INTERDISCIPLINARY PROGRAMME IN EDUCATIONAL TECHNOLOGY
Annual Report 2021-22

Introduction

The Interdisciplinary Programme in Educational Technology (IDP-ET) started in the Institute in the Autumn semester of the academic year 2010-11. The IDP-ET conducts research in areas of pedagogies and tools for technology-enhanced learning. In addition to Institute courses for Ph.D. and MTech, the IDP-ET organizes short-term courses and MOOCs on effective teaching-learning with emerging technologies and educational research methods through CEP, NPTEL, and IITBombayX. Members of the IDP-ET play a significant role in the organization of international conferences, carry out government and industry-sponsored projects and provide consultancy.

Noteworthy highlights:

- **EdTech Tulna Launch**: Created by the IDP in Educational Technology in partnership with Central Square Foundation, EdtechTulna provides evidence-led quality standards for EdTech products to guide decision making. The initiative was launched on November 26, 2021.
- **EdTech Society:** Faculty and Alumni of EdTech dept, registered a new society to improve instruction and learning through the use of educational technologies in India. This society will provide a public forum for linking research and best practices in educational technology to improve instruction and learning within India and internationally. Society registered in
- **EdTech Video Podcast:** The EdTech department started a new [YouTube video interview podcast](#) series, **"Talk Brainy to Me!"** and **"My Take on EdTech"** to get diverse viewpoints from experts in various fields to discuss their experiences and perspectives on topics related to education, technology, and neuroscience. This initiative was started in May 2021.

People

Convener: Prof Sridhar Iyer

Faculty members: The IDP-ET has 6 core faculty members, 1 adjunct faculty, and 16 associate faculty members from academic units across the Institute.

Academic staff: The IDP-ET has 5 post-doctoral research associates and a number of project research staff and interns.

Alumni: The IDP-ET has 19 Ph.D. and 5 M.tech alumni, who are currently pursuing various careers: post-doctoral researchers in India and abroad, college faculty, e-learning industry, independent consultants, and start-ups.

Academic Programmes

The IDP-ET offers Ph.D. and M.Tech. programs in Educational Technology.

Ph.D. students
Currently enrolled: 38
Degrees awarded in 2021-22: 3

M.Tech students
Currently enrolled: 15
Degrees awarded in 2021-22: 5

Courses:

The IDP-ET continues to offer core courses and electives in various topics in educational technology. These courses have had enrolment from B.Tech, M.Tech, and Ph.D. students in other academic programs within the Institute. The following new courses were added to the curriculum in 2021-22:
- Educational App Design
- Educational Neuroscience

R & D Activities
The main research areas of focus of the IDP-ET are:
- <u>TELeaD</u>: Technology-enhanced learning of disciplinary practices focuses on developing students' cognitive skills such as design thinking, problem-posing, estimation, algorithmic thinking, modeling, data representation and analysis, and divergent-convergent thinking. We design, develop and evaluate TELeaD environments for various thinking skills in different domains.
- <u>TUET</u>: Teacher Use of Educational Technology focuses on the research-informed development and outreach of ideas and innovations for empowering teachers in effective use of educational technology. Contributions of TUET include models for learner-centric MOOCs and large scale teacher professional development, development of teachers' design thinking, tools and strategies for effective technology integration and analysis.
- <u>EDA</u>: Educational data analytics is an emerging field where data pertaining to student behaviour in a computer mediated environment are used to analyse cognitive and affective states. Key EDA objectives are:
    - Use of multimodal data such as mouse clicks, MOOC navigation data, eye gaze information, facial emotion recognition, galvanic skin conductance and brain waves to understand learner behaviour
    - Use machine learning and big data analytics to model and predict learner behaviour
    - Design the next generation of learning products such as intelligent tutoring systems in which the learning content is personalized based on student's prior knowledge, cognition and emotion
- <u>Emerge</u>: Identify potential benefits that emerging technologies such as augmented reality, virtual reality, wearable devices etc might afford in the teaching-learning process and design appropriate learning activities with use of such technologies.

