INTEGRATING GENERATIVE AI INTO SCIENCE EDUCATION VIA CUSTOM GPTS: CONSTRUCTION, DEPLOYMENT, AND STUDENT INTERACTIONS

Elizabeth Yuriev[a], Jae Pyun[a], Samuel Lo[a], Talyssa Lea[a], Tom Ritchie[b], Dani Pearson[b]

Presenting Author: Jae Pyun (Jae.Pyun@monash.edu)
[a]Faculty of Pharmacy and Pharmaceutical Sciences, Monash University, Melbourne, Australia
[b]School of Chemistry, University of Warwick, Coventry, United Kingdom

KEYWORDS: Generative AI, personalised learning, co-creation with students
SUBTHEME: Technology Enhanced Learning

Generative AI presents new opportunities for discipline-specific, on-demand learning support, particularly in complex domains such as chemistry and physiology where students often struggle with conceptual integration and problem-solving transfer. This presentation reports on a Monash-Warwick collaborative project that develops and evaluates custom Generative Pre-trained Transformers (GPTs), designed to scaffold student problem solving in pharmaceutical science. Using the Goldilocks Help framework (Yuriev et al., 2017) as a pedagogical foundation – which emphasises providing 'just right' scaffolding that promotes deep learning without creating dependency – we constructed course-specific GPTs that offer Socratic prompts to support metacognitive engagement, while minimising the risk of reliance and overdependence on AI-generated answers.

The implementation process involved iterative refinement, student review, and rigorous pilot testing, both for content accuracy and pedagogical effectiveness in Socratic capability. Our mixed-methods study investigates how students interact with these custom GPTs compared to open-access chatbots, drawing on usage data, perception surveys, and think-aloud interviews. Preliminary findings reveal that students adopt distinct prompting strategies depending on their familiarity with the subject matter, problem-solving mindset (instrumental versus concept-driven), and the perceived authority of the chatbot. The custom GPTs were significantly more likely to elicit structured engagement aligned with learning objectives, while open tools tended to promote less-productive trial-and-error approaches.

We discuss how the specific design features of prompt scaffolds and model behaviour can influence student cognition, affect, and self-regulation during problem solving, providing evidence-based design principles of educational AI tools. We also highlight how participatory student co-design processes contributed to the tool's usability and perceived relevance, demonstrating the value of user-centred design in educational technology.

As a practical resource for others looking to design customised chatbots for their courses, we offer a validated skeleton template for a system prompt and step-by-step guidance to customise it for various disciplinary contexts. This work has broader implications for the development of GenAI-driven support tools in STEM education and offers a tested, scalable model for embedding discipline-aligned pedagogical principles into generative AI applications across diverse educational contexts.

References:
Yuriev, E., Naidu, S., Schembri, L. S., & Short, J. L. (2017). Scaffolding the development of problem-solving skills in chemistry: guiding novice students out of dead ends and false starts. *Chemistry Education Research and Practice*, 18(3), 486-504.

ACKNOWLEDGEMENTS

This work is supported by the Monash-Warwick Alliance Education Activation Fund 2025. ChatGPT 4o was used to assist with language editing and improving readability of this abstract.

Proceedings of the Australian Conference on Science and Mathematics Education, The University of Melbourne, 30 September - 2 October 2025, page 85, ISSN Number 2653-0481.