

Supporting Students' Understanding of Generative Artificial Intelligence (GenAI) in Science Learning: The Affordance of an Epistemic-Dialogic Approach

There is an increasing enthusiasm for GenAI in learning science. Junior secondary students are often asked to follow teacher instructions to use GenAI for designing scientific investigations. Students do not know how GenAI creates scientific information (*Cheung, Pun and Li, 2024). There is a lack of research in this epistemic aspect of GenAI. The problems are exacerbated by GenAI's capacity for "hallucinating" scientific information and the lack of curriculum guidelines for GenAI-related classroom practice (*Cheung et al., 2024). Without opportunities for dialogue during engagement, students are likely to place too much trust in GenAI-created scientific information. Epistemic-dialogue pedagogy supports students to build on others' ideas about the validity of scientific claims made by GenAI. Given its potential, teachers need to engage with them in epistemic dialogues to ensure there is critical use of GenAI in science learning. This proposed study will use design-based interventions to (1) develop and refine an epistemic-dialogic pedagogy and (2) examine its effectiveness on students' science learning. It will be conducted over two years with Secondary 1 teachers and students in three schools with various academic backgrounds (Bands 1, 2 and 3) in Hong Kong. Phase 1 is a trial implementation, while Phase 2 is the full implementation. In Phase 1, the research team will work with teachers to design a two-week curriculum unit in which they will co-construct ideas with students on how GenAI generates scientific knowledge. In Phase 2, the researcher and the teachers in Phase 1 will reflect on the initial results and revise the pedagogy for a six-week curriculum unit. In each school, this phase involves intact classes as intervention groups using an epistemic-dialogic pedagogy while another class will be used as a comparison group that adopts a business-as-usual approach. Quantitatively, students' pre- and post-tests on GenAI-science epistemic understanding, topic-specific knowledge and science intrinsic motivation will be collected. Qualitatively, videos of teacher-student and student-student dialogues, teacher-researcher meetings and interviews with students will be audio recorded. To evaluate each phase, ordered network analysis will visualize sequential connections between qualitative dialogue categories, the results will be triangulated with quantitative analysis of test results using Rasch analysis and thematic analysis of interviews and meetings. The project will contribute to a deeper understanding of successful epistemic-dialogic pedagogy that will assist students using GenAI in science learning. The findings will inform guidelines for using GenAI in local and international science curricula.