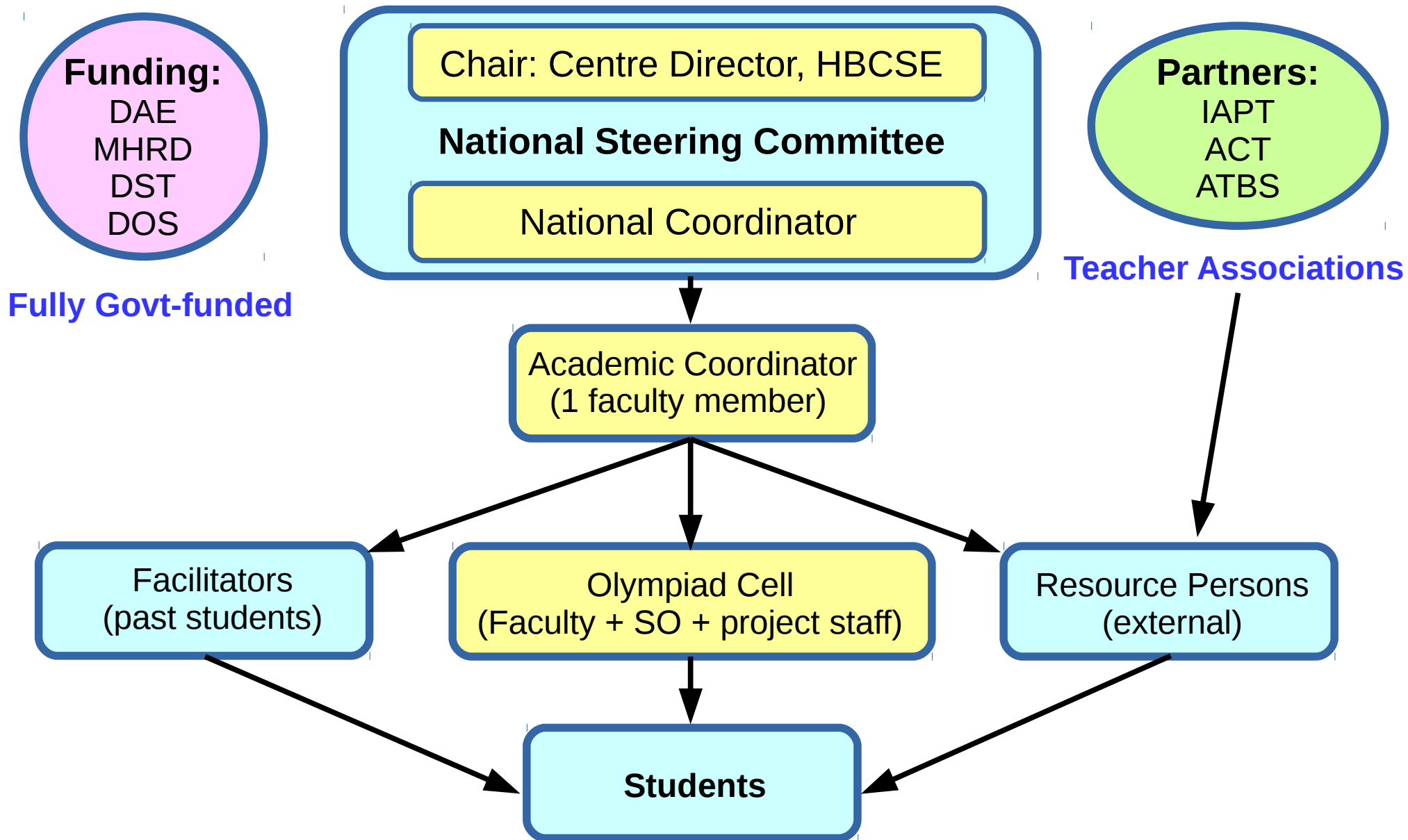
**Mathematics, Physics, Chemistry, Biology,
Astronomy & Astrophysics and Junior Science**

