

Shitanshu Mishra

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Research Interest

Educational Technology, Technology Enhanced Learning of Thinking Skills, Computational Thinking, Student Question Posing, Knowledge Integration, E-Learning, Cognitive Science.

Currently

Ph.D. Research Scholar (Expected Submission by December 2017)

Inter Disciplinary Program in Educational Technology, Indian Institute of Technology, Bombay, India.

Dissertation Title: *Improving Students' Cognitive Processes of Knowledge Integration through Exploratory Question Posing*

Abstract: When students encounter new knowledge, it is often fragmented and not well connected to their existing knowledge. It is known that students need to integrate knowledge pieces effectively to develop a deep and cohesive understanding of any topic. My doctoral work focuses on using student's question posing as a cognitive tool to foster the cognitive processes associated with knowledge integration (KI). These cognitive processes include eliciting prior knowledge, focusing on new knowledge and distinguishing among knowledge. In the initial phase of our research, we found that exploratory question posing can be used as a cognitive-tool to trigger these cognitive processes. Based on these findings, we designed a learning environment, named *Inquiry-based Knowledge Integration Trainer* (IKnowIT). To investigate the effect of IKnowIT on KI, we chose concepts of Data Structures and carried out a series of qualitative and quantitative studies with sophomore CS engineering students.

IKnowIT site: www.et.iitb.ac.in/iknowit

Educational Background

<i>Degree earned & Institution</i>	<i>Year</i>	<i>Marks</i>
Ongoing Ph.D. Inter Disciplinary Program in Educational Technology Indian Institute of Technology Bombay, Mumbai Doctoral Thesis: <i>Improving Students Cognitive Processes of Knowledge Integration using Exploratory Question Posing.</i> Committee: Prof. Sridhar Iyer (Advisor), Prof. Sahana Murthy, Prof. Supritam Biswas	2012 - current	9.82 / 10
M.Tech. Information Technology (Specialization in Intelligent Systems) Indian Institute of Information Technology Allahabad, Uttar Pradesh Master Thesis: <i>EEG Signal Classification for Cognition.</i> Advisor: Prof. Sudip Sanyal	2010 – 2012	9.80 / 10
B.Tech. Computer Science and Engineering Dr. A.P.J. Abdul Kalam Technical University, Lucknow, Uttar Pradesh Advisor: Prof. Ashwani Gupta	2006 - 2010	70.20 / 100

Professional experience

Institute Teaching Assistant for IDP in Educational Technology, IIT Bombay

13 July 2012 - current (5 years +)

Assisted in research projects and mentored first and second year PhD research students, interns and external workshop participants. As a teaching assistant, conducted interactive lectures for graduate students in Introduction to Qualitative Analysis and Introduction to Educational Technology course. Covered topics on content analysis, thematic analysis, grounded theory methodology, qualitative interviewing, etc. Contributed in academic services of reviewing academic articles and being in the local organizing committee of international conferences and workshops.

Institute Teaching Assistant for Department of Intelligent Systems, IIIT Allahabad

July 2010 - July 2012 (2 years)

Engaged in conducting undergraduate level lectures, tutorials, lab sessions and evaluated performance of students in courses related to Introduction to Programming (CS1) and Data Structures (CS2). Also actively worked in the organization of conferences and science conclaves.

Key Research Projects (in addition to thesis)

1. International Working group on “New Horizons in the Assessment of Computer Science at School and Beyond”. Vilnius, Lithuania, Feb - September 2015

The working group was comprised of Computing Education researchers from multiple countries, collaborated published a research report in the Innovation and Technologies in Computer Science Education (ITiCSE) 2015.

Abstract: A revolution is taking place across Europe and worldwide in how we teach our children about computing, in primary and secondary school. Assessment has a crucial role to play in this revolution. If teachers use low-quality assessment instruments we will end-up teaching the wrong subject; and vice-versa. This working group reviews the state of the field, and makes concrete, achievable proposals for developing shared, high quality assessments for computer science. Central to this proposal is the collaborative platform VIVA (the Vilnius collaboratively coded and Validated computer science questions/tasks for Assessment). Two requirements are key to VIVA: 1) support for multiple competency frameworks, so that the contributors can meta-tag resources with respect to the framework they are most familiar with; and 2) support for crowdsourcing the validation of each question/task and its mapping to competencies. The use of a taxonomy of questions/tasks type that has been mapped to computational thinking concepts and to a competency framework is proposed. Some seed questions are already available in the online platform prototype, and various supporters have granted permission to use large questions banks. The design requirements of a full implementation of the VIVA platform for a modern and effective approach to assessment including support for digital badges, have been outlined; and some preliminary results from a survey administered to the initial contributors to VIVA are extracted and presented.

