Proceedings of

epiSTEME 8

International Conference to review research in Science, Technology and Mathematics Education

January 3—6, 2020

Editors
K K Mashood, Tathagata Sengupta
Chaitanya Ursekar, Harita Raval & Santanu Dutta

Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
Mumbai, India

First published in India in 2020 by Gaurang Publishing Globalize Pvt. Ltd.
ISBN No: 9788194156796

Gaurang Publishing Globalize Pvt. Ltd.
1, Plot 72, Pandit M.M.M. Marg, Tardeo, Mumbai 400 034.
Email: gpglobalize@gmail.com
www.gpglobalize.com
Tel: +91 9969392245
CIN No. U22130MH2016PTC287238

On behalf of:
Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
V. N. Purav Marg, Mankhurd, Mumbai, 400088

Printed at: Nil Creation, Girgaum, Mumbai - 400 004, India.

Preface

"We've arranged a global civilization in which most crucial elements profoundly depend on science and technology. We have also arranged things so that almost no one understands science and technology. This is a prescription for disaster. We might get away with it for a while, but sooner or later this combustible mixture of ignorance and power is going to blow up in our faces."

— Carl Sagan

Conference epiSTEME 8 is a biennial international event to review research in science, technology and mathematics education (STME) hosted by the Homi Bhabha Centre for Science Education (HBCSE), a National Centre of the Tata Institute of Fundamental Research (TIFR). Initiated in 2004, the primary aim of the conference is to nurture and promote scholarship in STME research, which is still nascent in India. The conference, by bringing together leading researchers from across the globe, has been playing an important role in strengthening the field in this country. It is unique in its addressal of multidisciplinary issues pertaining to the teaching and learning of science, technology and mathematics. Arguably epiSTEME is the flagship conference in STME research in India, an area that holds great potential for the country owing to its huge, aspiring student and teacher population. Details of the past seven editions of the conference are available at http://www.hbcse.tifr.res.in/episteme.

Quality science education to a larger populace is integral to our economic and societal progress. To enable this challenging task, it is important that we deconstruct the core issues at the intersection of content, cognition and culture relevant to STME education. Conference epiSTEME 8 will have its focus centred around some of these core issues. In particular the conference aims to generate discussion around topics on important scientific practices such as modelling in STME, alternative conceptions in various disciplines, role of language in STME, insights from cognitive science and sociocultural studies relevant to STME, among others. The premise of the conference is based on the conception of science as a liberal art. A panel discussion on the same titled *'Towards a pedagogy of science as a liberal art'* will also be held as part of the conference.

The four different strands and various sub-themes around which the review talks, papers and poster presentations of the conference fall, are:

Strand 1: Historical, Philosophical and Socio-cultural Studies of STME: Implications for Education

- Theme 1: History and Philosophy of STME
- Theme 2: Socio-cultural and gender issues in STME
- Theme 3: Science and Technology Studies
- Theme 4: Science as a Liberal Arts

Strand 2: Cognitive and Affective Studies of STME

- Theme 1: Modelling in Science Education
- Theme 2: Knowledge representation
- Theme 3: Affective aspects of learning
- Theme 4: Problem solving, learning and reasoning
- Theme 5: Visuo-spatial thinking

Strand 3. Language, Pedagogy and Curriculum in STME

- Theme 1: Language and learning
- Theme 2: New Media, Role of ICT in teaching-learning
- Theme 3: Classroom interaction and discourse

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- Theme 4: Assessment and evaluation
- Theme 5: Professional development of teachers
- Theme 6: Educational initiatives and innovations

Strand 4. Discipline-based Education Research with Emphasis on Undergraduate Science Education

- Theme 1: Astronomy Education Research
- Theme 2: Biology/Life Science Education Research
- Theme 3: Chemistry Education Research
- Theme 4: Physics Education Research

There are nine review talks from leading scholars around the globe on some of the key themes mentioned under the above strands. In addition researchers from across the world will be presenting papers and posters. In total epiSTEME 8 received around 110 submissions from 13 different countries (Australia, Brazil, Cyprus, Germany, India, Nepal, Rwanda, Somalia, South Africa, Switzerland, Uganda, United Kingdom and United States). All submissions were sent to at least two reviewers working in related areas for blind reviews. The list of reviewers is included in the proceedings. We thank all the reviewers for their scholarly remarks which we hope helped the authors and significantly improved the quality of the manuscripts. We accepted around 60 papers, out of which authors of 51 papers registered for the conference. Of these 30 papers will be presented in the oral mode and the rest 21 in the poster mode.

We express our sincere gratitude to all members of HBCSE for their help and cooperation at various phases of the conference organisation. In particular we thank Prof. K. Subramaniam and Prof. Sugra Chunawala for their support, guidance and encouragement. We thank the convenors of the previous two editions of the conference, Prof. Savita Ladage and Prof. Sanjay Chandrasekharan for their guidance throughout. We greatly appreciate the contribution from all the members of the academic committee and local organisation committee for the conference. The head of administration Shri Abhyankar and head of accounts Shri V.P. Raul deserve special mention for their help towards planning and execution of various crucial organisational aspects of the conference. We thank Manoj Nair for his help in setting up the conference website, paper submission portal and the payment gateway.

We specially thank Charudatta Navare, Deborah Dutta, and Deepika Bansal for helping us with editing works. We thank Adithi Muralidhar for her guidance with the publication of these proceedings.

— K.K. Mashood, Tathagata Sengupta, Chaitanya Ursekar,
Harita Raval and Santanu Dutta
January 2020

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