AI-Driven STEM Enrichment for High School: Personalization and Inclusive Excellence in the UAE

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Abstract:

This study presents a quasi-experimental research project that aims to design, implement, and evaluate a 10-week AI-driven STEM enrichment program for high school students (Grades 10–11) in one of Al Ain high schools. Thematically anchored in "Smart Sustainable Cities and Climate Action," the program integrates artificial intelligence tools, project-based and problem-based learning approaches, and personalized learning strategies tailored to the UAE Ministry of Education curriculum standards. The initiative directly responds to national priorities outlined in the UAE's AI Strategy 2031, Vision 2031, and SDG commitments related to climate education, innovation, and inclusive learning.

The research adopts a mixed-methods, design-based framework. A treatment group of students will participate in weekly enrichment sessions using AI tools (e.g., ML-based data analysis, AI design apps) to solve real-world sustainability problems. A matched comparison group will not receive the intervention. Data will be collected through pre/post content tests, attitudinal surveys, structured classroom observations, and interviews with students and teachers. This comprehensive design enables assessment of both measurable outcomes (e.g., gains in AI/STEM knowledge, shifts in interest and self-efficacy) and process-level dynamics (e.g., engagement, inclusion, technology use).

The project will produce a validated 10-week enrichment curriculum, a teacher-facing toolkit for future implementation, and a research article targeting a Scopus Q1 journal in STEM or AI education. The program engages two student research assistants in curriculum development, data collection, and dissemination, fulfilling the CEDU emphasis on undergraduate and graduate research capacity-building.

Anticipated impacts include increased high students' engagement in STEM and AI, stronger problem-solving and collaborative learning behaviors, and evidence-based guidance for integrating AI in school-based enrichment programs. For the broader research and educational community, the project contributes urgently needed evidence on the role of AI in personalizing and deepening STEM learning in secondary education.

This projects supports SDG 9 by building students' AI literacy, innovation capacity, and problem-solving skills through hands-on STEM projects, preparing future talent to contribute to advanced technologies, digital infrastructure, and innovation-driven industries. Also, the project directly