ROBIN JEPHTHAH RAJARATHINAM

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RESEARCH INTERESTS

Multimodal Learning Analytics, Educational Data mining, Computer-Supported Collaborative Learning (CSCL), Artificial Intelligence (AI) in Education

EDUCATION

Ph.D. in Curriculum & Instruction *Summer 2025*
Department of Curriculum & Instruction
University of Illinois Urbana-Champaign, IL, USA
Thesis: Ranking features used in modeling student collaboration using multimodal learning analytics

M.A. in Curriculum & Instruction *Spring 2021*
Department of Curriculum & Instruction
University of Illinois Urbana-Champaign, IL, USA
Thesis: Impact of Monitoring of Instructor on the Conceptual Understanding of Students working on a Collaborative Task as a Group

M.S. in Mechanical Engineering *Spring 2018*
Department of Mechanical Science & Engineering
University of Illinois Urbana-Champaign, IL, USA

B.E. in Mechanical Engineering *Spring 2013*
Department of Mechanical Engineering
Anna University, Chennai, India

WORK EXPERIENCE

Radicality Ministries
Curriculum Development and AI Researcher *Dec 2025 - Present*
PI: Tamara Rowe
Founder and Executive Director

- ▷ Designed and developed Intimacy with God: 90-Day Teen Journal, a 188-page devotional workbook for young adults, architecting the daily content progression around evidence-based instructional design and producing all interior layouts, typography, and front/back cover artwork in Canva.
- ▷ Revamped the Radicality Ministries Squarespace website by unifying design, typography, and color systems across all pages and implementing SEO improvements that drove a 10% increase in site impressions in the first month; now iterating on structured user feedback collected across audience segments (newcomers, churchgoers, donors).
- ▷ Prompt engineering LLMs (Claude, Canva AI) to automate curriculum and content generation, and configuring Claude Cowork scheduled tasks to streamline recurring production workflows across the ministry's educational pipeline.

HONORS AND AWARDS

- ▷ Honorable mention for best short paper award at Edcuational Data Mining Conference, 2024
- ▷ Honorable mention for best short paper award at Learning Analytics and Knowledge Conference, 2023
- ▷ Won the College of Education Graduate student Travel grant award $500.

JOURNAL ARTICLES

- **Rajarathinam, R. J.**, Palaguachi, C., & Kang, J. (2025). 360-degree cameras vs traditional cameras in multimodal learning analytics: Comparative study of facial recognition and pose estimation. *Journal of Educational Data Mining.*
- D'Angelo, C., **Rajarathinam, R. J.**. (2024). Speech analysis of teaching assistant interventions in small group collaborative problem solving with undergraduate engineering students. *British Journal of Educational Technology*, 00, 1–19.
- Kang, J., Zhou, Y., **Rajarathinam, R. J.**, Tan,Y., Shaffer, D.W. (2024). Unveiling joint attention dynamics: Examining multimodal engagement in an immersive collaborative astronomy simulation *Computers and Education*, 105002.
- Planey, J., **Rajarathinam, R. J.**, Mercier, E., Lindgren, R. (2023). Gesture-Mediated Collaboration with Augmented Reality Headsets in a Problem-Based Astronomy Task. *International Journal of Computer-Supported Collaborative Learning*, 18, 259–289.

HANDBOOK CHAPTER

- Mercier, E., Goldstein, M., Baligar, P., & **Rajarathinam, R. J.** (2023). *Collaborative Learning in Engineering Education.* In A. Johri (Eds.), International Handbook for Engineering Education Research. Routledge.

PEER-REVIEWED CONFERENCE PROCEEDINGS

- **Rajarathinam, R. J.**, Palaguachi, C., & Kang, J. (2024). Enhancing multimodal learning analytics: A comparative study of facial features captured using traditional vs 360-degree cameras in collaborative learning. *In B. Paaßen & C. D. Epp (Eds.), Proceedings of the 17th International Conference on Educational Data Mining* (pp. 551–558). International Educational Data Mining Society.
- **Rajarathinam, R. J.**, Katz, J. E., Shehab, S., Johnson, B. E., Chen, Y. W., Pool, M., & Chochola, K. M. (2024, June). The Impact of a Graduate Teaching and Leadership Course on Engineering Graduate Teaching Assistants' Learning of Pedagogy. In 2024 ASEE Annual Conference & Exposition.
- Katz, J. E., **Rajarathinam, R. J.**, Shao, Y. V., & Chen, Y. W. (2024, June). Understanding the Influence of a Week-Long Electrical and Computer Engineering Summer Camp on Middle School Students' Interests in STEM (RTP). In 2024 ASEE Annual Conference & Exposition.
- **Rajarathinam, R. J.**, D'Angelo, C.M. (2023, June). Description of instructor intervention using individual audio data in co-located collaboration. *Proceedings of the 16th International Conference on Computer-Supported Collaborative Learning - CSCL 2022* (pp. 317-320) Montreal, Canada: International Society of the Learning Sciences.

