Mitch Gerhardt

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RESEARCH INTERESTS

Sociotechnical studies of generative AI adoption in workplace settings, ethnographic methods, science and technology studies (STS), epistemic cultures, computational approaches to qualitative research, symbolic interactionism, workplace learning and expertise

EDUCATION

Ph.D. in Engineering Education, Virginia Tech, GPA: 4.00/4.00 May, 2027 (expected)
- PhD Candidate (advanced to candidacy Fall 2025)
- Committee: Courtney Faber, Andrew Katz (Chair), Holly Matusovich, and Nicole Pitterson
- 2025 NSF GRFP Honorable Mention
- 2024 Google PhD Fellowship Nominee
- 2023-2024 Davenport Fellowship Awardee

M.S. in Computer Science, Virginia Tech, GPA: 3.95/4.00 December, 2026 (expected)
- Committee: Sara Hooshangi (Chair), Andrew Katz, Sanmay Das
- Coursework: *Machine Learning*, *Natural Language Processing*, *Computer Education Research*, *AI Tools for Software Engineering*, *Applied Design and Assessment of Educational Environments in Engineering*

Graduate Certificate: Cognition and Education, Virginia Tech, GPA: 4.00/4.00 May, 2025

B.S. in Electrical Engineering, Virginia Tech, GPA: 3.69/4.00 Dec., 2020
- Graduated Magna Cum Laude and Dean's List
- Pratt Engineering Scholarship, Donald and Madeline Stewart Scholarship, and Konrad-Steinmetz Scholarship for Engineering Leadership Awardee
- Hardware Team Lead for AutoDrive Design Team

BOOK CHAPTERS

Under Revision

Leveraging Large Language Models in Engineering Education Research: Methods and Applications
2026 International Handbook of Engineering Education Research Methods
Mitchell Gerhardt, Gabriella Coloyan Fleming, Siqing Wei, and Andrew Katz
Expected publication: February 2027

JOURNAL PUBLICATIONS

Pending Publication

Collaborative (In)decision: A Preliminary Investigation of the Differences in Undergraduate Engineering Capstone Students' Collaborative Behaviors
International Journal of Engineering Education - Special Issue for Capstone Design
Mitchell Gerhardt, Mayar Madboly, Nicole Pitterson, Emily Dringenberg, and Benjamin Ahn

Submitted

Improving Engineering Education GAI Qualitative Research Workflow Quality: Techniques and Documentation Strategies
Studied in Engineering Education - Special Issue on GAI in Methods
Mitchell Gerhardt and Andrew Katz

In Preparation — **Decade-Long Analysis of Skills in Mechanical Engineering Job Advertisements 2010-2022**
Targeting: ASME
Mitchell Gerhardt, Shawn Sun, Andrew Katz, David Knight, Jessica Deters, Maura Borrego, Riya Budhathoki, and Herman Ronald Clements III

In Preparation — **Addictive GAI Use Among STEM Graduate Students: Dependency-Based Technological Diffusion**
Targeting: Computers & Education: AI
Mitchell Gerhardt and Andrew Katz

Nov, 2024 — **Using Generative Text Models to Create Qualitative Codebooks for Student Evaluations of Teaching** [Paper]
International Journal of Qualitative Methods - Volume 23
Andrew Katz, **Mitchell Gerhardt**, and Michelle Soledad

PEER-REVIEWED CONFERENCE PUBLICATIONS

Accepted — **It's like "X": How Engineering Faculty Metaphors Construct (and Constrain) GAI Understanding in Engineering Education**
2026 ASEE Annual Conference & Exposition
Mitchell Gerhardt, Kylee Shiekh, Andrew Katz, and Benjamin Chaback

Accepted — **WIP: Unpacking Mechanical Engineering Students' Career Goals, Skill Development, and Perspectives on Industry**
2026 Frontiers in Education Conference
Herman Ronald Clements III, **Mitchell Gerhardt**, Jessica Deters, Shawn Sun, David Knight, Maura Borrego, Andrew Katz, and Riya Budhathoki