- Leading to participation in International Olympiads
- Three-stage selection coupled with two-stage training
- Fully funded by Govt. of India
- Partnership with NBHM and teacher organisations
- HBCSE is the nodal centre

Overview of the Science Olympiads

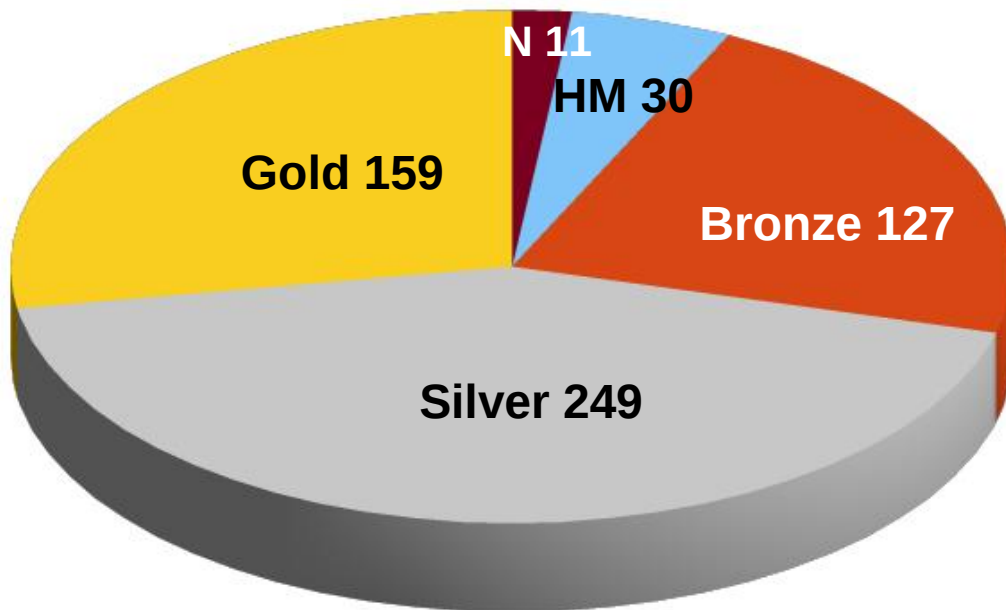


Structure of the programme



A Glittering Performance

Medals in all 6 subjects 1989 – 2016



- Excellent performance of Indian students right from start
- **28%** students have struck **Gold**
- **93%** students have won a medal
- **99% students in last 15 years** have won an award (**32% Gold**)
- Many instances of **special awards**
 - Overall winner
 - Best performance in Theory, Experiment/Observation
 - Team winner

International Olympiads

Olympiad	Year	Place
International Chemistry Olympiad (IChO)	2001	Mumbai
International Astronomy Olympiad (IAO)	2006	Mumbai
International Biology Olympiad (IBO)	2008	Mumbai
Asian Physics Olympiad (APhO)**	2012	Delhi
International Junior Science Olympiad (IJSO)	2013	Pune
International Physics Olympiad (IPhO)	2015	Mumbai
International Olympiad of Astronomy & Astrophysics (IOAA)**	2016	Bhubaneswar

