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Helper or Hindrance? A Structured Workshop for Responsible AI Integration in PCD development

Hangil Park, and Thomas E. Rufford

School of Chemical Engineering, The University of Queensland, St Lucia, QLD 4072

hangil.park@uq.edu.au and t.rufford@uq.edu.au

ABSTRACT

As Large Language Models (LLMs) increase in capability, the challenge for engineering educators has shifted from policing usage to fostering "AI literacy" and professional accountability. This presentation shares a case study of a specialised workshop implemented in a final-year Chemical Engineering Capstone Design course. The course requires students to integrate knowledge from their 2nd to 4th years to design a complete chemical plant, a task demanding high-level critical thinking and technical integration.

While LLMs are permitted in the course to reduce workload and refocus effort on higher-value learning, initial evaluations by the teaching team revealed that current general-purpose models perform below expectations for Process Control Diagram (PCD) development. Specifically, models struggled to provide clear control specifications for a specific operation and often failed to generate accurate diagrams.

Based on the evaluation, a three-stage workshop was developed: (1) manual, team-based development of a PCD from a Process Flow Diagram (PFD); (2) generation of a parallel design using a general-purpose LLM; and (3) a comparative critique where students audited the AI output for "hallucinations" and technical inaccuracies.

By contextualizing LLM errors through instructor experience and peer-to-peer discussion, the workshop successfully shifted the student mindset from viewing LLM as a "replacement" to utilizing it as a "helper/critique tool". This presentation discusses the workshop's structure and the common technical errors produced by LLMs in a process control context.

KEY WORDS

Education, Capstone Design, Process Control Diagram, Large Language Models

BIOGRAPHY

Dr. Hangil Park is a Research Fellow at the University of Queensland, specializing in mineral processing, specifically froth flotation and dewatering. Over the past decade, he has led projects bridging fundamental modeling, sensor development, and technology translation. His portfolio includes over 20 journal papers and two PCT patents. Dr. Park has developed several industry-adopted innovations, including a drag sensor for real-time mass-pull monitoring (TRL 6), an

automated frother concentration tool, and a digital-twin-based centrifuge simulator. His work focuses on delivering practical industrial impact and advancing process optimisation through novel sensors and physics-based simulators.

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