Accepted — **Understanding the Master's Engineering Workforce Landscape: Employer Demands and Student Goals**
2026 ASEE Annual Conference & Exposition
Herman Ronald Clements III, Riya Budhathoki, **Mitchell Gerhardt**, Jessica Deters, Shawn Sun, David Knight, Maura Borrego, and Andrew Katz

Under Revision — **When Can GAI be Used Anyway? An Analysis of Engineering Faculty's Generative AI Policies**
2026 ASEE Annual Conference & Exposition
Benjamin Chaback, **Mitchell Gerhardt**, Andrew Katz, and Kylee Shiekh

June, 2025 — **Automated Analysis of Knowledge Types in Computer Science Textbooks: A Natural Language Processing Approach to Understanding Epistemic Climate** [Paper]
2025 ASEE Annual Conference & Exposition - Montreal, QC, Canada
Mitchell Gerhardt and Andrew Katz

June, 2025 — **Beyond Calculations: Engineering Judgment as Epistemic Cognition in Engineering Education** [Paper]
2025 ASEE Annual Conference & Exposition - Montreal, QC, Canada
Mitchell Gerhardt, Michael Robinson, and Brian Faulkner

June, 2024 — **Reimagining Behavioral Analysis in Engineering Education: A Theoretical Exploration of Reasoned Action Approach** [Paper]
2024 ASEE Annual Conference & Exposition - Portland, OR
Mitchell Gerhardt, Nicole Pitterson, Emily Dringenberg, and Benjamin Ahn

June, 2024 **Why do capstone students choose to perform behaviors? Differing prevalence in collaborative choices** [Paper]
Capstone Design Conference - Knoxville, TN
Mitchell Gerhardt, Nicole Pitterson, Emily Dringenberg, and Benjamin Ahn

RESEARCH EXPERIENCE

Research Assistant Aug., 2025 - Present
Department of Engineering Education, Virginia Tech Blacksburg, VA
NSF Award #2339702: "CAREER: Minds and Machines: Exploring Engineering Faculty Member Mental Models of Generative AI and Instructional Decisions"

- Examining sociotechnical dimensions of GAI adoption in STEM higher education workplace contexts using mental model theory and Theory of Planned Behavior (TPB)
- Conducting qualitative interviews with faculty to understand how perceptions of GAI shape instructional decisions, assessment practices, and workplace norms around GAI use
- Applying ethnomethodological and symbolic interactionist frameworks to analyze epistemic cultures and expertise recognition in AI-mediated educational environments
- Developing LLM-based qualitative workflows to scale aspects of qualitative data analysis and make them available to fellow researchers

Research Assistant May., 2025 - Present
Department of Engineering Education, Virginia Tech Blacksburg, VA
Assisted NSF Award #2433099: "Collaborative Research: Research: The Engineering Master's Workforce: Leveraging NLP Techniques to Understand Employer Demands and Student Goals":

- Created a Python-based workflow to manage DuckDB-based database to analyze over 5 million jobs spanning 2007-2025
- Implemented Jupyter notebooks to extract job postings' qualification information, tasks and responsibilities, skills and knowledge, and technologies required
- Currently applying open-source large language models (LLMs) to add flexibility and granularity to job posting extractions

Research Assistant Jan., 2024 - July, 2024
Department of Engineering Education, Virginia Tech Blacksburg, VA
Assisted NSF Award #2300977: "Design for Sustainability: How Mental Models of Social-Ecological Systems Shape Engineering Design Decisions":

- Developed a novel natural language processing (NLP) methodology for generating qualitative codebooks from large datasets (e.g., students' instructor evaluations)
- Co-authored a journal publication in the *International Journal of Qualitative Methods* outlining the extract, embed, cluster, and summarize (EECS) workflow
- Contributed to ongoing refinement and improvement of the NLP-based methodology for analyzing qualitative data
- Applied open-source LLMs to preserve data security and privacy while maintaining analytical rigor

