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Touching the invisible: learning electromagnetism in virtual worlds

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Abstract

Purpose – Engineering education, particularly in complex fields like electromagnetism, faces a significant challenge in conveying multiphysics systems. Traditional methods fall short in building deep, intuitive understanding. The purpose of this paper is to address this "cognitive interface challenge" by presenting a novel conceptual framework for creating human-centric, interactive learning environments to bridge this gap.

Design/methodology/approach – This paper details a methodology of interdisciplinary knowledge transfer. The proposed conceptual framework is derived from a multi-year analysis of best practices in the Architecture, Engineering, Construction and Operations sector, which has already developed mature solutions for navigating complex three-dimensional digital twins.

Findings – The primary contribution is a formal four-stage methodological framework for developing human-centric virtual environments. This model moves beyond traditional tools to create interactive systems based on defined cognitive goals and proven interactive design paradigms, providing a new, robust method for the computation and mathematics community.

Research limitations/implications – As a conceptual paper, the primary implication is the need for empirical validation of the proposed four-stage framework. Future research should focus on implementing and testing the framework's effectiveness against traditional methods in controlled educational and professional settings.

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