AI-BASED EDUCATIONAL PLATFORMS AS A VECTOR FOR COOPERATION AND TECHNOLOGY TRANSFER IN SCIENCE AND ENGINEERING FOR THE CIRCULAR ECONOMY

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Introduction and Background

The transition to a circular economy, conceptualised as a regenerative system that minimises resource input and waste, emissions and energy leakage [1,2], requires new forms of collaboration between universities and industry, as well as graduates able to address complex sustainability and resource-efficiency challenges [3]. AI-based educational platforms can function as shared digital infrastructures that connect scientific knowledge, real industrial data and project-based learning in science and engineering, in line with recent work on AI applications in higher education and STEM [4–6] and on AI-enhanced tools for engineering education [7]. Such platforms are particularly relevant as artificial intelligence and digitisation are increasingly recognised as key enablers of circular business models and innovation [8,9]. This study examines how such platforms can act as drivers of cooperation and technology transfer for circular-economy-oriented engineering education, building on sustainable models of university–industry collaboration [10].

Material and methods

The paper proposes a conceptual and applied model in which an AI-enhanced platform supports project work on real industrial problems related to circularity (product redesign, process optimisation, performance indicators). The methodology combines a descriptive case study in an engineering faculty with elements of mixed methods: analysis of platform functionalities, observation of student activity and collection of feedback from academic staff and industrial partners through questionnaires and semi-structured interviews, in line with approaches used in recent evaluations of AI in education and engineering learning environments [4,5,7].

Results: The analysis shows that the platform supports key circular-economy competences, such as systems thinking, life-cycle assessment reasoning, environmental impact evaluation, circular product and process design and data-driven decision making, which are consistent with systemic conceptualisations of the circular economy [1–3] and with emerging transdisciplinary frameworks for AI in STEM education [6]. Students report higher perceived relevance of learning tasks, better understanding of industrial constraints and increased motivation when working with real data and AI-supported simulations, echoing findings from AI-in-education studies [4,5]. Industrial partners value the access to conceptual prototypes and optimisation scenarios generated within student projects, as well as early contact with graduates familiar with their processes, aspects highlighted as central in sustainable technology transfer models [10]. The platform also enables continuous refinement of curricula based on aggregated learning analytics and partner feedback.

Conclusions

AI-based educational platforms can become effective socio-technical ecosystems for aligning engineering education with circular-economy needs, while simultaneously supporting knowledge co-creation and bidirectional technology transfer, in line with broader analyses of AI and digital technologies as accelerators of the circular transition [8,9]. Further research should refine impact indicators for such platforms, explore their contribution to sustainability competences in engineering education [6,7] and examine their scalability in wider industry–university networks focused on circular innovation [2,3].

Keywords: *AI-based educational platforms, Engineering education, Circular economy, Industry–university collaboration, Technology transfer, Learning analytics, Sustainability competences*

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