

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department of Information Systems, Business Statistics and Operations Management

IS SEMINAR ANNOUNCEMENT



Cognitive Load in Video-based Education: Estimation, Impact, and Usefulness

by

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DATE	17 November 2025 (Monday)
TIME	2:30 pm - 4:00 pm
VENUE	4/F Meeting Room (Room 4047), LSK Business Building

ABSTRACT

Video-based learning has become an important mode of instruction in digital higher education. Yet, design practices still largely rely on engagement proxies (e.g., viewing duration or click counts) or anecdotal guidelines rather than data-driven evidence. Grounded in Cognitive Load Theory (CLT), our study develops and validates a scalable multimodal analysis pipeline that estimates intrinsic, extraneous, and germane cognitive load from video features using multimodal machine learning. Applying this approach to observational data from a high-quality online chemistry platform, we demonstrate that our pipeline not only reproduces the core relationships predicted by CLT, where intrinsic and germane cognitive load enhance learning performance and extraneous load hinders it, but also extends the theory by uncovering dynamic effects that cognitive load may induce. Leveraging large language models to align assessment questions with video segments, we show that learning outcomes are systematically linked to how cognitive load is distributed within a video. Complex content and integrative ideas are most effective once foundational knowledge has been established, while distracting elements introduced toward the end of a video are particularly detrimental. Using results from a randomized experiment, we also show that learners who perceived the materials as complex benefited the most from staged video designs that provide motivational framing at the outset and integrative wrap-ups at the end, highlighting the value of scaffolding and the potential for personalized, adaptive instruction. Overall, our work introduces a scalable method for automated cognitive load measurement that provides new and actionable insights for both teachers and students, and thereby enhancing digital learning designs.

BIOGRAPHY

Yi-Yun Chu's research lies at the intersection of technology, human behavior, and business, with a focus on how AI systems and people co-evolve within digital platforms. Her work examines the AI-human feedback loop: how algorithmic signals shape user and learner behaviors, and how these behavioral patterns, in turn, inform the design and adaptation of AI-driven systems. Methodologically, she integrates economic modeling, causal inference, agent design and multimodal machine learning to analyze large-scale behavioral data. Her research provides actionable insights for platform strategy, digital product design, and data-driven innovation, helping organizations leverage AI to create more adaptive, effective, and human-centered business systems.