- **Rajarathinam, R. J.**, D'Angelo, C. M. (2023, March). Turn-taking analysis of small group collaboration in an engineering discussion classroom. *In LAK23: 13th International Learning Analytics and Knowledge Conference* (pp. 650-656).
- **Rajarathinam, R. J.**, Mercier, E. (2022, June). Impact of Instructor Intervention on the Conceptual Understanding of Undergraduate Engineering Students Working in a Group. In Weinberger, A., Chen, W., Hernández-Leo, D., & Chen, B. (Eds.), *Proceedings of the 15th International Conference on Computer-Supported Collaborative Learning - CSCL 2022* (pp. 258-265). Hiroshima, Japan: International Society of the Learning Sciences.
- Planey. J., **Rajarathinam, R. J.**, Mercier, E., Lindgren, R., Zhou, Y. (2022, June) Gesture's Role in Collaborative Problem Solving With Augmented Reality. In Weinberger, A., Chen, W., Hernández-Leo, D., & Chen, B. (Eds.), *Proceedings of the 15th International Conference on Computer-Supported Collaborative Learning - CSCL 2022* (pp. 431-434). Hiroshima, Japan: International Society of the Learning Sciences.
- **Rajarathinam, R. J.**, D'Angelo, C., Mercier, E. (2022, June). Speech analytics on individual and group audio data to understand collaboration. In Weinberger, A., Chen, W., Hernández-Leo, D., & Chen, B. (Eds.), *Proceedings of the 15th International Conference on Computer-Supported Collaborative Learning - CSCL 2022* (pp. 599-600). Hiroshima, Japan: International Society of the Learning Sciences.
- **Rajarathinam, R. J.**, Ehrlich, G., Mercier, E. (2022, June). Developing a boundary practice for collaborative task design in a design-centric research–practice partnership. In Chinn, C., Tan, E., Chan, C., & Kali, Y.(Eds.), *Proceedings of the 15th International Conference on Computer-Supported Collaborative Learning - ICLS 2022* (pp. 2082-2083). Hiroshima, Japan: International Society of the Learning Sciences.

PEER-REVIEWED CONFERENCE PRESENTATIONS

- **Rajarathinam, R. J.**, Mercier, E. (2022, April). *Impact of Instructor Intervention on the Conceptual Understanding of Undergraduate Engineering Students Working in a Group.* Poster session presented at American Education Research Association Annual meeting, San Diego, CA.
- **Rajarathinam, R. J.**, Mercier, E. (2021, November). *Impact of Instructor Intervention on the Conceptual Understanding of Undergraduate Engineering Students Working in a Group.* Poster session presented at Learning Sciences Graduate Student Conference, Champaign, IL.

CAMPUS PRESENTATIONS

- **Rajarathinam, R. J.**, Mercier, E. (2021, November). Designing collaborative problem-based discussion tasks. *Stronger Together- Increasing Student Learning Through Collaborative Activities* [Symposium]. Academy for Excellence in Engineering Education (AE3) Lightning Symposium, Champaign, IL, United States.

RESEARCH EXPERIENCE

COLLABORATIVE SKETCH TOOLS FOR ENGINEERING PROBLEM SOLVING (CSTEPS)

Modeling Student Collaboration using Multimodal Learning Analytics
PI: Dr. Emma Mercier, Dr. Jina Kang *Spring 2023 - Summer 2025*
Department of Curriculum & Instruction, UIUC

Dissertation: *Ranking features used in modeling student collaboration using multimodal learning analytics*

- ▷ Led a project on annotating and modeling student collaborative behaviors across multiple data modalities. Applied machine learning in Python and feature interpretation revealed key relationships between collaborative constructs and data sources.