Research Assistant August, 2024 - Jan., 2024
Department of Engineering Education, Virginia Tech Blacksburg, VA
Assisted NSF Award #2217523: "Collaborative Research: Collaboration in Engineering Student and Practitioner Teams: A Study of Beliefs about Effective Behaviors":

- Designed and implemented a pilot study to examine the frequency and prevalence of collaborative behaviors in senior engineering capstone teams
- Co-authored a conference paper for the 2024 Capstone Design Conference about why students choose certain collaborative behaviors
- Expanded the conference paper into an accepted journal article based on the preliminary findings from the project

- Developed foundation for future research on student collaborative decision-making within engineering design contexts

Ethnographic Researcher Fall, 2025
Cornell University Science & Technology Studies Ithaca, NY
Independent ethnographic study of Science Studies Reading Group (SSRG) feedback practices

- Conducted 15+ weeks of participant observation examining how different feedback formats (facilitated dialogues, "ping pong" discussions) shape scholarly collaboration and expertise networks
- Produced 10,000-word analytical ethnography applying STS frameworks to understand epistemic cultures, knowledge production practices, and organizational dynamics in interdisciplinary research communities
- Analyzed conversational patterns, turn-taking behaviors, and collaborative meaning-making in academic workplace settings
- Working on methodology paper explicating study and decision-making for contributions to studying workplace knowledge practices in EER

Principal Investigator, Graduate Student Survey Research May, 2025 - Present
Multi-institutional Ithaca, NY
IRB-approved multi-institutional study examining STEM graduate students' GAI use patterns

- Designed and distributed Qualtrics survey across a few universities collecting 100+ responses examining nuanced patterns of GAI adoption beyond reductive "cheating" narratives
- Applying mixed methods approach combining descriptive statistics, correlation analyses, demographic studies, and planned qualitative interviews
- Investigating workplace socialization processes, community norms around GAI use, and shifting definitions of legitimate expertise in graduate education contexts

PROFESSIONAL EXPERIENCE

Graduate Assistant to the Director for Special Programs Aug., 2024 - May, 2025
Center for Excellence in Teaching and Learning (CETL), Virginia Tech Blacksburg, VA
Worked with Dr. Tiffany Shoop on various teaching and learning initiatives:

- Conducted mid-semester feedback sessions across various disciplines, gathering and analyzing student input to help faculty enhance teaching effectiveness and student engagement
- Developed and presented a faculty workshop on Interactive Lecturing with approximately 30 attendees, providing resources and strategies for enhancing student engagement in the classroom
- Co-led the implementation of the CIRTL (Center for the Integration of Research, Teaching, and Learning) program at Virginia Tech, researching best practices and developing an institutional implementation strategy for Practitioner and Scholar CIRTL levels leveraging cross-campus resources and partnerships
- Helped organize the 17th annual Conference on Higher Education Pedagogy (CHEP), reviewing submissions, coordinating sessions, and developing a custom Python application to automate post-conference booklet creation
- Systematically reviewed empirical research on Collaborative Online Interactive Learning (COIL) to assist in faculty training program development and institutional integration
- Created resources for faculty including presentations, research compilations, and implementation guides to support teaching excellence and innovation

Global Product Development Engineering June, 2021 - June, 2023
General Motors Warren, MI
Software Engineer - Software Defined Vehicle

- Responsible for developing next-gen software infrastructures and technology for software-defined vehicles
- Key implementation role in mobile app development, in-vehicle interfaces, and back-end deployment
- Established and applied testing protocols including CI/CD pipelines, automated build processes, and testing mechanisms

Infotainment Technical Program Manager

- Part of an integral team to plan, execute, and deliver leading-edge technology to our customers
- Worked with global partners, external suppliers, and internal teams to track, drive, support, and report vehicle readiness metrics