My Role: I was one of the working group member and my role was to develop the VIVA platform.

2. “Exploring Indian Computer Science (CS) Undergraduate Student’s Conception about the CS major”.

Mumbai, India, June 2015 - September 2016.

In year 2016 in International Computing Education Research (ICER) 2016 conference, myself, in collaboration with Dr. Mike Hewner published a research report on Indian CS students’ conceptions about computer science major. Applying grounded theory methods we unfolded how Indian educational system and the popular perception about careers in CS-related fields in India, lead to student’s decision of choosing CS as their major for undergraduate studies.

My Role: I was one of the two researchers. Co-designed the study, collected data (interviewed), co-performed the grounded theory analysis, co-authored the research report, presented at ICER 2016, Melbourne, Australia.

3. International Working group on “Exploring Link between Early Developmental Activities and Computing Proficiency”. Bologna, Italy, Feb - August 2017

The working group was comprised of Computing Education researchers from multiple countries, collaborated published a research report in the Innovation and Technologies in Computer Science Education (ITiCSE) 2017.

Abstract: As countries adopt computing education for all pupils from primary school upwards, there are challenging indicators: significant proportions of students who choose to study computing at universities fail the introductory courses, and the evidence for links between formal education outcomes and success in CS is limited. Yet, as we know, some students succeed without prior computing experience. Why is this? Some argue for an innate ability, some for motivation, some for the discrepancies between the expectations of instructors and students, and some – simply – for how programming is being taught. All agree that becoming proficient in computing is not easy. Our research takes a novel view on the problem and argues that some of that success is influenced by early childhood experiences outside formal education. In this study, we analyzed over 1300 responses to a multi-institutional and multi-national survey that we developed. The survey captures enjoyment of early developmental activities such as childhood toys, games and pastimes between the ages 0 — 8 as well as later life experiences with computing. We identify unifying features of the computing experiences in later life, and attempt to link these computing experiences to the childhood activities. The analysis indicates that computing proficiency should be seen from multiple viewpoints, including both skill-level and confidence. It shows that particular early childhood experiences are linked to parts of computing proficiency, namely those related to confidence with problem solving using computing technology. These are essential building blocks for more complex use. We recognize issues in the experimental design that may prevent our data showing a link between

early activities and more complex computing skills, and suggest adjustments. Ultimately, it is hoped that this line of research will feed in to early years and primary education, and thereby improve computing education for all.

My Role: I volunteered as a non-official member, actively participated in deliberations, administered the data collection from Indian population, assisted the data analyses in Bologna.

4. Institute - level project: Incorporating Educational Technology in CS1 and CS 2". Mumbai, India, 2012 - 2015.

My department (IDP in EduTech) at IIT Bombay has carried out number of efforts to incorporate innovative pedagogies and technologies for improving the teaching-learning of undergraduate learners from other departments within IIT Bombay, specially Computer Science. These projects include: (i) Using problem-posing activities in CS1 class; (ii) Using Scratch (a visual programming language) based introduction to programming (CS1) for novice learners; (iii) using "think-pair-share" pedagogy in CS2 (data structures) class, etc.

My Role: I have administered the implementation and evaluation studies on number these efforts. The empirical studies and findings have been published in peer-reviewed conference proceedings.

5. SQDL: Student Question Driven Learning. Mumbai, India, 2013 - 2015

Under the guidance of Prof. Sridhar Iyer, I designed a pedagogy that uses student question posing to enable student directed learning. The pedagogy proposes to use the questions posed by the students to decide which content has to be taught in the next instruction. The pedagogy has been empirically tested primarily on two factors: (i) How much course-coverage is achieved in a SQDL - based classroom; (ii) What are it's effects on students' affective dimensions such as their interests, motivation and belongingness to the instructions.