** Academic responsibility only

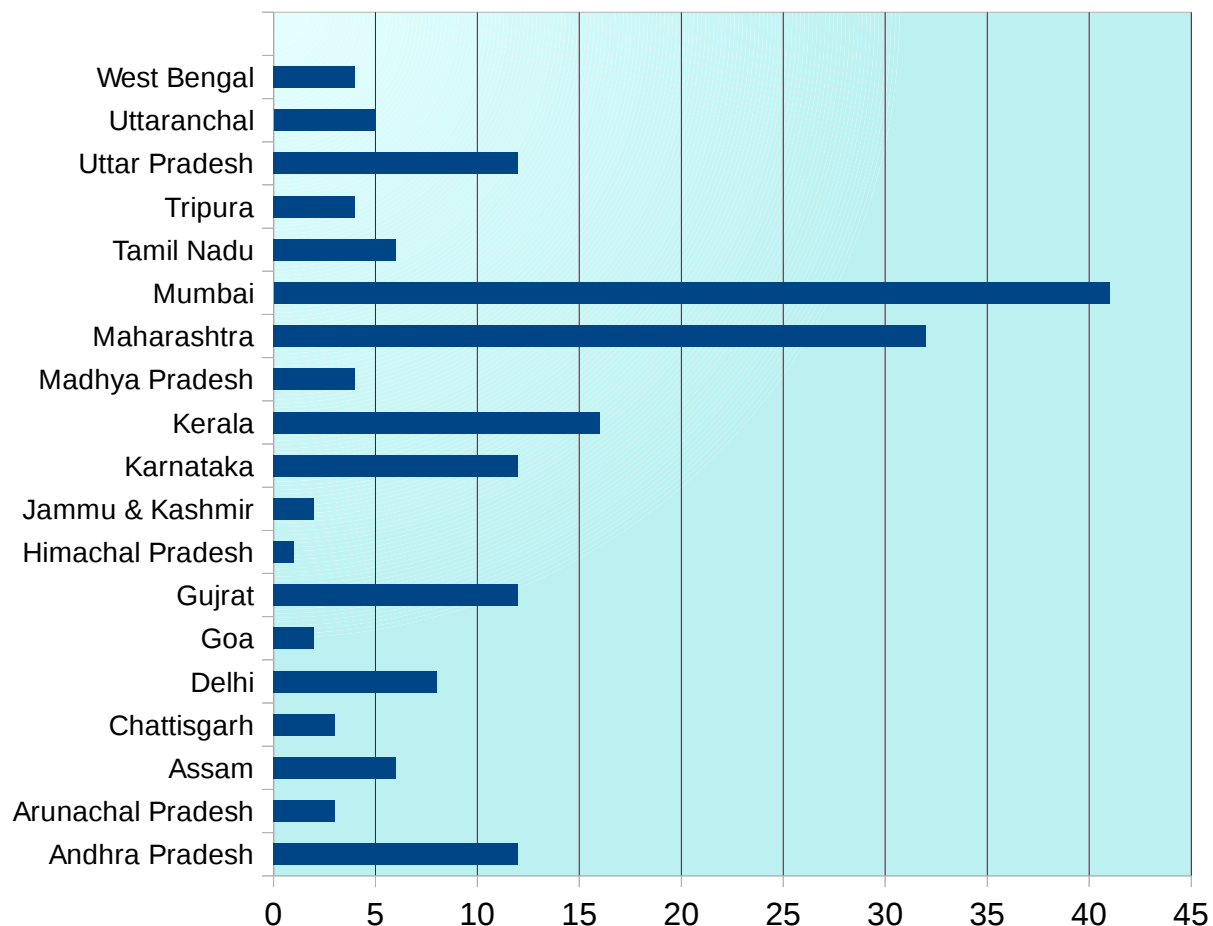
- **Several HBCSE members are currently appointed in International Olympiad academic bodies**

Student training in Olympiads

- **Orientation-cum-selection camp**
 - **Top 35 to 50 students in each subject** from second stage exam
 - **1053** students in Science subjects in last seven years
 - **Conducted at HBCSE** between April and June
 - Duration: **1 – 4 weeks**
 - Involves lectures, tutorials, with **emphasis on experimental sessions, night sky observation**
- **Pre-departure training camp** for 4-6 students in each subject
- Similar camps in **Mathematics** (approx **50 students every year**)
- Teamwork of **HBCSE faculty, scientific staff and educators from across the nation**