Sponsored Projects
Ongoing
- Next Education Research Lab. Endowed lab sponsored by Next Education India Pvt. Ltd. 2017-22
- Edtech Product Rating. Sponsored by Central Square Foundation, 2020-23
- Personalized Adaptive Tutoring System to Train the Employees, Sponsored by Bank of Baroda Innovation Center, 2020-22
- Multimodal Learning Analytics for Intelligent Tutoring Systems, Sponsored by Science and Engineering Research Board, Startup research grant. 2021 - 22
- Reasoning About Uncertainty and Efficient Decision-making in Engineering Design. IIT Bombay IRCC Seed Grant. 2018 - 22
- Modeling User's Self-Regulated Learning Behaviour using Multi-Modal Learning Analytics. IIT Bombay IRCC research internship grant, 2018-22

Completed
- Leveraging eye-tracking and allied bio-sensing for education research. IIT Bombay IRCC Seed Grant

Consultancy Projects
Ongoing
- Advice on R&D of current and future education projects. Next Education India Pvt Ltd.

Book Chapters
- Raina, A., Jogeshwar, R., Yadav, Y., & Iyer, S.. "TA to AI: Tinkering Approach to Artificial Intelligence and Computational Thinking Education in Indian Schools". In H. Abelson & S.-C. Kong (Eds.), Computational Thinking Curricula in K-12: International Implementations. Cambridge, MA: MIT Press.

Papers published
Journals

- Chavan, P., Mitra, R., & Murallidharan, J. S., (2022). Multiscale nature of student and teacher perceptions of difficulty in a mechanical engineering lecture. European Journal of Engineering Education, (1-20). DOI: 10.1080/03043797.2022.2047159.
- Shah, V., Murthy, S., Warriem, J., Sahasrabudhe, S., Banerjee, G., & Iyer, S. (2022). Learner-centric MOOC model: a pedagogical design model towards active learner participation and higher completion rates. *Educational technology research and development*, 1-26.
- Kapil Kadam, Shitanshu Mishra, Anurag Deep & Sridhar Iyer (2021). Enhancing engineering drawing skills via fostering mental rotation processes, European Journal of Engineering Education, 46:5, 796-812, DOI: 10.1080/03043797.2021.1920891. *(Published online: 07 May 2021)*

Peer-reviewed conference proceedings

- Ngeze, L. V. & Iyer, S. (2021). *From Teaching to Teacher Training: Embedding Important Skills Needed to Develop a Teacher Trainer in Cascaded Teacher Professional Development Programmes.* Proceedings of the 29th International Conference on Computers in Education, Online: Asia-Pacific Society for Computers in Education.
- Bhuse, P., Jain, J., Shaju, A., John, V., Joshi, A., Rajendran, R. (2021). *SQLearn: A Browser Based Adaptive SQL Learning Environment.* Adaptive Instructional Systems. Design and Evaluation. HCII 2021. Lecture Notes in Computer Science, vol 12792.
- Patel A., Dasgupta, C., Murthy S., & Dhanani, R. (2021). Co-designing for a healthy EdTech ecosystem: Lessons from the Tulna research-practice partnership in India. Published in the *International Conference on Computers in Education (ICCE) 2021*, Bangkok, Thailand, November 22-26, 2021.
- Badhe, V., Banerjee, G., & Dasgupta, C. (2021). Design Guidelines for Scaffolding Self-Regulation in Personalized Adaptive Learning (PAL) systems: A Systematic Review. Published in the *International Conference on Computers in Education (ICCE) 2021*, Bangkok, Thailand, November 22-26, 2021.
- Pathan, R., Murthy, S., & Rajendran, R. (2021). A Coding Mechanism for Analysis of SRL Processes in an Open-Ended Learning Environment.Published in the *International Conference on Computers in Education (ICCE) 2021*, Bangkok, Thailand, November 22-26, 2021.