My Role: I designed the pedagogy, implemented the study and collected-analysed the data, under the guidance of Prof. Sridhar Iyer.

Technical Skill set

Key Programming Languages: Java, C/C++, C#, Python, MATLAB

Server Site Technologies: SQL, PHP, JSP

Designing: Web - HTML5, Java Script, CSS

Relevant Coursework

Fundamentals of Educational Technology, Research Methodology in Educational Technology, Educational Technology Tools, Educational Game Designs, Intelligent Tutoring Systems, Learning Analytics, Machine Learning, Cognitive Science, Computational Intelligence, Natural Language Processing, Soft Computing, Computer Vision.

Academic Publications

Journal

- **Shitanshu Mishra**, Sridhar Iyer. An Exploration of Problem Posing Based Activities as an Assessment Tool, and as an Instructional Strategy. Research and Practice in Technology Enhanced Learning (RPTEL), June 2015.

Conferences

- Michael Hewner, **Shitanshu Mishra**. When Everyone Knows CS is the Best Major. Decisions about CS in an Indian context. ACM International Computing Education Research (ICER) Conference, Melbourne, Australia, September 2016.
- **Shitanshu Mishra**, Sridhar Iyer. Exploratory question posing: Towards improving students' knowledge integration performance. Learning Environments for Deep Learning in Inquiry and Problem-Solving Contexts, the pre-Conference workshop at the 12th International Conference of the Learning Sciences (ICLS), Singapore, June 2016.

- **Shitanshu Mishra**, Sridhar Iyer. Question-Posing Strategies used by Students for Exploring Data Structures. ACM International conference on Innovation and Technology in Computer Science Education (ITiCSE), Vilnius, Lithuania, June 2015.
- Daniela Giordano, Andrew Paul Csizmadia, Simon Marsden, Charles Riedesel, **Shitanshu Mishra**, Lina Vinikienė. New Horizons in the Assessment of Computer Science at School and Beyond: Leveraging on the ViVA Platform. Proceedings of the 2015 ITiCSE on Working Group Reports, ACM, 2015.
- Abhinav Anand, **Shitanshu Mishra**, Anurag Deep, Kavya Alse. Generation of Educational Technology Research Problems using Design Thinking Framework. IEEE conference on Technology for Education (T4E), Warangal, India, December 2015.
- Deepti Reddy, **Shitanshu Mishra**, Ganesh Ramakrishnan, Sahana Murthy. Thinking, Pairing, and Sharing to Improve Learning and Engagement in a Data Structures and Algorithms (DSA) Class. IEE Conference on Teaching and Learning in Computing and Engineering (LaTiCE), Taipei, Taiwan, April 2015.
- **Shitanshu Mishra**, Mukulika Maity. A Software Solution to Conduct Inquiry Based Student Directed Learning. IEEE International conference on Technology for Education (T4E), Amritapuri, India, December 2014.
- Rekha Ramesh, **Shitanshu Mishra**, M Sasikumar, Sridhar Iyer. Semi-Automatic Generation of Metadata for Items in a Question Repository. IEEE conference on Technology for Education (T4E), Amritapuri, India, December 2014.
- Abhinav Anand, Aditi Kothiyal, Anita Diwakar, Anura Kenkre, Anurag Deep, Depti Reddy, Jayakrishnan Warriem, Kapil Kadam, Kavya Alse, Kiran Eranki, Rekha Ramesh, Rwitajit Majumdar, **Shitanshu Mishra**, Vasanta Akondy, Yogendra Pal, Neena Thota. Designing Engineering Curricula Based on Phenomenographic Results: Relating Theory to Practice. IEEE conference on Technology for Education (T4E), Amritapuri, Indi, December 2014.
- **Shitanshu Mishra**, Sudish Balan, Sridhar Iyer, Sahana Murthy. Effect of a 2-week Scratch Intervention in CS1 on Learners with Varying Prior Knowledge. ACM conference on Innovation Technology in Computer Science Education (ITiCSE), Uppsala, Sweden, June, 2014.
- **Shitanshu Mishra** and Sridhar Iyer. Problem Posing Exercises (PPE): An Instructional Strategy for Learning of Complex Material in Introductory Programming Courses. IEEE Conference on Technology for Education (T4E 2013), Kharagpur, India, December 2013.
- **Shitanshu Mishra** and Rekha Ramesh. A Software Solution to Facilitate Moderation, Observation and Analysis in a Focused Group Interview. IEEE Conference on Technology for Education (T4E 2013), Kharagpur, India, December, 2013.

