

## CONTENTS

Preface	iii
<b>Invited Talks</b>	
1 Teaching mathematics in ways that disrupt patterns of inequity predominant in classrooms <i>Deborah Lowenberg Ball</i>	ix
2 Altruistic Uses of Socio-scientific Capital: A Pro-ecojjustice Pedagogy <i>John Lawrence Bencze</i>	ix-x
3 Mathematics and material media: The role of sense and sensation in mathematical activity <i>Elizabeth de Freitas</i>	x
4 Some Observations on Discipline-Based Educational Research in Science, with Particular Reference to India <i>Arvind Kumar</i>	xi
5 Problem Solving: Strategies, Solutions and Successes <i>Tina Overton</i>	xi
6 Mathematics Research and Teaching: A Transcultural History of the Circulation of Mathematical Ideas between India and Europe ( <i>Keynote lecture</i> ) <i>Dhruv Raina</i>	xii
7 Catalyzing Advances in Undergraduate STEM Education <i>Susan Rundell Singer</i>	xii- xiii
8 Interactive Lecture Demonstrations: An Effective Active Learning Strategy for Lecture <i>David R. Sokoloff</i>	xiii
8 An Empirical Approach to Curriculum Development <i>Jyotsna Vijapurkar</i>	xiv
<b>Strand 1: Historical, philosophical and socio-cultural studies of STM: implications for education</b>	
1 Teaching Feminist Appraisals of History, Philosophy, and Content of Science <i>Deepika Bansal</i>	1
2 The Question of Value in Science Education <i>Abhijeet Bardapurkar</i>	9
3 Children as Film Makers <i>Sachin Datt and Sugra Chunawala</i>	17
4 Measuring Practices, Cultural Contexts and Power Relations: A Study in Rural Bihar <i>Charu Gupta and Md. Jawaid Hussain</i>	26
5 Towards Development of a Scale Based on the Concept of Science Field in Indian Context <i>Ramjit Kumar and Smriti Singh</i>	34
6 Children's Funds of Knowledge, and the Role of the School (Among Other Settings), in Developing 'Science-Related Capabilities' <i>Sindhu Mathai</i>	42
7 Design and Technology Education's Potential to Address Diversity <i>Adithi Muralidhar, Rohan Kapil and Sugra Chunawala</i>	49
8 Health Literacy among Adolescents in a Marginalized Community in India <i>Himanshu Srivastava, Tuba Khan and Aswathy RaVeendran</i>	58

9	Who Knows and Does Science? -Textbook Analysis of Karnataka State Board Science Textbooks of Classes 8 and 9 <i>Indumathi S.</i>	68
10	Science for Children: Survey of Tamil Printed Books (1820 –1857) <i>T.V Venkateswaran</i>	76
<b>Strand 2: Cognitive and affective studies of STME</b>		
11	Orchestrating Dialogic Discourse in Secondary Science Classrooms <i>Garima Bansal</i>	87
12	Additive Model of Language Policy and Hybridity: Glimpses from Numeracy Learning in Early Grades in a South African Province <i>Arindam Bose and Nosisi N. Feza</i>	97
13	Are We Ready for Technology in Classroom?: University Teachers’ Perspectives <i>Mahima Chhabra</i>	107
14	Astronomy Education: A Case for Blended Learning <i>Sheetal Chopde and Shamin Padalkar</i>	116
15	Probing 'Design Thinking' Through Simulation Tasks: A Novel Tool to Elicit Thinking Strategies and Principles in Grassroots Engineering Design <i>Geetanjali Date, Harshit Agrawal and Sanjay Chandrasekharan</i>	125
16	The Conceptual Grid Method: An Effective Approach to Problem Solving in Physics <i>H.S. Vinay Deepak, Chitkala B.C. and H.S. Nagaraja.</i>	137
17	“The Soil is Alive!” – Exploring Emergence of Embodied Environmental Sensibilities in an Urban Farm <i>Deborah Dutta, Sanjay Chandrasekharan and Ankush Gupta</i>	147
18	Vectors in Higher Secondary School Textbooks <i>Durgaprasad Karnam and Aniket Sule</i>	159
19	Mathematics Teachers’ Knowledge and Beliefs in Problem Solving <i>Shweta Naik</i>	168
20	Assessing Mathematical Modelling <i>Xenia-Rosemarie Reit</i>	177
<b>Strand 3: Curriculum and pedagogical studies in STME</b>		
21	Bringing Excitement into Chemistry through Action Research <i>Karanam Bhaskar and Neeraja Raghavan</i>	186
22	In-Service Teacher Enhancement for Improved Science Curriculum Transaction: The Appalachian STS Project <i>Pradeep Dass</i>	195
23	Experiences and Learning from Participatory Action Research with a Local School <i>Narendra Deshmukh, Shubhangi Bhide, Vinod Sonawane, Sugra Chunawala and Jayashree Ramadas</i>	204
24	Zone of Proximal Development in the Era of Connected Computers <i>Amit Dhakulkar, Rafikh Shaikh and Nagarjuna G</i>	214
25	Action Research on Mixed Age Group (MAG) Classes for Mathematics in Middle School <i>Hema Gowda, Kanchana Suryakumar and Shubha Venkataraman</i>	222
26	A Novel Educational Approach Using Parental Occupation Linked Learning for Low Socioeconomic Status Children in India	231