- Ishika, Banerjee, G. and Murthy, S. "Developing a taxonomy of Edtech products for teachers: An integrated analysis from research literature and product landscape," 29th International Conference on Computers in Education (ICCE 2021), Nov 22-26, 2021.
- Singh, D., Pathan, R., Banerjee, G., & Rajendran, R. "From Hello to Bye-Bye: Churn Prediction in English Language Learning App." 29th International Conference on Computers in Education (ICCE 2021), Nov 22-26, 2021
- Raste, S., Murthy, S., & Deep, A. "Karyotype: An Interactive Learning Environment for Reasoning and Sense Making in Genetics through a Case-based Approach", 29th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education (ICCE 2021)
- Jaiswal, G., Raste, S., & Murthy, S. "Learn to Design (L2D): a TPD Program to Support Teachers in Adapting ICT Learning Materials to Their Local Context through Research-Based Strategies", 29th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education (ICCE 2021)
- Satavlekar, S., Mishra S., Raina A. & Iyer S. "Programming-RIO: Initiating Individuals into Computational Thinking using Real-world IoT Objects." *29th International Conference on Computers in Education (ICCE 2021), Nov 22-26, 2021.*
- Raina, Ashutosh, Sridhar Iyer and Sahana Murthy. "Tinkery: A Tinkerer's Nursery for Problem Solving with Lego Mindstorms", In Proceedings of the 29th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education. ICCE 2021.
- Jain, Shruti, Raina, Ashutosh, Iyer, Sridhar, "TinkerBot: A Semi-Automated Scaffolding Agent as a Companion for Tinkering", In Proceedings of the 29th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education. ICCE 2021.
- Swamy, N & Dasgupta, C. 2021. Investigating the Nature of Learners' Feedback Seeking Actions and its Role in the Development of Representational Competence. In the International Society of the Learning Sciences Annual Meeting 2021.
- Kaur, N. & Dasgupta, C. (2021). Students' Epistemological and Positional Framing in Uncertain Situations During a Collaborative Design Activity. In de Vries, E., Hod, Y., & Ahn, J. (Eds.), Proceedings of the 15th International Conference of the Learning Sciences - ICLS 2021. (pp. 899-900).
- R. Priyadarshini, I. Nishane, N. Pokle, U. Khwaja and C. Dasgupta, "Carbon Warrior: A game-based environment to understand Carbon Footprint and its effect on Sustainable living," in *2021 International Conference on Advanced Learning Technologies (ICALT)*, Tartu, Estonia, 2021 pp. 291-293.
- Satavlekar, S., Nath, D., Priyadarshini, R., Prasad, P., Singh, D. K., & Rajendran, R. (2021, July). Unraveling Learner Interaction Strategies in VeriSIM for Software Design Diagrams. In *2021 International Conference on Advanced Learning Technologies (ICALT)* (pp. 308-310). IEEE.
- Nishane, I., Sabanwar, V., Lakshmi, T. G., Singh, D., & Rajendran, R. (2021, July). Learning about learners: Understanding learner behaviours in software conceptual design TELE. *In 2021 International Conference on Advanced Learning Technologies (ICALT)* (pp. 297-301). IEEE.

Conferences/Symposia/Workshops/Seminars (Participated/ Papers presented)

- Murthy, S, Dasgupta, C., Dhanani, R., Kazmi, A. & Kaye, T. "Seeking Quality in EdTech Solutions: Perspectives from Across the Ecosystem". Panel discussion in the 29th International Conference on Computers in Education (ICCE 2021), Nov 22-26, 2021.

Invited Talks

- Pankaj Chavan. "Online Education: Challenges and Solutions", Talk at Shikshan Katta, Saraswati Mandir Trust, Mumbai, June 2021
- Ramkumar Rajendran, Daevesh Kumar Singh, Debarshi Nath, Antony Prakash online FDP on "Free Software for Collaborative Learning" 06.10.21
- Ramkumar Rajendran, Daevesh Kumar Singh, Debarshi Nath, Antony Prakash "Learning Analytics in online learning" IGNOU Staff Training and Research Institute of Distance Education (STRIDE), Mar 2022.
- Ramkumar Rajendran, Antony Prakash, "Learning Analytics: Optimizing Learning and Teaching" in CEP by IITB for NABARD Trainers, Dec 2021
- Ramkumar Rajendran, Antony Prakash, Daevesh Kumar Singh, and Debarshi Nath, "Analytics for LMS" in an FDE by NITTTR Chennai on Oct 6, 2021.
- Ramkumar Rajendran, Invited Speaker in Panel Discussion on School 21 Century - Indus National Ideation Colloquium on Future of Education, Sep 2021.
- Ramkumar Rajendran, Antony Prakash, Daevesh Kumar Singh, and Debarshi Nath, "Research in Learning Analytics" in a virtual Symposium on "Innovative Teaching-Learning Techniques in Engineering Education", Mumbai, July 2021.
- Sahana Murthy. "Towards enhancing online pedagogic processes." Invited talk at Workshop on Online Pedagogy and Evaluation, IUCAA Pune. June 30, 2021.
- Sahana Murthy. "Creating quality content for online training: The LCM approach". CARE – IQAC conference on Design & development of MOOCs for faculty members of HEIs. Chettinad Academy of Research & Education. July 13, 2021.
- Sahana Murthy. "Nurturing disciplinary practices through research in the learning sciences." Invited keynote at Workshop on Next-Generation Education Technology, IIT Jodhpur. September 4, 2021.
- Sahana Murthy. "A Framework for educational technology product quality evaluation". Keynote talk at Teach.erat.hon 2021, Lilavatibai Podar High School. December 18, 2021.
- Sahana Murthy. "EdTech Tulna: A quality evaluation framework for EdTech products". Invited talk for ID Insight, March 3, 2022.
- Ashutosh Raina, Webinar on Artificial Intelligence and Machine Learning, Kotak Education Foundation, 16th June 2021