Spatial Pedagogy of Teachers in a Collaborative Discussion Classroom
PI: Dr. Emma Mercier, Dr. Jina Kang *Spring 2024 - Summer 2025*
Department of Curriculum & Instruction, UIUC

- ▷ Analyzed classroom dynamics by annotating student-teacher interactions and extracting teacher positional data via fisheye camera footage using OpenPose. Investigated the impact of spatial pedagogy on student help-seeking behaviors.

Speech Analytics in Collaborative Learning
Graduate Research Assistant *Fall 2021 - Spring 2023*
PI: Dr. Cynthia D'Angelo
Department of Educational Psychology, UIUC

- ▷ Collected and processed group and individual audio data during undergraduate collaborative sessions using the openSMILE toolkit. Analyzed non-lexical features to elucidate patterns in student collaboration and teacher-student interactions.

Thesis: Impact of monitoring of instructor on the conceptual understanding of students working on a collaborative task as a group
Graduate Research Assistant, Colearn Lab *Fall 2019 - Spring 2021*
PI: Dr. Emma Mercier
Department of Curriculum & Instruction, UIUC

- ▷ Developed coding schemes for monitoring instructor-student interactions and conceptual understanding. Conducted Confirmatory Factor Analysis and path analysis to study relationships between variables.

Research Fellow, Colearn Lab *Fall 2018 - Spring 2019*
PI: Dr. Emma Mercier
Department of Curriculum & Instruction, UIUC

- ▷ Developed tasks for Introductory Solid Mechanics and collected multimodal data. Created prompts for the CSTEPS teacher tool and built a database based on collaborative theories.

CONNECTIONS OF EARTH AND SKY WITH AUGMENTED REALITY (CEASAR)

Analysis of Joint attention in CEASAR
PI: Dr. Jina Kang *Fall 2022 - Summer 2024*
Department of Curriculum & Instruction, UIUC

- ▷ Devised coding schemes for collaboration and gestures to explore their role in embodied collaborative learning. Employed temporal methods such as Ordered Network Analysis (ONA) and Epistemic Network Analysis (ENA) to examine the relationships between joint attention states and collaborative interactions.

Role of Gesture in facilitating collaboration in CEASAR
Graduate Research Assistant, EMIT Group *Fall 2020 - Summer 2022*
PI: Dr. Robb Lindgren
Department of Curriculum & Instruction, UIUC

- ▷ Collected mixed-media data in an astronomy course using Hololens 2.0 and tablets. Developed coding schemes for gesture and collaboration, and analyzed log data to understand embodied cognition.

HOLOORBITS

Using Large Language-and-Vision Assistant (LLaVA) to automate non-verbal interaction annotation in videos within HoloOrbits
PI: Dr. Jina Kang *Spring 2025 - Summer 2025*
Department of Curriculum & Instruction, UIUC

- ▷ Leveraging LLaVA open-source model to code 10-second video clips for gesture and non-verbal

Using Small Language Models (SLMs) to replicate LLM Tutor Agent in HoloOrbits
PI: Dr. Jina Kang *Fall 2024 - Spring 2025*
Department of Curriculum & Instruction, UIUC

- ▷ Fine-tuned Microsoft Phi3 3.8b parameter model to replicate Tutor Agent built with GPT4o using synthetic data generated using GPT4o. We achieved 85% replication of results from LLM.
- ▷ Identified systematic patterns of Hallucinations.

User feedback of tool interaction (webGL version) for iterative improvement of HoloOrbits
PI: Dr. Jina Kang *Fall 2023 - Spring 2025*
Department of Curriculum & Instruction, UIUC

- ▷ Implemented webGL version of HoloOrbits to 40 participants and obtained feedback on user experience, design improvements, and multi-user interactions. Utilized the feedback to improve activity and the webGL version of HoloOrbits.

Optimizing data collection for facial affect recognition and pose estimation analysis in HoloOrbits using 360 camera
PI: Dr. Jina Kang *Fall 2023 - Spring 2025*
Department of Curriculum & Instruction, UIUC

- ▷ Utilized GoPro Max 360 camera to capture student interaction in small groups. Facial recognition and Pose estimation of every student in a small group was improved by 4x and 10x compared to traditional video capturing methods.

AI IN EDUCATION

Using LLMs to anotate qualitative text dataset
Graduate Research Assistant *Summer 2024 - Spring 2025*
PI: Dr. Jina Kang
NSF AI institute INVITE: Inclusive Intelligent Technologies for Education

- ▷ Automatically annotate collaboration behaviors on dialogues using various prompting techniques: InContext Learning, Auto Chain-of-Thought, and Synthetic prompting.

