



SCHOOL OF  
**CHEMICAL ENGINEERING**  
College of Engineering, Architecture and Technology

# CHE SEMINAR SERIES

## Teaching and Assessing Engineering Ethical Decision Making using Pretrained Language Models and Text Analytics

**DANIEL D. BURKEY, PH.D.**

Engineering practice requires professional skills beyond technical calculations, including the ability to make sound judgments in uncertain, high-stakes situations. These skills are difficult to teach and even harder to assess authentically. Games and interactive simulations help address this challenge by placing learners in realistic environments where decisions have meaningful consequences. Such contexts mirror the uncertainty and trade-offs of professional practice, promoting engagement and generating rich data on decision-making. We apply these approaches in the contexts of process safety and engineering ethics, through two projects: *Contents Under Pressure*, an immersive digital game where players navigate decisions at a chemical production facility that impact safety, productivity, and reputation, and *Mars! An Ethical Expedition*, a narrative-driven visual novel that engages engineering students in realistic, situated ethical scenarios. Both projects address a common challenge: how to capture and evaluate complex reasoning in a way that is authentic, scalable, and educationally meaningful. In *Contents Under Pressure*, decision-making is measured through scenario outcomes and decision patterns over time. In *Mars! An Ethical Expedition*, open-ended responses embedded in narrative contexts allow participants to articulate not only what they would do, but *why*. Our work underscores the importance of open-ended responses for understanding reasoning in situations with no single correct answer. To analyze qualitative data at scale, we apply Pretrained Language Models (PLMs) to identify reasoning patterns, classify perspectives, and evaluate completeness of justifications. This combination of narrative context and advanced text analytics enables us to measure subtle differences in decision-making while capturing the complexity of participants' reasoning. This presentation will trace the evolution of this work, from early case-based discussions to immersive simulations and machine learning and share insights into what makes narrative-based assessment effective for higher-order professional competencies. Our goal is to provide scalable, research-informed assessments that capture the complexity of professional decision-making and can be readily adopted by engineering educators, supporting faculty in teaching and assessing these competencies at scale.

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Daniel D. Burkey is the Castleman Term Professor of Engineering Innovation, Associate Dean of Undergraduate Education and Diversity, and the Graduate Director of the Engineering Education Ph.D. Program at the University of Connecticut. Dr. Burkey holds his B.S. in Chemical Engineering from Lehigh University in Bethlehem, PA, his M.S.C.E.P. and Ph.D. in Chemical Engineering from the Massachusetts Institute of Technology, and an M.A. in Educational Psychology from the University of Connecticut. Prior to UConn, he held positions at Northeastern University and at GVD Corporation in Cambridge, MA. Since joining UConn in 2010, Dr. Burkey's area of research has focused broadly on engineering education, and specifically on moral and ethical development of engineering students, process safety education, and game-inspired educational techniques. Dr. Burkey currently serves as a Director of the Education Division of AIChE, where he runs the Future Faculty Mentoring Program. He is a past program chair of the ASEE Chemical Engineering Division and serves as an assistant editor of the journal *Chemical Engineering Education*. In 2020, he was inducted into the Connecticut Academy of Science and Engineering (CASE) for his contributions to engineering education in the state. In addition to his many teaching awards, Dr. Burkey is also the recipient of the 2020 AIChE Education Division Innovation Award, the 2021 ASEE Corcoran Award for the best paper in *Chemical Engineering Education* in the previous year, the 2023 David Himmelblau Award from the CAST Division of AIChE for innovations in computer-aided chemical engineering education, and the 2025 AIChE Education Division Award for Excellence in Engineering Education Research. He was inducted as a Fellow of AIChE in 2024.

