

INTER-DISCIPLINARY PROGRAMME IN EDUCATIONAL TECHNOLOGY

Annual Report 2017-18

Introduction

The Inter-Disciplinary 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 at a Ph.D. level, the IDP-ET organizes short-term intensive courses and MOOCs on effective teaching-learning and educational research methods through CEP, Train 10000 Teachers project and IITBombayX. Faculty members and Ph.D. research scholars of the IDP-ET play a significant role in the organization of international conferences, carry out sponsored projects for the National Mission on Education through ICT (NMEICT) and provide consultancy to educational technology industries.

Noteworthy highlights:

- The Next Education Research Lab was set up in the IDP-ET, with funding from Next Education India. The objective of this lab is R&D on the use of emerging technologies for learner-centred education.
- The IDP-ET designed and offered a series of new MOOCs for school teachers, which saw a total enrolment of over 15000 participants.

People

Convener: Prof Sridhar Iyer

Faculty members: Two new faculty members joined the IDP-ET – Prof Ritayan Mitra and Prof Chandan Dasgupta. The IDP-ET now has 4 core faculty members, 2 adjunct faculty and 19 associate faculty members from academic units across the Institute.

The IDP has 1 post-doctoral research associate.

Academic Programme

The IDP-ET offers a Ph.D. programme in Educational Technology.

Ph.D students

Currently enrolled: 21

Degrees awarded in 2017-18: 3

Courses

The IDP-ET continues to offer core courses and electives in educational technology content and methods. These courses have had enrolment from B.Tech, M.Tech and Ph.D students in other academic programmes within the Institute. Three new courses were added to the curriculum in 2017-18: Learning Analytics, Introduction to Learning Sciences and Discipline-based Education Research.

R & D Activities

The main research areas of focus of the IDP-ET are:

- TELoTS: Technology-enhanced learning of thinking skills. Develop students' pan-domain cognitive skills such as engineering design, problem-posing, estimation, algorithmic thinking, modeling, data representation & analysis. Design, develop and evaluate TELoTS systems for various thinking skills in different domains.
- TUET: Teacher use of educational technology. Develop and evaluate models for various modes of training such as MOOCs and blended learning. Develop tools to assist teachers in technology integration, analytics.
- Multimodal study of learning using psychophysiological sensors such as electroencephalogram (EEG), galvanic skin resistance (GSR) and eye tracking.

- Design-based research for creating technology-rich learning environments that scaffold students' design thinking in the context of ill-structured engineering problems. Develop tools for priming students for decision-making process, taking informed design decisions by leveraging design heuristics and science inquiry, and providing formative and summative feedback to the teachers and students to enable productive disciplinary engagement.

Areas of development focus for the IDP-ET are:

- Educational products and tools – technology-enhanced learning environments, educational animations & simulations, spoken-tutorials, virtual labs, tutoring systems, and assessment instruments.
- Creation of online courses and multimedia textbooks.
- Guidelines for teachers - on classroom practice, effective strategies, large classes, incorporation of ICT tools, teaching in new situations such as online education and flipped classrooms.

Sponsored Projects

Ongoing

- Pedagogy for effective use of ICT by School teachers. Sponsored by Next Education India Pvt Ltd. 2017-20.
- Next Education Research Lab. Endowed lab sponsored by Next Education India Pvt. Ltd. 2017-22.
- Central sector scheme for MOOC compliant e-content (NPTEL Phase IV), sponsored by MHRD. 2016-19.
- Teaching Learning Centre for Information and Communication Technologies (TLC), sponsored by MHRD. 2017-21.
- Educational Services for Outreach at Scale (ESOS) sponsored by MHRD. 2017-22.
- Leveraging eye tracking and allied bio-sensing for education research. IIT Bombay IRCC Seed Grant project.
- Reasoning About Uncertainty and Efficient Decision-making in Engineering Design. IIT Bombay IRCC Seed Grant project.
- Interface development and pilot-testing of a novel classroom feedback system. IIT Bombay IRCC research internship grant.

Completed

- Benchmarking digital content. sponsored by Next Education India Pvt Ltd. 2016-18
- Talk to a Teacher Project (T10KT), sponsored by MHRD. 2013-17.

Consultancy Projects

Ongoing

- Advice on R&D of current and future education projects. Next Education India Pvt Ltd. 2016-19.

Completed

- Evaluation of Train-the-trainer course. Naval Institute of Educational Training and Technology.

Papers published

Journals

- Kenkre, A & Murthy, S (2017) MIC-O-MAP: a technology-enhanced learning environment for developing micro-macro thinking skills. *Research and Practice in Technology Enhanced Learning*, 12(1), 23.
- Rajendran, R., Iyer, S. & Murthy, S (2018). Personalized affective feedback to address students' frustration in ITS. *IEEE Transactions on Learning Technologies*.
- Taleyarkhan, M., Dasgupta, C., Garcia, J. M., & Magana, A. J. (2018). Investigating the impact of using a CAD simulation tool on students' learning of design thinking. *Journal of Science Education and Technology*, 1-14.