Operationalizing collaboration skills assessed in learning environments for K-12 students with AI pedagogical agent
Graduate Research Assistant *Fall 2023 - Spring 2024*
PI: Dr. Robb Lindgren, Dr. Jina Kang
NSF AI institute INVITE: Inclusive Intelligent Technologies for Education

- ▷ Conducting an meta-review on K-12 student collaboration frameworks to develop a topology to link collaboration constructs with measurable behaviors that can be improved using a AI pedagogical agent.

Validating Multimodal Analysis framework in learning environments with diverse students population
Graduate Research Assistant *Fall 2023 - Summer 2024*
PI: Dr. Kristy Boyer, Dr. Jina Kang
NSF AI institute INVITE: Inclusive Intelligent Technologies for Education

- ▷ Annotated CEASAR dataset along with other datasets within INVITE institute for confusion and conflict during collaboration. Validating LSTM based-Neural Network with corss-attention and late fusion in all the different datasets.

ENGINEERING EDUCATION

Service Learning Ecosystem
Graduate Research Assistant *Summer 2023 - Summer 2024*
PI: Dr. Blake Everett Johnson, Dr. Saadeddine (Saad) Salim Shehab
Department of Mechanical Engineering, UIUC
Siebel Center for Design, UIUC

- ▷ Designed an infrastructure to streamline interactions among teachers, TAs, and TCs, and conducted survey-based analyses to evaluate the reciprocal contributions within this educational ecosystem.

Electrical and Computer Engineering Middle School Summer Camp
PI: Dr. Yuting-Wu Chen, Dr. Victoria Shao *Summer 2023*
Department of Electrical & Computer Engineering, UIUC

- ▷ Adapted summer camp activities to align with NGSS standards and designed pre- and post-camp surveys to gauge changes in student interest. Conducted data analysis using dependent samples t-tests to assess the camp's educational impact.

Implementation of Entrepreneurial Mindset in Engineering Classrooms
Graduate Research Assistant *Summer 2022*
PI: Dr. Leon Liebenberg
Department of Mechanical Science & Engineering, UIUC

- ▷ Created and summarized twenty KEEN cards aimed at fostering an entrepreneurial mindset among engineering students. Conducted interviews to capture student experiences in courses incorporating entrepreneurial pedagogical elements.

PrairieLearn implementation in '*Introductory Solid Mechanics*' course
Graduate Research Assistant *Fall 2016 - Spring 2018*
PI: Dr. Mariana Silva
Department of Mechanical Science & Engineering, UIUC

- ▷ Developed questions based on Bloom's taxonomy levels and integrated feedback into PrairieLearn. Scripted questions and solutions into the repository.

TASK DESIGN

Co-design of Collaborative Physics Tasks for an undergraduate physics course *Fall 2020 - Spring 2021*
PI: Dr. Eric Kuo
Department of Physics, UIUC

- ▷ Developed and iteratively improved collaborative tasks for freshman physics. Collected and analyzed multimodal data to study student interaction and collaboration in physical shared spaces.

Co-design of collaborative mathematics task for an undergraduate linear algebra course
Graduate Research Assistant *Spring 2020 - Spring 2021*
PI: Dr. Emma Mercier
Department of Curriculum & Instruction, UIUC

- ▷ Co-designed tasks for an Applied Linear Algebra course and collected data via Zoom. Conducted surveys and focus groups to improve task design and understand its impact on collaboration.

MACHINE TRANSLATION

Translation of English Video lecture into Spanish subtitles in a church context using Large Language Models *Fall 2024 - Spring 2025*
PI: Daniel Goulet
The Vineyard Church, Urbana, USA

- ▷ Developed and iteratively improved translation of 36 Video lectures that are 50 minutes long using LLM and Human-in-the-loop method.
- ▷ Achieved METEOR $\geq .85$ and COMET $\geq .92$ (evaluation metrics) by implementing RAG for improved dictionary context, state-history, expert-inspired system prompt, and structured output.

Book translation: *Cabbage in the Desert* (English → Swahili) *Spring 2025 – Spring 2025*
PI: Jim Egli
The Vineyard Church, Urbana, USA

- ▷ Adapted the LLM + human-in-the-loop translation pipeline (originally built for the Spanish video lectures above) to a full-length book; published Swahili edition of *Cabbage in the Desert*.