Complexity Optimization Engineer

- Engaged in measuring, managing strategy, and reducing program hardware and software complexity
- Optimized tactics for efficient build combinations and part reuse across programs and vehicle subsystems

Autonomy Systems Research May, 2019 - Dec., 2020
Caterpillar Inc. Peoria, IL and Blacksburg, VA
Software Engineer I

- Implemented a control interface for autonomy simulation platform using ROS, teleoperation control, and robot modeling software
- Validated and integrated sensor data on large-scale machinery into algorithms for mapping and navigation via complex data structures
- Developed CI/CD protocols and workflows for software distribution using Docker, ROS, and the C++ testing framework

GRANTS & AWARDS

Co-Principal Investigator Fall, 2025
Bridging the Conversational AI Gap: Synthetic Dataset Generation for Engineering Education Dialogue
NSF CCSS Seed Grant ($4,500), Cornell University - 10-month project

- Developing novel methodology for creating synthetic speech datasets preserving conversational phenomena critical to workplace learning research (overlapping speech, strategic pauses, collaborative turn-taking)
- Fine-tuning open-source ASR models using 500-1,000 multi-speaker dialogue samples generated via ElevenLabs API to enable large-scale analysis of engineering classroom interactions
- Applying synthetic data to study feedback literacy in design studios and facilitated dialogues about research group culture and inclusion
- Publicly archiving all synthetic audio, generation parameters, and evaluation results in Cornell CSSR Data & Reproduction Archive for reproducible research across institutions
- Positions research program for larger NSF/NIH proposals by demonstrating technical feasibility of computational methods in engineering education research

Co-Facilitator Fall, 2025
Fulbright Brazil International Collaboration
Virginia Tech and Brazilian Universities Partnership

- Selected by Fulbright Brazil with advisor and VT colleagues for intensive 3-day faculty development program examining GAI adoption in higher education workplace contexts
- Presented to 80+ engineering faculty from dozens of Brazilian universities on sociotechnical dimensions of GAI integration: technical fundamentals, assessment transformation, ethics, institutional policy development, faculty-student relationship dynamics
- Served as technical expert and instructional designer facilitating cross-cultural dialogue about workplace technology adoption and organizational change

Nominee 2025
Google PhD Fellowship in Human-Computer Interaction
Nominated by Virginia Tech for national fellowship

Honorable Mention 2025
NSF Graduate Research Fellowship Program
National Science Foundation

PROJECTS

Ducky Fall, 2025
AI-powered software developer assistant built with Streamlit providing intelligent development support through specialized features for CS 5740: AI Tools for Software Engineers

- Developed ReAct-pattern agent system with sandboxed tool execution capabilities, enabling GAI agents to autonomously perform file operations, code editing, and multi-step task completion with security through path validation
- Implemented dual interface architecture: rich web interface with Monaco editor integration and CLI interface, supporting persona-based agent behaviors across software development roles (planning, development, QA, operations)
- Integrated RAG (Retrieval Augmented Generation) using local sentence-transformers for offline-capable document queries and comprehensive LLM integration with OpenAI-compatible APIs supporting function calling and streaming responses
- Built with modern Python tooling including uv for dependency management, demonstrating full-stack development skills including async programming, state management, UI/UX design, and secure tool execution patterns

Between the Lines Fall, 2025
React + TypeScript bookstore e-commerce application developed for CS 5244: Web App Development

- Built full-stack e-commerce site using React + TypeScript with Vite, evolving from Figma and static HTML/CSS into a complete bookstore application with shopping cart, category browsing, and checkout functionality
- Developed Java servlet backend (MitchBookstoreTransact) running on Tomcat to handle categories, books, and order processing with RESTful API design
- Implemented state management using React Context providers (CategoryContext, CartContext, OrderDetailsProvider) with useReducer pattern for cart and order state, including persistent cart state via localStorage
- Created component-based architecture with React Router v6 for navigation across six main routes: home, category pages, cart, checkout, and order confirmation
- Integrated Formik/Yup for form validation with custom validators for phone numbers and credit cards, ensuring robust client-side validation throughout checkout flow