Panel Report (s)

- 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.

Doctoral Consortiums

- **Shitanshu Mishra**. Improving Students' Knowledge Integration in Data Structures. ACM conference on International Computing Education Research, Melbourne, Australia, September 2016.
- **Shitanshu Mishra**. Developing Students' Problem-Posing Skills. ACM conference on International Computing Education Research, Glasgow, Scotland, August 2014.

Service experience

- **Reviewer** for: Journal of Educational Technology & Society (ET&S), International Conference on Innovations and Technology in Computer Science Education (ITiCSE 2017), International Conference on Special Interest Group in CS Education (SIGCSE 2018), International Conference on Technology for Education (T4E 2015)
- **Sub-reviewer** for: AIED (2013, 2015), epiSTEME (2015), ICALT (2013), ICCE (2014, 2015), ICSLE (2015), ITiCSE (2014), LaTiCE (2014, 2015, 2016), SIGCSE (2015), T4E (2013, 2014)
- **Local Organizing Committee** Member for International conferences: LaTiCE 2016, ICCE 2016, T4E 2016, COLING 2012
- Administered an online course, ET612Tx: Pedagogy for effective teaching and learning of Computer Science in schools, on IITBombayX, as chief teaching assistant (May 18th - June 14th, 2017)
- Headed the Research Scholars' Forum, IIT Bombay, as the Overall Coordinator for the tenure 2014-2015
- Coordinator, Research Scholars' Confluence (ReSCon) 2015

Talk

- Panel Talk on International Perspectives on CS Teacher Formation and Professional Development. July 4th, 2017, ITiCSE 2017, Bologna, Italy. *Role: Panelist.*

Workshops

1. Workshop on using Exploratory Questioning to foster cognitive skills of Knowledge Integration. August 5th, 2017, Fr. Conceicao Rodrigues College of Engineering, Mumbai. *Role: Instructor.*
2. Workshop on Exploratory Questioning and Knowledge Integration Skills. February 19th, 2017, IIT Bombay, Mumbai. *Role: Instructor.*
3. Workshop on Exploratory Questioning and Knowledge Integration Skills. April 4th, 2017, MPSTME, Vile Parle West, Mumbai. *Role: Instructor.*
4. Workshop on Knowledge Integration Skills. August 1st - 15th, 2016, IIT Bombay, Mumbai. *Role: Instructor.*
5. A three-day workshop on Exploratory Questioning skills. October 27th - 30th, 2015, DIT University, Dehradun. *Role: Instructor.*
6. Design Thinking for Creative Problem Solving in the context of MOOC platform. April 11th - 12th, 2015 IIT Bombay. *Role: Instructor.*
7. Technology Integration in Education (TIE) workshop. March 22nd, 2015, IIT Bombay. *Role: Instructor.*
8. Workshop on data structures using question posing and online collaboration strategy. January 25th, 2015, IIT Bombay. *Role: Instructor.*
9. A three-day workshop on introduction to data structures using question posing based active learning strategy. 4th-6th July, 2014, IIT Bombay. *Role: Instructor.*
10. Instructional Design Workshop. October 6, 2013, BITS Pilani. *Role: Instructor.*
11. Technology Enabled Quality Improvement Program (TEQIP) workshop on Effective Teaching Strategies for Quality Engineering Education teachers on Educational Technology. 24th - 28th January, 2013, IIT Bombay. *Role: Content Creator and Organizer.*
12. Improvement of Spatial Thinking Skills using Blender. 29th - 30th September, 2012, Goa University. *Role: Instructor.*

Awards

- Mashruwala Award for Educational Innovation, 2017
- MHRD Postgraduate Assistantship, 2012-2017
- Google India travel funding, 2015
- SIGCSE ICER DC travel grants, 2016

Co-curricular Activities

Poetry, Traveling, Designing (Web), Voluntarily provide consultancy to an NGO working against sexual violence.

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Mumbai