INTEGRATED STEM EDUCATION AND STUDENTS' 21ST CENTURY SKILLS

Jung Han, Postdoctoral Researcher, Purdue University, han336@purdue.edu
Yunjin Lim, Associate Research Fellow, Korea Institute for Curriculum and Evaluation, guyverlim@gmail.com
Woongbin Park, Graduate Student, Purdue University, park1710@purdue.edu
Kyongson Park, Assistant Professor, University of Michigan-Dearborn, kyongson@umich.edu

Abstract

This research investigates the impact of integrated STEM education on students' 21st century competencies, aiming to enhance science and engineering design teaching within a local design-based context. Specifically, the project targets high school students in a rural area and utilizes local contexts, including local rural knowledge and indigenous science knowledge, to facilitate STEM learning. The collaborative effort involves partnering high school environmental science and Technology and Engineering Educators, leveraging their diverse content expertise to teach students collaboratively as a science-technology and engineering teacher pair. Furthermore, university faculty members and industry partners provided support to create a STEM community of practice. The study administered a 21st-century skills survey to students before and after the project to explore the project's influence on critical thinking, creativity, collaboration, and communication skills.

Integrated STEM Education Project in an Underrepresented Rural Location

International Technology and Engineering Educators Association (ITEEA) presented the eight technology and engineering practices, and these practices encompass the knowledge, dispositions, and 21st-century skills necessary for students to effectively learn STEM disciplines (ITEEA, 2020; Li et al., 2019). During the 2022-2023 school year, students from both science (life science or environmental science) and engineering and technology classrooms were involved in an authentic design task and participated in the shared practices of science and engineering collaboratively throughout the project. The overarching goal was to enhance the 21st-century skills of underserved and underrepresented rural high school students and prepare secondary teachers to provide technology-rich integrated STEM learning experiences with a focus on local rural knowledge.

Findings and Suggestions

A total of 96 students took the pre- and post- 21st century skills survey developed and validated by the research team. The results of the data analysis indicate that Critical Thinking, one of the four 21st-century skills, significantly increased after the project ($t(96) = 3.037$, $p = 0.003$). However, no statistically significant changes were observed in creativity, collaboration, or communication skills at a 95% confidence level. These findings suggest that technology-rich integrated STEM learning experiences, particularly those that incorporate the local context for students in specific regions, have the potential to enhance 21st-century skills, specifically critical thinking. These suggest the possibilities that technology-rich integrated STEM learning experiences, especially when incorporating the local context for students in specific regions, may strengthen students' 21st-century skills, especially critical thinking. Given the short period of the study and a single lesson implementation, further research is needed to draw more definitive conclusions. The study highlights the potential of partnerships between researchers, teachers, and local industry to strengthen local rural context integrated STEM education.

References

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