International Conference on Research in EDUCATION, TEACHING and LEARNING

21 - 23 November 2025 Copenhagen , Denmark

# Generative Ai for Learning Motivation and Performance: an Empirical Study in a Thermal Machines Course

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## Abstract

This study investigated the integration of generative AI tools into the teaching–learning process of a Thermal Machines course. The primary objective was to examine the impact of incorporating generative AI in a course that had employed a project-based learning pedagogy for three consecutive years using MATLAB software. Specifically, the research aimed to analyze how generative AI influenced students' academic performance and learning engagement. The participants were sixth-semester undergraduate students in Mechanical Engineering. A quantitative research design was adopted, drawing on multiple sources of data: academic results, attendance records, tutoring time, and survey responses. The study compared outcomes from three previous academic years, during which generative AI had not been used, with those of the most recent year, in which generative AI tools were integrated. The survey, designed to capture students' perceptions of AI use in the course, consisted of 10 items across three dimensions: (i) perceived usefulness and professional application, (ii) theory–practice connection, and (iii) prior experience and self-efficacy. The survey demonstrated a Cronbach's alpha of 0.83, indicating acceptable internal consistency and suggesting adequate construct validity. The findings revealed highly positive student perceptions of generative AI, particularly regarding its usefulness for learning and its relevance to future professional contexts. These results emphasize the role of perceived usefulness, teacher preparation, and prior student experience in the effective adoption of AI technologies. Nonetheless, the relatively small sample size calls for cautious interpretation and underscores the need for further studies to validate and extend these findings.

**Keywords:** Cronbach's Alpha, Matlab, Mechanical Engineering, Project-Based Learning, Student Engagement