

Lecture Notes in Educational Technology

Series Editors

Ronghuai Huang, *Smart Learning Institute, Beijing Normal University, Beijing, China*

Kinshuk, *College of Information, University of North Texas, Denton, Canada*

Mohamed Jemni, *University of Tunis, Tunis, Tunisia*

Nian-Shing Chen, *National Yunlin University of Science and Technology, Taiwan, Taiwan*

Arif Altun, *Department of Computer Education and Instructional Technology, Hacettepe University, Ankara, Türkiye*

The series Lecture Notes in Educational Technology (LNET), has established itself as a medium for the publication of new developments in the research and practice of educational policy, pedagogy, learning science, learning environment, learning resources etc. in information and knowledge age, – quickly, informally, and at a high level.

Abstracted/Indexed in:

Scopus, ACM Digital Library, ERIC, INSPEC, Norwegian Register for Scientific Journals and Series, SCImago

Shitanshu Mishra · Aditi Kothiyal · Sridhar Iyer ·
Sameer Sahasrabudhe · Andreas Lingnau ·
Rita Kuo
Editors

Proceedings of the International Conference on Technology 4 Education 2024, Volume 2

Editors

Shitanshu Mishra
ICSSR Building
UNESCO MGIEP
New Delhi, Delhi, India

Sridhar Iyer
Educational Technology
Indian Institute of Technology Bombay
Mumbai, Maharashtra, India

Andreas Lingnau
Computer Science
German University of Applied Sciences
Potsdam, Germany

Aditi Kothiyal
Indian Institute of Technology Gandhinagar
Palaj, Gujarat, India

Sameer Sahasrabudhe
Indian Institute of Technology Gandhinagar
Gandhinagar, Gujarat, India

Rita Kuo
Computer Science Department
Utah Valley University
Orem, UT, USA

ISSN 2196-4963

ISSN 2196-4971 (electronic)

Lecture Notes in Educational Technology

ISBN 978-981-95-1733-6

ISBN 978-981-95-1734-3 (eBook)

<https://doi.org/10.1007/978-981-95-1734-3>

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Singapore Pte Ltd. 2025

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

If disposing of this product, please recycle the paper.

Preface

The International Conference on Technology 4 Education (T4E) 2024 continues to serve as a premier forum for researchers, practitioners, and industry professionals to discuss innovations in educational technology and the challenges associated with its adoption. The conference focuses on four major themes: *Development of Technologies to Support Education, Understanding How People Learn, Pedagogical Strategies and Interventions, and Access, Scale, and Sustainability*. This year, we have introduced additional themes, including *Culture and Technology, Out-of-School and Informal Learning, Education for Sustainable Development Goals, and Democracy, Technology, and Education*.

T4E 2024 was hosted by IIT Gandhinagar from 6–8 December 2024, bringing together experts from around the world to share their research and insights. The conference featured an engaging program with keynote speeches, invited talks, panel discussions, workshops, industry demos, and paper presentations, fostering rich discussions on the future of educational technology.

This year, T4E received 209 abstract submissions, out of which 186 qualified for further review. Each paper underwent a rigorous double-blind peer-review process, with at least two reviewers providing feedback. The final selection included 28 full papers, 54 short papers, and 24 poster presentations, ensuring a high standard of academic contribution.

We sincerely thank the technical program committee members, reviewers, session chairs, workshop coordinators, and industry partners for their invaluable support in shaping this conference. We extend our gratitude to the keynote speakers for their thought-provoking talks and to all authors and presenters for their contributions. Special appreciation goes to IIT Gandhinagar and the entire organizing committee for their efforts in making T4E 2024 a success.

We hope that the discussions and research presented at T4E 2024 will inspire future advancements in educational technology. We look forward to your participation in the next edition of the T4E conference.

