

**BACKGROUND & SPECIAL INTEREST:** To further my education and work experience, I intend to pursue a PhD in Educational Technology & Learning Design at Simon Fraser University (SFU) to research human-AI collaboration on design education. My unique educational background and work experience compliment this endeavor. I have a Bachelor of Applied Science and a Master of Educational Technology. I have extensive professional and personal work experience with design and makerspaces and have spent nine years in teaching positions. SFU is respected and well connected in the field of my studies with applicable coursework in educational technology and research methodologies.

**RESEARCH CONTEXT:** British Columbia's K-12 Applied Design, Skills and Technologies (ADST) curriculum states that the ability to design, make, and apply skills and technologies is essential in today's world (Government of British Columbia, 2016). Design and 'making' is process-based, iterative, and involves multimedia and diverse technologies. Although BC's ADST curriculum has been used for six years, and similar curricula are used across Canada, the incorporation of Artificial Intelligence (AI) is limited, even though AI is emerging as a powerful technology and critical skill for the future.

The use of AI has become prolific in society (Hu, 2023; Humlum & Vestergaard, 2024), yet its adoption and integration into education and pedagogy, along with the necessary support and understanding, remain limited (Zawacki-Richter et al., 2019; Holmes et al., 2019; Tan, & Subramonyam, 2024). Currently, AI is often incorporated into education with insufficient reflection on its pedagogical implications, creating a need for AI and Education (AIED) pedagogy (Memarian & Doleck, 2024; Zawacki-Richter et al., 2019). A re-evaluation of pedagogy is required as "it is questionable whether traditional theories of how people learn are useful in the age of AI" (Järvelä, Nguyen, & Hadwin, 2023). Learner-AI interactions are emerging as something 'other' to the educational relationships - learner-teacher, learner-content, and learner-learner - as defined by Anderson (2008). AI can play the role(s) of teacher, learner, and/or content in any learner-AI interaction. "AI and Education is not only a transformation of education but also a transformation of human knowledge, cognition, and cultures" (Hwang et al., 2020, p. 4).

AI tools hold promise to enable students to create artifacts previously unimaginable, to enhance student agency, and to introduce new pedagogical practices (Kimmons, Graham, & West, 2020). Hutson and Plate (2023) found that engaging an AI in syntactic level writing allowed space for the learner to engage in deeper metacognitive skills. Managerial task delegation to AI is found to improve the performance and satisfaction in human-AI teams (Hemmer et al., 2023). Conversely, Stadler, Bannert, and Sailer (2024) found that conducting research with an AI large language model instead of a traditional search engine recruited less cognitive load and resulted in a poorer outcome of learning. Kulkarni et al. (2023), found that the use of text-to-image AI in brainstorming led to a conflated self-perception of creativity but no improvements compared to using traditional image search engines; however, this engagement with AI demonstrably promoted reflective thinking and increased human-human collaboration. AI has already raised concerns of academic integrity as it can generate learning artifacts such as essays, images, videos, and code; therefore, it is crucial to thoughtfully integrate AI and AI literacy into pedagogy and to ensure equitable and ethical access to maximize its potential benefits in education.

The incorporation of AI in education is inevitable, but clear AIED pedagogy is necessary to mitigate its problems and optimize its benefits. Banning AI is difficult and counterproductive, since doing so would fail to prepare learners for an AI future and could negatively impact their motivation as learners want to engage with tools of their culture (John-Steiner & Mahn, 1996). Many of the current avenues of AIED, such as personalized and adaptive instruction, real-time assessment, just-in-time teaching, and student

engagement (Chen et al., 2022; Holmes et al., 2019; Zawacki-Richter et al., 2019), can be utilized to enhance equity and learning in K-12 ADST education.

**HYPOTHESIS:** H1. A human-AI collaboration will result in better ADST learning outcomes than without the use of AI. H2. Mediation of human-AI interactions will result in better ADST learning outcomes than unmediated human-AI interactions.

**METHODOLOGY AND APPROACH:** As every tool is embedded with an ideological bias (Postman, 1992), the affordances of AI should be evaluated. Valuable learning theories to explore and assess their efficacy in a human-AI relationship are: Vygotsky's Zone of Proximal Development, the balance of challenge and support (John-Steiner & Mahn, 1996); Cognitive Load Theory, the maximization of meaningful cognitive work and minimization of extraneous processing (Sweller, 2011); and Self-Determination Theory, the promotion of intrinsic motivation through autonomy, competence, and relatedness (Ryan & Deci, 2000). The proposed research will begin with a literature review of ADST pedagogy, the affordances of AI tools, and the effects of AI on humans' psychological processes.

Students of ADST classes will be observed as they progress through design projects in three subsequent conditions: without the use of AI; with unmediated use of AI; and with mediated use of AI through a custom-made user experience. The development of a mediated AI user experience will be informed by the literature review and may take the form of teacher interventions and/or a custom digital application that regulates learner interactions with AI. All conditions will use the latest stable release of OpenAI's generative AI that supports text input to generate text and/or image outputs.

K-12 learners at Navigate Nides, a progressive blended school, and/or other schools in BC School District 71, may be recruited as the research sample via existing personal and professional connections.

Data acquisition will involve multiple methods, including participant observation, student assessments of learning, and tracking of human-AI interactions. Participant observation will involve the researchers immersing themselves in the classroom at regular intervals throughout a semester-long design project to record qualitative observations. A formal, observational checklist will be developed to help maintain objectivity and reduce bias. Students will undergo formative assessments at project milestones to assess learning and recruit reflection on their design process. All AI interactions such as queries, time, and responses will be recorded. Thematic analysis will be applied to identify key patterns in the collected data to assess the impact of AI use on the students' processes, performance, and engagement.

The literature review and research will be shared as an accessible open educational resource (OER).

**IMPACT:** This research aims to improve learners' performance in K-12 ADST education through the integration of AI in pedagogy and educational methods. Learner exposure with AI will help develop AI literacy. Insights into the human-AI collaboration for learning will inform the development of AI powered tools and practices. An OER aims to provide accessible AIED content to key stakeholders, such as learners, educators, developers, and policymakers to support the equitable development and practice of AIED and to empower a broader group to contribute to the rapidly evolving field of AIED.

Industry, often focused on profits and market share, is leading the theory on AIED. The transformative potential of AI in education and its broader societal impact should be guided by unbiased research.

**SSHRC JUSTIFICATION:** This research is aligned with the SSHRC in the area of educational psychology. It aims to understand how humans engage with and are affected by AI to inform AIED pedagogy and enhance AIED methods.