Teacher involvement in Olympiads

- **Resource Generation Camps**
 - Started in **2004**
 - **Unique meeting place for teachers and researchers**
 - Outcomes: **high-quality assessment tools** and development of **experiments based on novel ideas**
 - **Direct impact on classrooms** through teacher experience
 - **453 participants in 43 camps in last three years**

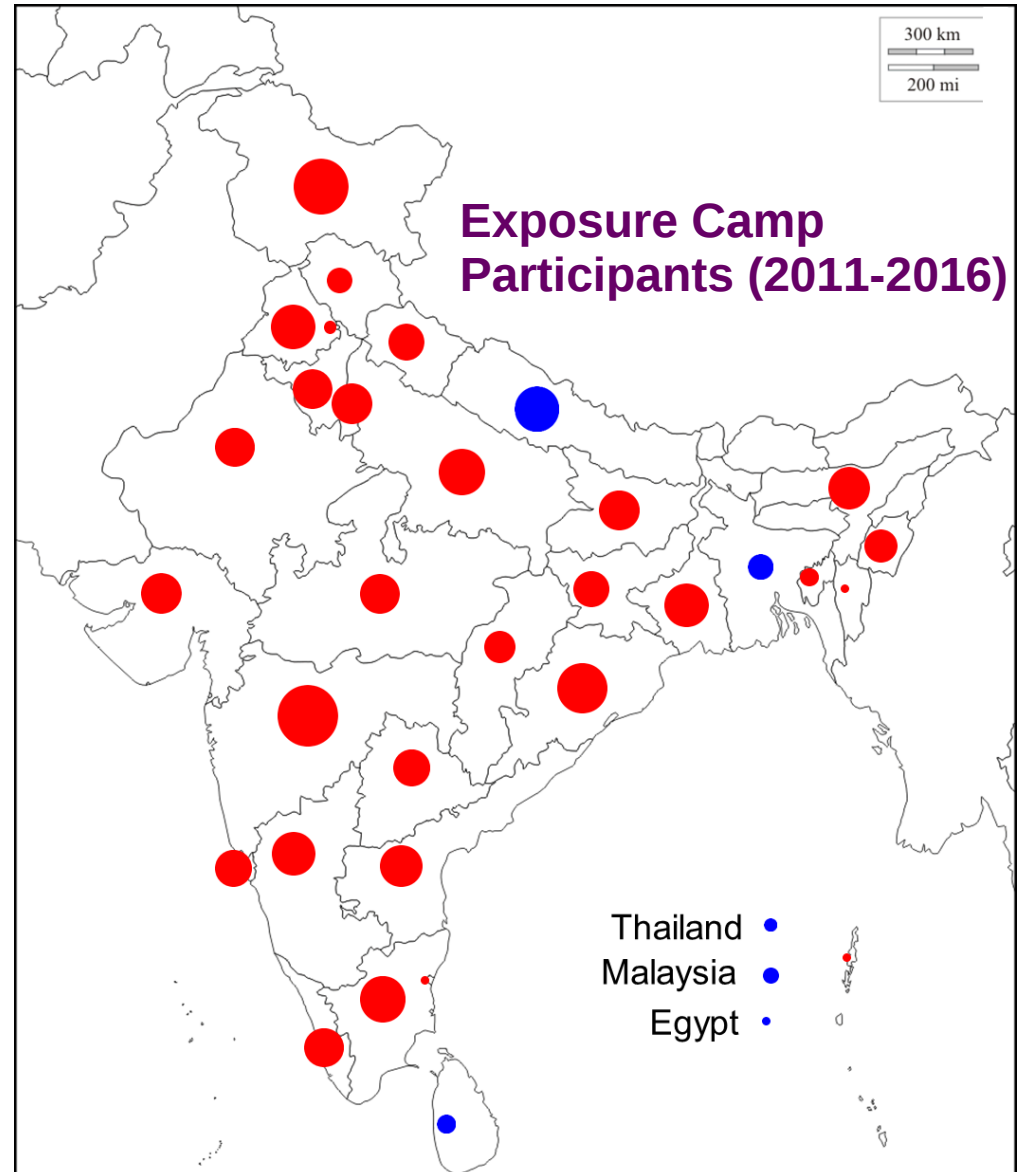


**Chemistry RGC participants
(2011-2013)**

Teacher involvement in Olympiads

Exposure Camps

- Started in **2009**
- **Teachers** and science communicators
- Both **academic** flavour and **organisational** information
- **942 participants (1425 invited) in 26 camps in last 6 years from all over India**
- Participants also from **neighbouring countries**



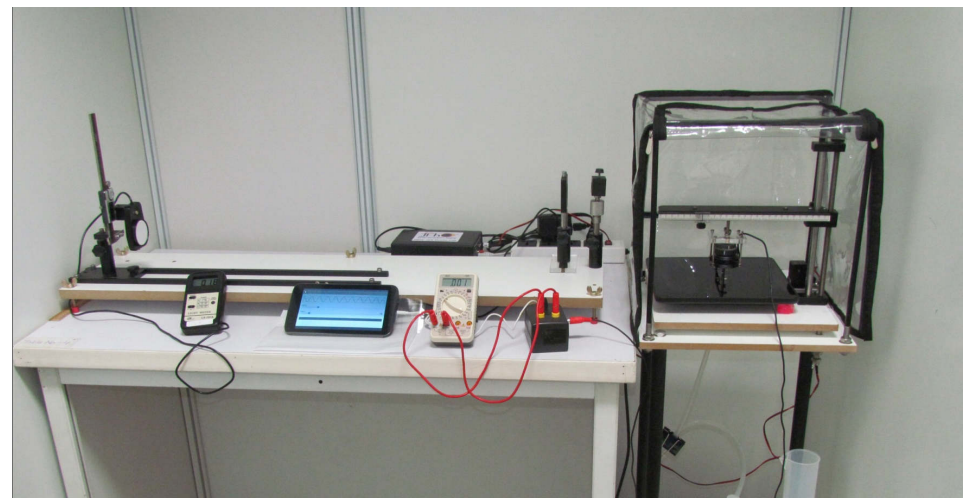
Outreach of Olympiads

- Dissemination of **experimental kits** among schools and colleges
- Publication of **books with detailed solutions** of national and international Olympiads



Outreach of Olympiads

- Involvement of **more than 50 college and school teachers in IPhO**
- Distribution of a large number of IPhO experimental apparatus to colleges



Teachers in IPhO 2015