Shitanshu Mishra
Aditi Kothiyal
Andreas Lingnau

Organization

General Co-chairs

Sridhar Iyer
Rita Kuo

IIT Bombay, India
Utah Valley University, USA

Program Chairs

Shitanshu Mishra
Aditi Kothiyal
Andreas Lingnau

UNESCO MGIEP, India
IIT Gandhinagar, India
German University of Applied Sciences

Local Organizing Chairs

Sameer Sahasrabudhe
Richin Kottaram

IIT Gandhinagar, India
Indian Institute of Management, Ahmedabad,
India

Finance Chairs

Sameer Sahasrabudhe
Richin Kottaram
Pankaj Chavan

IIT Gandhinagar, India
Indian Institute of Management, Ahmedabad
IIT Jodhpur

Workshop Chair

Shashikant Shankar

Amrita Vishwa Vidyapeetham

Workshop Co-chair

Deepti Reddy

NMIMS, Mumbai

Best Practices and Teaching Demos Co-chairs

Soumya Narayana

IIT Bombay

Yogendra Pal

NIIT University

Tools and Product Demos Chair

Brijju Thankachan

EdTech Society

Tools and Product Demos Co-chair

Bhumika Shah

Gujarat University

Academic Outreach Chair

Jayakrishnan Warriem

IIT Madras

Academic Outreach Member

Nandan P. A.

IIT Bombay

Industry Liaison

Pankaj Chavan

IIT Jodhpur

Mrityunjay Kumar

Independent Consultant

Foundations and Nonprofits Liaison

Navneet Kaur

IIT Delhi

Diversity, Equity and Inclusion Chair

Lakshmi Ganesh T. G.

Shikha Academy

Consultants

Sahana Murthy	IIT Bombay
Kannan Moudgalya	IIT Bombay
Venkatesh Kamat	IIT Goa
S. Ramani, Professor (Retd)	IIIT Bangalore
Kinshuk	University of North Texas, Denton
Ramkumar Rajendran	IIT Bombay

Conference Managers

Spruha Satavlekar	IIT Bombay
Setu Maheshwari	IIT Bombay
Daevesh Kumar Singh	IIT Bombay

Program Committee Members

Aanchal Sharma	Indian Institute of Technology Gandhinagar
Aastha Patel	Rocket Learning
Adithi Iyer	Indian Institute of Technology Gandhinagar
Aditi Kothiyal	Indian Institute of Technology Gandhinagar
Ajita Deshmukh	MIT Art, Design, and Technology University
Alekh V.	Indian Institute of Technology Bombay
Alisha Sinha	Indian Institute of Technology Bombay
Amalan Sigmund Kaushik S.	National Institute of Technology Tiruchirappalli
Aman Deep Singh	Nirma University
Andreas Lingnau	German University of Applied Sciences
Amit Paikrao	Indian Institute of Technology Bombay
Anita Diwakar	VJTI-TBI
Antony Prakash	Indian Institute of Technology Bombay
Aparajita Biswal	Parul University
Archana Sharma	K. J. Somaiya College of Engineering
Arjun Prasad	Indian Institute of Technology Bombay
Ashutosh Raina	EdTech Society
Ashwin T. S	Indian Institute of Technology Bombay
Astha Kotnala	Indian Institute of Technology Gandhinagar
Balraj Rathod	University of British Columbia
Bernard Yett	Stevens Institute of Technology
Chandan Medatwal	NIIT University Neemrana, Rajasthan
Charalampos Karagiannidis	University of Thessaly

Chathurya Kumarapperuma	Sri Lanka Institute of Information Technology
Daevesh Singh	IIT Bombay
David John	Indian Institute of Technology Bombay
Debarshi Nath	Indian Institute of Technology Bombay
Deepti Reddy	SIES Graduate School of Technology
Dipak Tatpuje	Vidyadeep Foundation, Satara, Maharashtra
Dipali Awasekar	Walchand Institute of Technology
Geetanjali Date	MSFDA
Herold P. C.	Indian Institute of Technology Bombay
Ilavenil K.	Karpagam Faculty of Medical Sciences and Research
Indra R.	Indian Institute of Technology Bombay
Indrayani Nishane	Indian Institute of Technology Bombay
Ishika Ishika	Indian Institute of Technology Bombay
Jatin Ambasana	Indian Institute of Technology Bombay
Jayakrishnan M.	NPTEL
Jon Mason	Charles Darwin University
Jorge Bacca-Acosta	Fundación Universitaria Konrad Lorenz
Jyoti Shaha	Indian Institute of Technology Bombay
Jyotiprava Mohanta	Indian Institute of Technology, Kharagpur
Kabyashree Khanikar	Indian Institute of Technology Bombay
Kapil Kadam	KIT's College of Engineering
Kaushik Mallibhat	KLE Technological University
KiranKumar Eranki	SR University Warangal
Kinshuk	University of North Texas
Krishna Kanta Roy	Symbiosis School of Economics, Symbiosis International (Deemed University), Pune
Lakshmi T. G.	Shikha Institute of Education
Leena Bhattacharya	Tilburg University Department of Econometrics and Operations Research
Lucian Ngeze	University of Dodoma
Madhuri Mavinkurve	Shikha Institute of Education
Manisha Nirgude	Walchand Institute of Technology, Solapur
Manjunath Vanahalli	Indian Institute of Information Technology Dharwad
Manjunatha Byrappa	Visvesvaraya Technological University, Karnataka
Meera Pawar	Indian Institute of Technology Bombay
Ming-Chi Liu	Feng Chia University
Mohini Darji	Devang Patel Institute of Advance Technology and Research
Muralidhar Kurni	Independent Consultant for Pedagogy Refinement, EduRefine, Ananthapuram