	<i>Lakshya Pawan Shyam Kaura and William H. Marks</i>	
27	Teaching Fractions with Meaning: Moving Beyond the Part-whole Interpretation <i>Ruchi S. Kumar</i>	240
28	A Study on Understanding How Teachers Overcome Challenges of Activity Based Science Teaching in Government School of Sheoganj Block (Sirohi, Rajasthan) <i>Vipin Kumar</i>	247
29	Did Mobile App-Supported Math Trails Increase the Students' Motivation? <i>Matthias Ludwig and Adi Nur Cahyono</i>	251
30	South African Science Teachers' Views on Language Use in Science Teaching and Learning: Messages from Literature and Lessons from Classroom Observation <i>Audrey Msimanga</i>	259
31	Difficulty, Discrimination, and Successive Discrimination Curve: Insights from Indian National Physics Olympiad Exam 2016 <i>Praveen Pathak</i>	269
32	Mathematics Training And Talent Search Programme: A Report <i>Mohan R.</i>	276
33	A Critical Evaluation of a Teacher Professional Development Model – A Case Study of a Physics Pre-Service Teacher <i>Yashwantrao Ramma and Ajeevsing Bhola</i>	285
34	Science Technology Engineering Mathematics (STEM) Land: Fostering Responsibility in Learning in Rural Schools <i>Sanjeev Ranganathan, Arun Iyyanarappan, Poovizhi Patchaiyappan, Pratap Ganesan, Sundarnathan Kodanaraman, Bala Anand, Naveen Kumar and Vaidegi G.</i>	294
35	An Analysis of Question-Response Sequences in Students' Spontaneous Talk <i>Gurinder Singh and Karen Haydock</i>	303
36	Establishing a Community of Participation in a Primary Mathematics Classroom: An Action Research <i>Pooja Keshavan Singh and Haneet Gandhi</i>	314
37	Knowledge Demands Placed on a Mathematics Teacher in Learning to Teach Responsively <i>Shikha Takker</i>	323
38	Negotiating Complexity while Writing Science Textbooks: A Case Study of a Discourse on Farming Methods <i>Rosemary Varkey</i>	332
39	Evaluation of Students' Cognitive Skills using Objective Type Questions <i>Rekha Vartak and Anupama Ronad</i>	341

**Strand 4: Discipline-based education research with emphasis on undergraduate science education**

40	What Faraday Couldn't See in His Gold Sols. Using Classic Research Articles to Implement Problem-Based Learning in Nanoscience <i>Sangeetha Balakrishnan</i>	347
41	Enlivening the Teaching and Learning of Chemistry <i>Reshma Kiran</i>	356
42	Probing Students' Understanding of Quantum Mechanical Eigenstates at Tertiary Level <i>Mahima Chhabra and Ritwick Das</i>	364

43	Exploration of Students' Understanding of Vector Addition and Subtraction <i>Usharani D and Meera B. N.</i>	374
44	Teaching One-Dimensional Time Independent Schrödinger Equation using Spreadsheet <i>Ashish Desai, Rajendra Adhikari and Vijay Peddasingh</i>	383
45	Effect of an Online Schema Based Learning Course on Conceptual Understanding of Physics Problems <i>Manoj Praveen G.</i>	392
46	Understanding Inertia of Motion through Galileo's Inclined Plane Experiment <i>Vijetha K.R., Ramasimha B, Raghavendra M.K. and Nagaraja H.S.</i>	400
47	Hot Skills Analysis in State Board Higher Secondary Physics Examinations of India <i>Moheeta Khan and Mohd Abid Siddiqui</i>	408
48	A Conceptual Test for the Physics Laboratory: Question-Framing Aids Articulation but also Reveals Susceptibility of Beliefs <i>Anish Mokashi and Karthik Bhat</i>	417
49	Use of Tarsia Grid as a Teaching Aid to Facilitate Active Learning in Chemistry Education <i>Aarathi P, Helen Kavitha and Vimala Oak</i>	427
50	Indian K-12 Physics Education: The Role of Gender and Language <i>Himanshu Pandey and Vijay Singh</i>	433
51	An Exploratory Study about Students' Misconceptions in Chemistry <i>Ram Babu Pareek</i>	440
52	An Empirical Study to Evaluate Undergraduate Students' Understanding of Sterilization and Disinfection <i>Aakanksha Sawant, Swapnaja Patil, Deepti Gupta, Jyotsna Vijapurkar and Needa Bagban</i>	447
53	Probing Students' Conceptualisation of Human Digestive System using Drawings Based Task <i>Garima Singh</i>	456
54	Misconceptions in Astronomy Present in High School Teachers: A Pilot Study <i>Aniket Sule and Swapnil Jawkar</i>	466
	List of Reviewers for epiSTEME 7	475
	Committees	476