Project Title

Investigating the Impact of AI Tutoring Strategies on Student Learning and Problem-Solving in Engineering Education

Project Description

Artificial Intelligence is rapidly transforming how students access information, receive support, and learn complex concepts. Unlike traditional learning environments, where students primarily rely on instructors, teaching assistants, textbooks, and peers, AI-powered tutors can provide immediate, personalized, and scalable assistance. However, not all AI tutoring approaches are equally effective. Some AI systems provide direct answers, while others offer hints, ask guiding questions, encourage reflection, or adapt assistance based on student progress. Understanding how these different tutoring strategies influence learning is critical for designing AI systems that enhance, rather than replace, the cognitive processes required for expertise development.

This research project aims to investigate how various AI tutoring approaches shape student learning, problem-solving, conceptual understanding, and knowledge retention in engineering education. The study will compare different forms of AI-assisted learning with traditional learning models and evaluate their effects on student performance, engagement, confidence, and long-term learning outcomes.

The student will contribute to the design and implementation of controlled educational studies involving engineering students.

The project will involve experimental design, educational intervention development, survey and interview design, learning analytics, and qualitative and quantitative data analysis. Students may also contribute to the development and evaluation of AI tutoring systems and educational technologies used within engineering courses.

Through this project, research assistants will gain experience in engineering education research, human-centered AI design, learning analytics, educational experimentation, and mixed-methods research. Students interested in artificial intelligence, learning sciences, educational technology, human-computer interaction, or engineering education are particularly encouraged to participate.

The findings from this work will contribute to the emerging field of Learning-Aware Generative AI and help inform the design of next-generation AI tutoring systems that not only improve immediate performance but also support meaningful learning, critical thinking, and the development of engineering expertise.

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