Natasha Gomes	Goa University
Navneet Kaur	IIT Delhi
Nishchal Shukla	EI
Nisumba Soodhani K.	Indian Institute of Technology Bombay
P. A. Nandan	Indian Institute of Technology Bombay
Pankaj Chavan	Indian Institute of Technology Jodhpur
Parkavi A.	Ramaiah Institute of Technology
Prabha Kasliwal	MIT Academy of Engineering
Prachi Rajarapollu	MIT Academy of Engineering
Prajish Prasad	FLAME University
Prakash Hegade	KLE Technological University
Pratiksha Patil	Indian Institute of Technology Bombay
Pratiti Sarkar	Indian Institute of Technology Bombay
Preethi Baligar	KLE Technological University
Preeti Patil	KLE Technological University
Priya Nagvekar	Indian Institute of Technology Bombay
Priyadarshni Elangaivendan	Homi Bhabha Centre for Science Education, TIFR
Radhika Amashi	K L E Technological University
Rafikh Shaikh	Tata Institute of Social Sciences
Rajashri Priyadarshini	Indian Institute of Technology Bombay
Ram Das Rai	Indian Institute of Technology Bombay
Ramkumar Rajendran	Indian Institute of Technology Bombay
Rekha Ramesh	Freelance Education Technology Researcher
Ruchi Dwivedi	NCERT
Rwitajit Majumdar	Kumamoto University
Sahana Murthy	Indian Institute of Technology Bombay
Sameer Sahasrabudhe	Indian Institute of Technology Gandhinagar
Sanjay Chandrasekharan	HBCSE TIFR
Sasikumar M.	CDAC
Saurabh Mehta	Vidyalankar Institute of Technology
Sheeja Vasudevan	Indian Institute of Technology Bombay
Shilpi Banerjee	Azim Premji University, Bangalore
Shitanshu Mishra	UNESCO MGIEP
Shruti Jain	Vanderbilt University
Siddhi Sreemahadevan	PSG College of Technology, Coimbatore
Soumya Narayanan	KLE Technological University
Spruha Satavlekar	Indian Institute of Technology Bombay
Sreecharan Sankaranarayanan	Amazon
Sridhar Iyer	Indian Institute of Technology Bombay
Suja J.	Vidyalankar Institute of Technology
Sumitra Sadhukhan	Indian Institute of Technology Bombay
Sunita Raste	Indian Institute of Technology Bombay, India

Suprabha Jadhav
Syaamantak Das
Tanmay Sinha

Ulfa Khwaja
Veenita Shah
Vikram Vincent
Vinod Kanvaria
Viraj Kumar
Vishwas Badhe
Vivek Sabanwar
Yogendra Pal

Indian Institute of Technology Bombay
Indian Institute of Technology Bombay
National Institute of Education, Nanyang
Technological University
Indian Institute of Technology Bombay
Tata ClassEdge Limited
Freethought Labs
University of Delhi
Indian Institute of Science
Indian Institute of Technology Bombay, India
Texas A&M University
NIIT University