Graduate Courses Analysis Tool [Web], [Code] Nov., 2023 - May, 2025
Full-stack web application for College of Engineering Associate Dean for graduate enrollment patterns

- Developed tool extracting structured course data from PDF timetables, identifying underenrolled graduate courses for strategic enrollment analysis and resource allocation decisions
- Technology Stack: React/Tailwind frontend, FastAPI backend, PyMuPDF for PDF processing, AWS S3 for production storage
- Implemented automated ETL pipeline for processing university course enrollment data at scale with cross-listing identification and data enrichment via VT Timetable API
- Containerized application using Docker for reproducible deployment and maintenance

Epistemic Climate Analysis in CS Education [Code] Sept., 2024 - June, 2025
Sociotechnical analysis of knowledge representation in computer science textbooks using STS frameworks and computational methods

- Developed novel methodology analyzing epistemic climate in CS textbooks using large language models, examining how different knowledge types shape students' understanding of legitimate expertise and disciplinary identity

- Created comprehensive coding scheme for 12 knowledge types (procedural, conceptual, historical, etc.) grounded in engineering education research and STS literature on epistemic cultures
- Implemented retrieval-augmented generation approach for large-scale textbook analysis, demonstrating how computational methods can reveal patterns in how disciplines present and value different forms of knowledge
- Generated insights about knowledge hierarchies in undergraduate CS education, revealing sociotechnical dimensions of how textbooks as material artifacts shape epistemic thinking
- Published findings at ASEE 2025 Annual Conference

SERVICE

Associate Chair, Panelist, & Facilitated Discussion Mediator
Virginia Tech Graduate Honor System Aug., 2023 - Present

- Serve as a trained facilitator for academic integrity discussions between faculty and students, mediating resolution of potential honor code violations through structured dialogue
- Participate in Review Panels that evaluate evidence and determine outcomes in academic integrity cases, upholding university standards while ensuring fair process
- Help educate the graduate community on academic integrity standards, ethical research practices, and honor system processes
- Collaborate with diverse stakeholders including faculty, administrators, and students across disciplines to resolve cases annually

Graduate Student Search Committee Member
Department of Graduate and Professional Studies Summer, 2025

Served on faculty search committee for GHS chair position, evaluating candidates and participating in selection process

Mentor, NSF Graduate Research Fellowship Program Applications
Cornell University Fall, 2025

Provided application review, feedback, and mentorship to Cornell graduate students applying for NSF GRFP

Graduate Ambassador
Department of Engineering Education Aug., 2024 - May, 2025

Reviewer, College of Engineering Torgersen Research Excellence Award May, 2025
Reviewer, ASEE Annual Conference May 2024, 2025, 2026
Reviewer, International Journal of Qualitative Methods Nov., 2024 & Sept., 2025
Reviewer, Capstone Design Conference May, 2024
President Emeritus, Hillel at Virginia Tech Dec., 2018 - Dec., 2020

INVITED TALKS, WORKSHOPS, AND PRESENTATIONS

Workshop, *Virginia Tech Graduate Instructors* (planned) March, 2026

- Initiated and lead a three-student group to organize a workshop for Virginia Tech graduate instructors about GAI course policies
- Addressing a critical need through participatory instruction and activities that promote GAI literacy
- Received IRB approval to study the workshop's implementation and effectiveness, with plans to publish results
- Leveraging networks and existing partnerships with the Graduate Honor System (GHS), the Center for Excellence in Teaching and Learning (CETL), the center for Technology-Enhanced Learning and Online Strategies (TLOS), and departmental leadership to host and market the event.

Guest Lecturer, *GRAD 5004: Graduate Teaching Assistant Workshop* Feb., 2026
Virginia Tech (Dr. Kevin Eager)
"Scholarly Ethics" presentation to in-coming GTAs at Virginia Tech, addressing topics like academic and professional integrity, the VT Undergraduate and Graduate Honor Systems, GTA integrity responsibilities, GAI use, and contemporary literature about cheating.