Z. B. Patil College, Dhule	Hindi H S School, Agartala	St. Bede's College, Shimla	H. B. Desai Govt. High School, Goa
G. J. College, Ratnagiri	Ramkrishna Mission Vidyamandir	NGPE, Dehradun	Abasaheb Garware College, Pune
K. J. Somaiya College, Mumbai	Chakdaha College, Nadia	Army Cadet College, Dehradun	Maharashtra Knowledge Foundation, Pune
St. Xavier's College, Mumbai	Midnapore College, Midnapore	S. G. G. S. College, Chandigarh	St. Paul College, Kerala
APPED, BARC, Mumbai	Rammohan College, Kolkata	Dayalbagh Educational Institute, Agra	BMS College for Women, Bangalore
Siddharth College, Mumbai	St. Xavier's College, Kolkata	St. Xavier's College, Ahmedabad	National Degree College, Bangalore
R. J. College, Mumbai	City College, Kolkata	IET, Ahmedabad	Vijaya College, Bangalore
Mithibai College, Mumbai	Presidency University, Kolkata	St. Xavier's College, Ranchi	VVS Sardar Patel PU College, Bangalore
D. G. Ruparel College, Mumbai	IISER, Kolkata	PMB Gujarati Science College, Indore	Indian Institute of Science, Bangalore
NIO, Mumbai	CAPSS, Bose Institute, Kolkata	Shri Ramdeobaba College, Nagpur	CMI, Chennai
Christ Church College, Kanpur	Ravenshaw University, Cuttack	S. M. Mohata College, Nagpur	Jaypee University, Guna

