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Advancing engineering graduate attributes through a living laboratory: A digital twin approach

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ABSTRACT

CONTEXT
Effective teaching involves engaging students in ways that are appropriate to the development of deep learning. Deep approaches are encouraged with opportunities to exercise responsible choice of study, demonstrating meaning and relevance of content to students, teaching and assessment methods to motivate active and long-term engagement, clearly stated expectations, interest in the subject, and educational settings. Capstone/engineering projects, which explore problem-based learning (PBL) approaches, provide an opportunity for students to practice applying their knowledge and workplace skills while they engage in a collaborative environment. PBL could be effective if teaching and learning methods were meticulously set in terms of course preparation, scenario design, implementation, and assessment.

PURPOSE
We investigate how engineering students can improve their graduate qualities and professional skills through project-based learning using living laboratories. We also evaluate how artificial intelligence and digital twin can engage students in learning fundamental civil engineering knowledge and enhance students' understanding of complex engineering problems.

APPROACH
In this project, the final year undergraduate Civil Engineering students had the opportunity to work on a real-world project. Students had access to a living laboratory and real-time structural health monitoring data of a pedestrian bridge. Students completed their projects under supervision of university academics and in close collaboration with industry partners. We used a two-phase mixed method approach including both quantitative and qualitative assessments to determine the effectiveness of the approach to improve graduate qualities in students.

ANTICIPATED OUTCOMES
Results are expected to provide a better understanding of how living labs and technologies such as digital twin in engineering courses can help students to improve their professional skills and graduate attributes and prepare them for the diversity and complexity of engineering practice.

CONCLUSIONS
The findings in this research can provide examples of effective design of project-based learning approaches for engineering students based on a living laboratory concept using advanced technologies such as AI and digital twin.

KEYWORDS

Graduate attributes, Digital twin, Student learning.