Guest Lecturer, *ECE Graduate Student Seminar* Dec., 2025
University of Pittsburgh
"AI Research Ethics in Engineering Education" co-presented with Andrew Katz to ECE graduate students examining ethical dimensions of AI research in educational contexts

Guest Lecturer, *ME 397/379M Qualitative Research Methods* Nov., 2025
University of Texas at Austin (Dr. Maura Borrego)
"Large Language Models in Qualitative Engineering Education Research: Technical Methods and Methodological Considerations"

- Examined human vs. machine pattern recognition, current GAI approaches for qualitative research, researcher positionality, translational challenges, and shifting definitions of "intelligence"
- Addressed methodological questions about computational approaches to qualitative work and implications for research practice
- Instructor feedback: "Students were honestly blown away...for many of them it was the highlight of the semester"

Invited Presentations, *Cornell DBER Research Group (2 presentations)* Oct., 2025
Cornell University
Presented technical background of large language models, AI history, and sociotechnical applications in engineering education research; demonstrated how computational methods intersect with critical perspectives on workplace learning and expertise

Conference Presentation, *2025 ASEE Annual Conference* June, 2025

- "Automated Analysis of Knowledge Types in Computer Science Textbooks: A Natural Language Processing Approach to Understanding Epistemic Climate" - exploring the use of LLMs to evaluate types of knowledge described in computer science textbooks
- "Beyond Calculations: Engineering Judgment as Epistemic Cognition in Engineering Education" - arguing for greater psychological interrogation of "engineering judgment"

Invited Student, *Board of Visitors* May, 2025
Virginia Tech
Discussed research on GAI adoption in higher education and ongoing projects examining workplace technology integration with university leadership

Panelist, *2024 Capstone Design Conference* June, 2024
Panel discussion examining teamwork dynamics and collaborative practices in capstone engineering workplace contexts

Conference Presentation, *2024 ASEE Annual Conference* June, 2024
"Reimagining Behavioral Analysis in Engineering Education: A Theoretical Exploration of Reasoned Action Approach" - examining decision-making in engineering student workplace teams

Conference Poster, *2024 Capstone Design Conference* June, 2024
"Why do capstone students choose to perform behaviors? Differing prevalence in collaborative choices"

Panelist, *Virginia Tech Interdisciplinary Capstone (IDC) course* Oct., 2023
Discussion of engineering industry workplace practices and career pathways with capstone students

TEACHING EXPERIENCE

Big Brothers Big Sisters of Metropolitan Detroit Detroit, MI
Academic Tutor Aug., 2021 - June, 2023

- Helped create and support mission for one-on-one mentoring sessions and academic assistance
- Exposure to COVID-19 instruction methods and challenges thereof

TECHNICAL SKILLS

Qualitative Methods: Ethnography, participant observation, semi-structured interviews, grounded theory, symbolic interactionism, ethnomethodology, thematic analysis, discourse and conversational analysis, content analysis

Theoretical Frameworks: Engineering expertise, sociology of expertise, Science & Technology Studies (STS), epistemic cultures, epistemic thinking, social construction of technology, engineering studies, academic integrity and cheating, human-computer interactions (HCI)

Computational Methods: Natural language processing, large language models (LLMs), prompt and context engineering, LLMs for qualitative research, retrieval-augmented generation (RAG), agent-based systems, computational text analysis

Programming & Tools: Python, JavaScript, C++, SQL, React, FastAPI, Docker, Git, Jupyter notebooks, PyTorch, MCP, scikit-learn, HuggingFace Transformers, AI-based programming systems

Mixed Methods: Survey design (Qualtrics), descriptive statistics, correlation analysis, triangulation of qualitative and quantitative data

Data Management: DuckDB, MySQL, AWS S3, Azure, version control, reproducible research practices