Conferences chaired

- Ramkumar Rajendran. Chair for sub-conference on Advanced Learning Technologies, Learning Analytics, Platforms and Infrastructure, in International Conference on Computers in Education (ICCE 2021), Virtual
- Sahana Murthy. Co-Chair for sub-conference on Learning Sciences/CSCL, in International Conference on Computers in Education (ICCE 2021), Virtual

Continuing Education Programs (CEP)

- Pedagogy for digital learning environments: CEP course for training around 30-35 faculty participants of NABARD (bank) on 27-28 November and 4 December 2021. instructors: Sahana Murthy and Dr. Mrinal Patwardhan. Teaching Assistants: Jatin Ambasana, Alekh V., Nandan P. A., Vishwas Badhe,

Amit Paikrao, Ishika, Kabyashree and Sunita Raste.

Faculty Professional Development programs
- "Online Teaching", a 1-Week workshop for Kotak Education Foundation (KEF) teacher trainers, Mumbai, June, 2021. Pankaj Chavan, Sunita Raste.
- "Use of ICT for Effective Teaching-Learning", at FDP on "Utilization of ICT tools and virtual lab platform for E-content development", Amity Institute of Pharmacy, Amity University Uttar Pradesh, Lucknow, July, 2021. Pankaj Chavan.
- "Effective Use of ICT for Conducting Live Interactions" at Navy Children School, Mumbai, May 04, 2021. Pankaj Chavan, Kapil Kadam.

MOOCs
Faculty, post-doctoral research scientists and PhD research scholars of the IDP-ET designed and taught the following MOOCs on NPTEL and/or IITBombayX platform:
- Designing Learner Centric MOOCs. 4-week MOOC for school teachers and e-learning curriculum designers. Offered on NPTEL, during 2022. Enrollment 1618 (Jan - March 2022). Sahana Murthy, Gargi Banerjee, Sameer Sahasrabudhe, Jayakrishnan M. Teaching assistants involved were Nandan P. A., Ishika, and Jatin Ambasana.

Honorary Work
- Sahana Murthy. Board member, International Society of the Learning Sciences. 2021-27.
- Sahana Murthy. External member, Training & Development (T & D), Reserve Bank of India. 2021-24.
- Sahana Murthy. Executive Committee Member, Asia Pacific Society of Computers in Education 2014-date.
- Sahana Murthy. Editorial board member, Research & Practice in Technology Enhanced Learning, 2019- date.
- Chandan Dasgupta. Member and reviewer, Institutional Review Board, IIT Bombay
- Chandan Dasgupta. Member, Workers' Welfare Committee, IIT Bombay
- Chandan Dasgupta. Member, International Society of Learning Sciences Membership committee
- International partner and advisory board member for Cyberlearning Consortium (Purdue University). Chandan Dasgupta. 2018-Present
- Ramkumar Rajendran. Member, International Society of Learning Sciences Membership committee
- Ramkumar Rajendran. Vice-Chair, IEEE P2955 Working Group, IEEE Standards Association
- Ramkumar Rajendran. Member, Board of Studies for Data Science department, DJSCE, Mumbai.

Faculty, post-doctoral research scientists and PhD research scholars participate as:
- Reviewer for journals: ACM Transactions on Computing Education (ToCE), IEEE Transactions on Education (ToE), ACM Transactions on Multimedia Computing Communications and Applications (TOMM), Educational Technology, Research & Development (ETR&D), International Journal of Distance Education Technologies (IJDET), Research & Practice in TEL (RPTEL), Interactive Learning Environments (ILE), Journal of Computers in Education (JCE), Cognitive Research: Principles and Implications, IEEE Transactions on Learning Technology (TLT), Journal of the Learning Sciences (JLS).

- International program committee member for various conferences: Artificial Intelligence in Education (AIED 2019), International Conference on Computers in Education (ICCE 2018), International Conference on Computational Thinking Education 2017 (CTE 2018), International Conference on Advanced Learning Technology (ICALT 2019).

Contribution in student wings of International conferences
Student wing Chair, vice-chair and members add relevant data in the following section :

- Vishwas Badhe, student wing member in 29th International Conference on Computers in Education (ICCE 2021) and also APSCE community. 2021-present.