Salient features of Olympiads

- First stage held all over the country at nearly **1200 centres** enables participation of nearly **180,000 students**
- **Round the year engagement with teachers** – close partnership with teacher associations in every subject. Overall nearly **200 teachers** involved in academic activities at HBCSE every year.
- **High-quality laboratory training**
- **Nominal registration fee (Rs 100)**. Full financial support from DAE, DST, MHRD, DoS.
- **Transparent evaluation and re-evaluation process**
- **Material development and dissemination** in the form of books and experimental kits

Beyond the Olympiads

Extended Nurture – Motivating students through research at the undergraduate stage

**National Initiative on Undergraduate Science
(NIUS)**

in Physics (including Astronomy), Chemistry, Biology

NIUS Programme

- **Background**

- Launched in the year **2004** as part of HBCSE efforts to foray into the tertiary science education sector in India.
- Provides opportunities for research to **college students**

- **Target Groups**

- Motivated **undergraduate science students in colleges**
- Meritorious students pursuing professional degrees but interested in basic sciences
- Motivated college **teachers**

- **General structure for each subject**

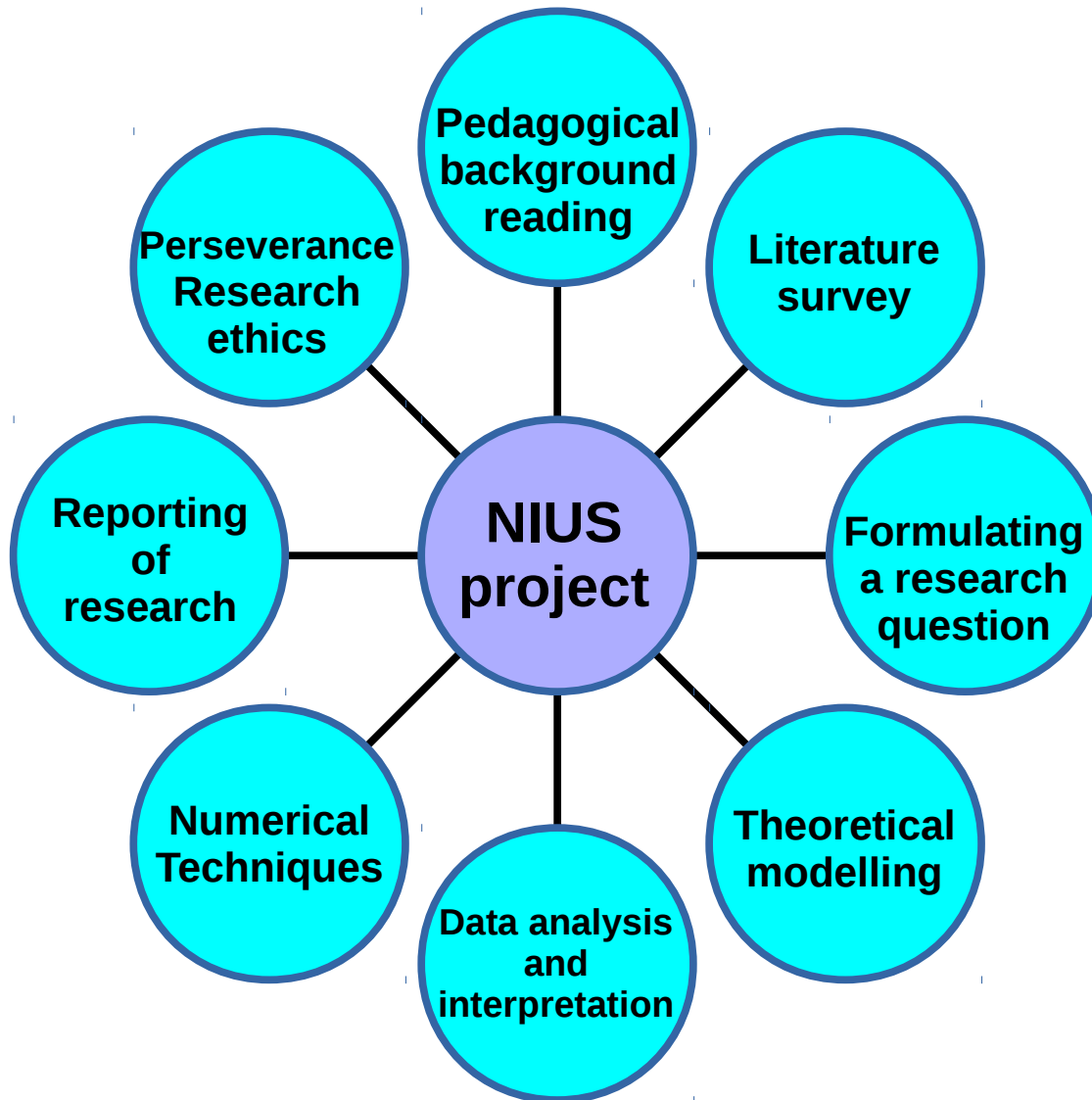
- 4 camps (1 exposure camp + 3 camps for project),
- **40-75** participating students in the first camp in each subject
- **20-45** students offered 2-year projects in each subject