Contents

Original Research Track: Short Papers

Learning Content Metadata Generation Through Fine-Tuning LLMs in Learning Experience Platforms	3
<i>Ayush Kataria and H. M. Venkateshprasanna</i>	
Social Learning Through Enterprise Learning Experience Platforms: A Usage Pattern Analysis	11
<i>H. M. Venkateshprasanna and Nitish Kumar</i>	
Enhancing Aptitude Skills: Development and Expansion of the Apti-Trainer Android App	19
<i>Mihir Patki, Aarya Teli, Saira Sanadi, Dhanashri Nirmal, Shraddha Patil, and Kapil Kadam</i>	
First-Year Design Challenges: A Qualitative Study on Student Experiences from Ideation to Prototyping	27
<i>Soumya Narayanan, Preethi Baligar, and Ashwin R. Kubasadgoudar</i>	
Evaluating the Impact of an Extended Orientation Program on First-Year Engineering Students' Perceptions of Engineering Attributes and Self-efficacy	35
<i>Garima Nagal, Aditi Kothiyal, and Sameer Sahasrabudhe</i>	
Unlocking the Triggers: Automating the Identification of Triggers of Socially Shared Metacognitive Regulation in Collaborative Problem-Solving	43
<i>N. V. J. K Kartik, Priyesh Gupta, Vinayak, Aarsh Desai, Vishwas Badhe, T. S Ashwin, Manjunath Vanahalli, and Ramkumar Rajendran</i>	
Assessing Social Emotional Learning in Diverse Contexts: Insights from an Exploratory Analysis Using MPA and CP-SRLI in India and Kenya ...	52
<i>Antony Prakash, Nisumba Soodhani K, Anand Sharma, Amit Mishra, Swati Shelar, and Ramkumar Rajendran</i>	
AI-Based TEL Tools for Teaching Through the Lens of Engineering Teachers	61
<i>Gayathri Pothancheri, Manu Latheesh, Bicky Kuriappan, Ishika Ishika, and Shashi Kant Shankar</i>	

Scaffolding Young Professionals in Preparation for English Group Discussions Using TalkingTree, A Virtual Reality-Based Learning Solution	69
<i>Alisha Sinha, Suraj Tamboli, Vishal Shede, Deepika Yadav, and Sridhar Iyer</i>	
Engaging the MOOC Learners to Excel Through Interventions: A Brief Review	78
<i>Shobita Rao and Indrayani Nishane</i>	
PitchVR: A Virtual Reality Environment for Elevator Pitch Practice for Postgraduate Students	86
<i>Ganesh Beniwal, Nisha Biju, Mohini Misale, Amrit Pal Singh, Omkar Joshi, and Sridhar Iyer</i>	
Unfolding Course Delivery with Identify Assign Assess Analyze-A Powerful Experiential Learning Model	95
<i>S. B. Prapulla, Shanta Rangaswamy, Malavika Hariprasad, N. Neha, Nimisha Dey, and G. Pratiksha Narasimha Nayak</i>	
Impact of Gamification on Student Engagement and Retention: An Experimental Study on Indian School Going Students	104
<i>S. K. Logeswaran, V. Preethi, and Krishna Kanta Roy</i>	
Addressing Ethical Dimensions of Data Custodianship in AIED Through Data Commons	113
<i>Shitanshu Mishra, Arpan Tulsyan, Navneet Kaur, and Daevesh Singh</i>	
Unboxing Learner Engagement in an Online Program on Social-Emotional Learning (SEL) for Teachers	121
<i>Hritik Gupta and Shitanshu Mishra</i>	
Artificial Intelligence for Legal Assistance: A Prescriptive Analytics Model Integrating Social Emotional Learning for Assisting Victims of Domestic Violence in India	132
<i>Dipali Awasekar and L. M. R. J. Lobo</i>	
Predicting Group Performance Through Individual Contributions: Augmenting Peer Evaluation with Group Speech	141
<i>Pratiksha V. Patil, Ashwin T. S, and Ramkumar Rajendran</i>	
The State of Educational Technology Products in India: Unveiling Performance Insights from EdTech Tulna Evaluations	149
<i>Angelina Susan Philip, Ishika Ishika, and Sahana Murthy</i>	