Peer-reviewed conference proceedings

- Lakshmi, T. G., Prasad, P., & Iyer, S. (2017, July). A System for Developing Operationalization Skills through Problem Decomposition. In IEEE 17th International Conference on Advanced Learning Technologies (ICALT 2017), Timisoara, Romania, July 3-7, 2017.
- A. Raina, T. G. Lakshmi and S. Murthy. CoMBaT: Wearable Technology Based Training System for Novice Badminton Players. In IEEE 17th International Conference on Advanced Learning Technologies (ICALT 2017), Timisoara, Romania, July 3-7, 2017.
- Anura Kenkre and Sahana Murthy. Learning of Micro-Macro Thinking in Analog Electronics via MIC-O-MAP TEL Environment. In IEEE 17th International Conference on Advanced Learning Technologies (ICALT 2017), Timisoara, Romania, July 3-7, 2017.
- Patil Deepti Reddy, Sridhar Iyer, Sasikumar M. FATHOM: TEL environment to develop divergent and convergent thinking skills in software design. In IEEE 17th International Conference on Advanced Learning Technologies (ICALT 2017), Timisoara, Romania, July 3-7, 2017.
- Francesco Maiorana, Miles Berry, Mark Nelson, Chery Lucarelli, Margot Phillipps, Shitanshu Mishra, & Andrea Benassi. International Perspectives on CS Teacher Formation and Professional Development. In Proceedings of the 2017 ACM Conference on Innovation and Technology in Computer Science Education (pp. 236-237). ACM, Bologna, Italy, July 2017.
- Lakshmi, T. G., Narayana, S., Penugonda, H., Vaidya, D., Poonia, V., Ganguly, S., & Murthy, S. (2017). "PIVOTeeING: A Flipped Approach in a Postgraduate Solid State Devices Course", In *The 25th International Conference on Computers in Education* (pp. 974-983). Asia-Pacific Society for Computers in Education. Christchurch, New Zealand, Dec 4-8, 2017.
- Kothiyal, A. & Murthy, S. (2017). "Examining Student Learning of Engineering Estimation from METTLE", In *The 25th International Conference on Computers in Education* (pp. 166-175). Asia-Pacific Society for Computers in Education. Christchurch, New Zealand, Dec 4-8, 2017.
- Warriem, J., Murthy, S. & Iyer, S. "Transfer of Ownership: Designing for Scholarship of Learning and Teaching," 6th Workshop on ICT Trends in Emerging Economies in the 25th International Conference on Computers in Education (ICCE2017), Christchurch, New Zealand, Dec 4-8, 2017.

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

- Ashutosh Raina: Presented paper "CoMBaT: Wearable Technology Based Training System for Novice Badminton Players," in 17th International Conference on Advanced Learning Technologies (ICALT), Timisoara, Romania, July 3-7 2017.
- Sahana Murthy. Presented paper "Learning of Micro-Macro Thinking in Analog Electronics via MIC-O-MAP TEL Environment" in ICALT 2017, Romania, July 3-7 2017.
- Deepti Reddy: Presented paper "FATHOM: TEL environment to develop divergent and convergent thinking skills in software design" in ICALT 2017, Romania, July 3-7 2017.
- Deepti Reddy: Attended "Open Source Software Experience (POSSE) workshop" held at the University of Bologna, Italy, July 1-2, 2017.
- Lakshmi T.G.: Presented paper "A System for Developing Operationalization Skills through Problem Decomposition", in 17th International Conference on Advanced Learning Technologies (ICALT), Timisoara, Romania, July 3-7 2017.
- Sahana Murthy: Presented paper "Examining Student Learning of Engineering Estimation from METTLE" in the 25th International Conference on Computers in Education (ICCE2017), Christchurch, New Zealand, Dec. 4-8, 2017
- Jayakrishnan M.: Presented paper "Transfer of Ownership: Designing for Scholarship of Learning and Teaching" in the 6th Workshop on ICT Trends in Emerging Economies in the 25th International Conference on Computers in Education (ICCE2017), Christchurch, New Zealand, Dec. 4-8, 2017.

Invited Talks

- Large-scale teacher professional development for effective technology integration. Sahana Murthy. Theme-based invited talk at ICCE 2017 - International Conference on Computers in Education, Christchurch, New Zealand. Dec 6, 2017.
- Teaching-learning of computer science in schools," Principals Conference, Next Education Hyderabad. Nov. 9, 2017.
- Designing Learner-Centric MOOCs. Sridhar Iyer. CSI TechNext Conference, Mumbai. Feb. 10, 2018.
- Would technology help in making students better learners? Sahana Murthy. CSI TechNext Conference, Mumbai. Feb. 11, 2018.

Conferences chaired

- Sridhar Iyer, Chandan Dasgupta and Sahana Murthy, Track Program Chairs of TELoTS track IEEE International Conference in Advanced Learning Technologies (ICALT 2017), Timisoara, Romania.