TEACHING EXPERIENCE

College of Education, University of Illinois Urbana-Champaign
Graduate Teaching Assistant under Dr. Nidia Ruedas-Gracia (Hybrid)

- ▷ EPSY 405/PSYC 465: Personality and Social Development (UG/Graduate course) *Spring 2023*

Graduate Teaching Assistant under Dr. Kary Zarate (Hybrid)

- ▷ CI550/EPSY550: Methods of Educational Inquiry (Graduate course) *Fall 2022*

College of Engineering, University of Illinois Urbana-Champaign
Graduate Teaching Assistant under Dr. Mariana Silva

- ▷ TAM251: Introductory Solid Mechancis (UG course) *Spring 2017 - Spring 2018*
- ▷ TAM210/211: Statics (UG course) *Fall 2016*

Graduate Student Leacturer under Dr. Mariana Silva

- ▷ TAM251: Introductory Solid Mechancis (UG course) *Summer 2017*

Graduate Teaching Assistant under Dr. Moshe Matalon

- ▷ TAM435: Intermediate Fluid mechanics (UG/Graduate course) *Spring 2017*

MENTORSHIP

- ▷ Mentored udergraduate researchers in annotation of collaborative behaviors within CEASAR and HoloOrbits datasets.
  - ☐ Jacob Frank Sobel, UIUC *Spring 2024- Spring 2025*
  - ☐ Gabby Potocki, UIUC *Spring 2024- Summer 2024*
- ▷ Mentored undergraduate researchers in developing reliable coding techniques for analyzing student collaborative interactions.
  - ☐ Jacob Frank Sobel, UIUC *Spring 2023- Fall 2023*
  - ☐ James Park, UIUC *Spring 2023- Fall 2023*
- ▷ Guided undergraduates from the College of Education in assisting engineering graduate teaching assistants with effective lesson planning.
  - ☐ Braedyn Sydney Bailis, UIUC *Fall 2023*
  - ☐ Grace Kraft, UIUC *Fall 2023*

ACADEMIC SERVICE

Elected positions

- ▷ Co-chair of College of Education Graduate Student Conference, UIUC *2023-2024*

  Led a team of 15 in organizing an academic educational conference with 200+ attendees, coordinating with various departments to manage logistics, budget, and scheduling.

▷ Event schedule committee chair for Graduate Student Conference, *2022-2023*

Oversaw the development of the conference schedule, ensuring a balanced representation of topics and speakers.

▷ Review committee member for Learning Sciences Graduate Student Conference *2021-2022*

Critically evaluated and selected academic papers for presentation.

University Service

▷ **Graduate student representative**, Faculty Search Committee for Open rank CS education faculty, UIUC *2023*

Conference Reviewing

▷ American Educational Research Association (AERA) annual meeting

▷ International Conference on Learning Analytics & Knowledge (LAK)

▷ International Conference on Educational Data Mining (EDM)

▷ International Conference on Computer Supported Collaborative Learning (CSCL)

▷ International Conference on the Learning Sciences (ICLS)

▷ Learning Sciences Graduate Student Conference (LSGSC)

Event Organizations

▷ PINNACLE, a nation-level technical symposium for mechanical engineers, 2012

▷ Workshop 'Auto-Anatomy' at Kurukshetra'12, a techno-management fest, 2012

INVITED TALKS

▷ Guest speaker at an Graduate course CI 536, UIUC *Fall 2023*

Delivered a guest lecture on 'My Ph.D. journey', engaging with 10+ Ph.D. students and sparking discussions on dissertation, life as a graduate student, and work-life balance.

MEDIA ENGAGEMENT

▷ Interviewed to speak about collaborative learning on the WPGU radio station , 2023

Featured in a 30-minute segment discussing the impact and strategies of collaborative learning in modern educational systems.

TECHNICAL SKILLS

Software:	RStudio, Mplus, SPSS, MATLAB, Mathematica
Programming languages:	Python, R
Frameworks:	PyTorch, TensorFlow
Libraries:	OpenCV, OpenSMILE, OpenFace, OpenPose

MEMBERSHIPS

◇ International Educational Data Mining Society (EDM)

- ◇ Society of Learning Analytics Research (SOLAR)
- ◇ International Society of Learning Sciences (ISLS)
- ◇ American Educational Research Association (AERA)