Outline of NIUS programme

- **First camp – Enrichment and Exposure**
 - Sets of 2-4 classroom lectures by eminent researchers
 - Experimental sessions with open-ended/innovative experiments
- **Next three camps over 2 years**: students visit mentors for 1-4 weeks for project work
- Student submits a final report – very often a publication results from it.
- Projects have flexibility about topic and level:
 - Challenging extensions to undergraduate level problems
 - Development/Study of innovative experiments
 - Research on current problems, often using state of the art data



NIUS: what and how do students learn?



Students learn science through research

- Not necessarily to become an expert in the specific field of the research project ...
- ... but the skills they learn in the NIUS project are **fully transferrable** to other areas of science
- Builds **thinking capacity** which helps in understanding science even in the classroom or laboratory
- Projects have **right balance** of existing knowledge of the student and advanced topics

Distinctive features of NIUS

- **Open-ended programme**. Basic aim is to promote learning through projects and research-like activities
 - Great freedom in scope and time allows good educational benefit for student
- **Sustained learning** programme for 2-3 years
- Delinked from grades and examinations
- Projects are offered in **theoretical and experimental areas**
- Provides **research opportunities for college students**
- **Mentors from a wide range of Indian institutions:** HBCSE, TIFR, BARC, IITs, IISERs, IISc, RRI, PRL, IIA, NCRA, IMSc, CMI, IPR apart from a host of colleges under different universities



Outcomes of NIUS

- Enrichment camps: 42 (approx **1800 students**)
- Completed projects: **187**
- **Publications in refereed journals and conferences: 134**
- **A very large fraction of NIUS students choose a research career later on**
- **Development of laboratories** at HBCSE and even some in colleges
- Lecture notes
- **Network of college teachers and researchers**
- NIUS experimental developments at HBCSE have helped the laboratory courses of different scientific institutions like UM-DAE CBS (Mumbai), NISER (Bhubaneswar) & IISER (Pune).

Future directions of NIUS

- **Developing pedagogical resources** for students and teachers
 - lecture notes, experimental kits
- Conducting **workshops for teachers** (content and pedagogy)
- Upscaling the programme and increasing its reach further
 - number, frequency, multiple entry
- **Discipline-based educational research**
- **Computational science** as a thrust area

A national impact