Continuing Education Programs (CEP)

- Pedagogy training for 'Outcome Based Education'. 2-day CEP in-house training program, BEC University, Bagalkot, October 21-22, 2017.
- Pedagogy training for student-centered teaching-learning. 2-day CEP in-house training program, REC Bijnor, November 9-10, 2017.
- Training on 'Methodologies for Effective Teaching-Learning' for Faculty Members of Centre for Excellence in Telecom Technology and Management(CETTM), Mahanagar Telephone Nigam Limited (MTNL). 2-day CEP in-house training program, CETTM, December 15-16, 2017.

Faculty Professional Development programs

- Pedagogy training for learner-centred integration of ICT in teaching-learning. 2-day FDP at Atharva College of Engineering, Mumbai, April 6-7, 2017.
- Pedagogy training for learner-centred integration of ICT in teaching-learning. 1-day FDP at BITS, Hyderabad, April 21, 2017.
- Pedagogy training on "Strategies and Practical Approaches of Outcome Based Education and NBA Process", as a part of ISTE Approved 1-week FDP, PES's Modern College of Engineering, Pune. June 16, 2017.
- Pedagogy training on "Innovative Teaching Tools & Technologies for Engineering Faculty", as part of ISTE Approved STTP, VIT, Mumbai. June 19, 2017.
- Pedagogy training on "Active Learning with ICT and Flipped Classrooms", 2-day FDP at KIIT, Bhubaneswar September 9-10, 2017.
- Training on 'Digital Era Tools for Teaching-Learning'. 2-day FDP at Nirma University, Ahmedabad, September 15-16, 2017.
- Pedagogy training on 'Effective integration of ICT tools in Engineering education'. 2-day FDP at GMR Institute of Technology (GMRIT), Rajam, Andhra Pradesh.
- Training on 'Nurturing Quality Teaching in Engineering Education'. 1-day FDP at TKM College of Engineering, Kollam, Kerala, December 19, 2017.
- Sessions in Faculty Induction Training program organized under Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching, December 2017. Sessions: Learning Objectives, Active Learning Techniques, Discipline-based Education Research, teachers' Technological Pedagogical Content Knowledge, Formative Assessment.
- Training on 'Augmented Reality App for Molecular Visualization in Chemistry Education' for 50 in-service chemistry teachers of Kendriya Vidyalayas from across India, November 27, 2017, Mumbai.
- Pedagogy training on 'Innovative Practices in Teaching and Learning', 2-day FDP at SAKEC, Mumbai, January 19 - 20, 2018.

- Sessions in TEQIP-III KIT: Faculty Induction Program, January-February 2018. Sessions: Learning Objectives, Active Learning Techniques, teachers' Technological Pedagogical Content Knowledge, Promoting Metacognition, Formative Assessment.
- Pedagogy training for 'Capacity Development Workshops for Engineering Teachers', 1-day FDP at Amal Jyothi College of Engineering, Kanjirappally, February 24, 2018.
- Interaction session on "*Types of MOOCs and Digital Learning Technology*" as part of training on Massive Open Online Courses at Central University of Rajasthan, March 14, 2018.

MOOCs

Faculty, post-doctoral research scientists and PhD research scholars of the IDP-ET designed and taught the following MOOCs on IITBombayX platform:

- ET611Tx: Pedagogy for effective use of ICT for school teachers. 4-week MOOC for school teachers and e-learning curriculum designers. Offered twice -- Apr-May 2017, Enrolment 11478 and Sep-Oct 2017, Enrolment 2707.
- ET621Tx: Effective teaching-learning of CS in schools. 4-week MOOC for school teachers. Offered in May-Jun 2017 (as ET612Tx), Enrolment 573, and Nov-Dec 2017 Enrolment 1642.
- FDP101x: Foundation program in ICT for education. 8-week course for engineering college teachers. Jul-Sep 2017, Enrolment 7516.
- FDP201x: Pedagogy for Online and Blended Teaching-Learning Process. 8-week course for engineering college teachers. Offered in Sep-Nov 2017, Enrolment 5503.

Conferences and Workshops organized

- 2-day hands-on workshop on 'Basic 3D Animation and Modelling Using Blender', February 24 - 25, 2018, RAIT, Mumbai.

Honorary Work

- New Initiatives Chair, IEEE Technical Committee on Learning Technologies (TCLT). Sridhar Iyer. 2015-18.
- Executive Committee Member, Asia Pacific Society of Computers in Education (APSCE). Sahana Murthy, Sridhar Iyer. 2014-20.

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), Educational Technology, Research & Development (ETR&D), International Journal of Distance Education Technologies (IJDET), Research & Practice in TEL (RPTEL)
- International program committee member for various conferences: Conference on Special Interest Group in Computer Science Education (SIGCSE 2018), Artificial Intelligence in Education (AIED 2018), International Conference in Learning Sciences (ICLS 2018), International Conference on Computers in Education (ICCE 2017), Learning and Teaching in Computing and Engineering (LaTiCE 2017), International Conference on Computational Thinking Education 2017 (CTE 2017)