Abstracts of the 2021 Technology, Mind, & Society Conference

Designs for Enhancing Science Learning through Metavisualization
Leanne Ma (OISE/University of Toronto).

Scientific visualizations play a critical role in the development of students’ understanding (Vekiri, 2002) as well as metacognition (Gilbert, 2005). Despite repeated assertions by educational experts that visualizations are a core part of authentic scientific practices (Roseman et al., 2008), a gap continues to exist between science-as-it-is-taught and science-as-it-is-practised. Some challenges for incorporating scientific visualizations into teaching practices, include finding age-appropriate material, learning how to use the tool, and adapting it to curricular goals (Naps et al., 2003). In this study, an alternative approach to using visualizations in science teaching is proposed – one that involves repositioning student-generated visualizations as objects of inquiry and scaffolding metacognition around such visualizations (i.e., metavisualization) to deepen scientific understanding. Using Knowledge Building pedagogy and Knowledge Forum technology (Scardamalia & Bereiter, 2014) as the framework, a design-based approach to teaching forces and structures was implemented in a grade 5 class (n=23). In the first iteration, discussions were supported by metacognitive scaffolds (“My theory”, “I wonder”, “I need to understand”). In the second iteration, discussions were supported by both metacognitive scaffolds and student-generated diagrams. Statistical analyses reveal significant differences between use of metacognitive verbs and depth of explanations across design iterations. Discourse around the visualizations was also qualitatively different, with students engaging in more hypothesis generation and counterfactual reasoning in the second iteration. Taken together, findings suggest that metavisualization, as an emergent competency, is integral to science learning. Implications are discussed for designing multimodal learning environments to advance young students’ scientific literacy, visual literacy, and metavisualization.