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Navigating the Terrain:

Emerging Frontiers in Learning Spaces, Pedagogies, and Technologies

A Framework for Using GenAI to Support Student Engagement in Interdisciplinary Learning from Self-determination Theory

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Artificial intelligence (AI) is an interdisciplinary field, including mathematics, sciences, psychology, linguistics, sociology, and engineering (Bisconti et al., 2023; Chen, 2020; Zhuang et al., 2020). The development of its technologies requires experts from various disciplines. In education, generative AI (GenAI) tools such as ChatGPT and Dall-E facilitate interdisciplinary learning by breaking down barriers between disciplines and enabling students to see connections across different disciplines, resulting in a more holistic understanding of complex concepts. The tools enable students from different disciplines to collaborate on projects by combining their diverse knowledge and skills (Chiu, 2023, 2024; Chiu et al., 2023). For example, in STEAM education, students who are weak at coding can develop simple applications by asking GitHub Copilot, which generates specific code suggestions including variables, classes, and methods based on their situations. Those who are poor in art designs, can ask t Dall-E to generate visuals, fostering an interdisciplinary approach. Therefore, students can use the tools to complement the knowledge gaps they have because they have instant access to information and resources related to other disciplines (Kusters et al., 2020; Peters et al., 2023). Students become more adaptable, open, flexible, and innovative in their thinking. These enhance critical thinking skills, creativity, and problem-solving skills in students. This interdisciplinary learning using AI also fosters a sense of curiosity and a willingness to explore new ideas, which are essential skills for success in the AI era, better preparing students to address real-world problems and excel in a variety of disciplines.

Most related current studies focus on how GenAI affects assessment and essay-based assignments (Chiu, 2024; Xia et al., 2024). However, student engagement in using GenAI tools in completing interdisciplinary learning remains unclear. Student engagement is a multi-dimensional concept generally considered to include behavioral, emotional, cognitive, and agentic components (Chiu, 2021; Fredricks, 2011), which can be explained by self-determination theory (SDT) through needs satisfaction (autonomy: feel having choices; competence: feel capable; relatedness: feel relevant) (Chiu, 2021; Ryan and Deci, 2020). This mixed-methods study investigated how GenAI tools engage students in interdisciplinary learning from SDT perspectives. The two main research questions are: RQ1: How is needs satisfaction related to student engagement in interdisciplinary learning? RQ2: How do GenAI tools satisfy students three SDT needs?. The participants were 310 university students from various academic major backgrounds (sciences: 72; engineering: 78; social sciences: 79; art: 76; others: five). All of them attended a 3-hour workshop on how to use GenAI in completing a project under the topic of sustainability. The participants tried different GenAI tools, and discussed how they completed the project. A questionnaire with validated itemswas used to examine how GenAI tools satisfy their needs for competency in a sustainability project (RQ1) (Chiu, 2024). Three iterative cycles of group interviews were conducted with randomly selected 30 participants to understand the roles and affordances of GenAI in interdisciplinary learning (RQ2). The quantitative findings suggested that during interdisciplinary learning, GenAI can satisfy student needs by fostering classification and generalization skills (grouping knowledge), encouraging unpacking model and solution skills (revising thinking), and providing alternative intelligence (inspiring with new ideas). The qualitative findings from this study were used to propose a framework for using GenAI to support interdisciplinary learning. The framework also visualizes the roles and affordances of GenAI in the learning.

Keywords: Generative AI, student engagement, Self-determination theory, interdisciplinary learning

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