Enhancing Engineering Mathematics Learning Through Mathematics Laboratory: A Review of Practices and Implications of Innovative Techniques	157
<i>V. Chaitra and M. R. Deepthee</i>	
AI-Powered Learning: Exploring the Dual Impact of Generative AI Chatbots on Enhancing Cognitive Skills and Efficiency Amongst Computer Science Learners	166
<i>Poorna Shankar, Jayasri Murali, Soumitra Das, Abhilash Shinde, and Manvi Tekriwal</i>	
How Effectively Can Off-the-Shelf Generative AI Tools Solve Circuit Design Problems?	177
<i>Md Azhaan, Mohd Afeef, and Viraj Kumar</i>	
Interactive Simulation Tool to Help Students Blend Visuospatial and Conceptual Elements While Learning Electromagnetic Induction	189
<i>Shizuka Dara, Saurabhee Huli, Melwina Albuquerque, and Sanjay Chandrasekharan</i>	
Empathy in Engineering Education: A Bibliometric Study	198
<i>Sanjeevini Gundagatti, Preethi Baligar, Vinay Talageri, and Radhika Amashi</i>	
Integrating Cultural Heritage with Engineering Education: Engaging Students Through Innovative Pedagogies	206
<i>Aswathi Chandran, Yogesh Velankar, and Georg Gutjahr</i>	
EACR Framework for Capacity Building of Science Educators in Writing Science Stories	214
<i>Dhairya Pandya, Savita Sharma, Vivek Sabanwar, and Gauri Pednekar</i>	
Using Google 'Read Along' Mobile Application in Classrooms to Develop Hindi Language Skills in Young Readers	222
<i>Aanchal Sharma</i>	
Designing a Sequence of Systems to Facilitate the Evolution of Embodied Learning in Teaching Rate of Change and Slope in 7th Grade	230
<i>Melwina Albuquerque, Shizuka Dara, Priyadharshini Elangaivendan, and Sanjay Chandrasekharan</i>	
In-Service Teacher Education: Insights from a Blended Science Teaching Course in India	238
<i>Shamin Padalkar, Rafikh Shaikh, and Avanish Singh</i>	

Experience Report Track: Short Papers

Status of Open Education Resources Suitable for Indian Context: Case of Biology Subject Resources	249
<i>Rani Prasad, Sonali Kadam, and Rafikh Shaikh</i>	
Employing Team-Based (Active) Learning Strategies in Undergraduate Biological Science and Engineering Education	257
<i>Ashish Katyal, Pankaj Kumar Sharma, and Manoj Kannan</i>	
Augmented Reality for Engineering Exploration: Visualizing Mechanical Concepts	264
<i>Krishna Hassaraddi, Radhika Amashi, B. M. Priyanka, and M. Vijayalakshmi</i>	
Initial Analysis of Student Team Response Data from a Web Platform for Guided Inquiry Learning	272
<i>Clif Kussmaul, Kelly Butler, Richard S. Moog, and Patricia B. Campbell</i>	
Interactive Storytelling with StoryBuilder: A Generative AI Approach to Reading	280
<i>Dev Dutta, Shivangi Dixit, and Navya Monson</i>	
Enhancing COA Learning: A Structured Approach to Individual Contributions and Team Dynamics	288
<i>Namrata D. Hiremath, Aruna S. Nayak, and F. M. Umadevi</i>	
Factors Influencing Success and Failure in a PBL-Based Robotics Competition	296
<i>Kaushik Srivatsan, Suprabha Jadhav, Kavi Arya, and Sridhar Iyer</i>	
Impact of Flipped Classroom Approach: Teaching and Learning Motivation for Engineering Education	304
<i>Mansi Sharma, Antony Prakash, and Usha Chahal</i>	
Curating Open Educational Resources for a School Education System: An Experience Report	312
<i>Anil Mammen and Sadaqat Mulla</i>	
Exploring PBL in Real-Life Course Projects: An Analysis of Two Consecutive Years	320
<i>Suprabha Jadhav, Meera Pawar, Sumitra Sadhukhan, and Sridhar Iyer</i>	

Learner Engagement and Role of Technology in Online Asynchronous Courses	327
<i>Rishav Chakraborty</i>	
Analysis of Problem-Based Learning on Undergraduate Students' Problem-Solving Skills in Operation Research Course – A Case Study	336
<i>Nagaraj Peddapalli and Sumitra Sadhukhan</i>	
Rural Grassroots Knowledge Enriches Contextual and Cultural Makerspaces	344
<i>Rahul Aggarwal, Ridhi Aggarwal, and Akshita Kaushik</i>	
Harnessing Jigsaw Learning for Effective Visualization Tool Exploration in Learning Algorithms Course	351
<i>R. Indra, Spruha Satavlekar, Sumitra Sadhukhan, P. D. Parthasarathy, and Priya Nagvekar</i>	
Beyond the Code: Identifying Surface Learning Approaches in Engineering Students' Programming Solutions	360
<i>Kanchan Patil and Vishwas Badhe</i>	
Enhancing Students' Learning by DIY Experiments: Dynamics Using Smartphone-Based Sensing	370
<i>Aakash Dewangan, Sumanta Kumar Dutta, Subodh Bhosale, and V. Kartik</i>	
Author Index	379