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Creating a Skilled Workforce to Meet Future Industry Needs: The Promise of Teaching and Learning Approaches Based on Digital Twins in Engineering Education

Keriile Lesrb

Department of Biochemistry, La Trobe Institute of Molecular Science, La Trobe University, VIC 3086, Australia

Introduction

In an era characterized by rapid technological advancements and evolving industry demands, there's a growing necessity to prepare a highly skilled workforce equipped with cutting-edge knowledge and hands-on experience. Digital twins, a virtual representation of physical objects or systems, have emerged as a transformative tool in engineering education. This article aims to explore the promise of teaching and learning approaches based on digital twins to create a skilled workforce capable of meeting future industry needs. Digital twins simulate real-world systems or processes, replicating their behavior, performance, and characteristics in a virtual environment. These digital replicas enable analysis, prediction, and optimization without direct interaction with physical prototypes, offering a costeffective and efficient means to study complex systems. The landscape of industries is rapidly evolving, demanding a workforce equipped with cutting-edge skills and expertise. Engineering education stands at the forefront of this transformation, leveraging innovative methodologies like digital twins to prepare students for the challenges and opportunities of tomorrow. This article explores the promise of teaching and learning approaches based on digital twins in engineering education and their role in shaping a skilled workforce to meet future industry needs.

Description

Engineering education has traditionally focused on theoretical knowledge and practical applications. However, with the rise of digitalization and industry 4.0, there's a pressing need to integrate emerging technologies into educational curricula. Digital twins, virtual representations of physical systems or processes, offer a paradigm shift in teaching methodologies by providing immersive and interactive learning experiences. Digital twins offer a visual and interactive platform for students to comprehend intricate engineering concepts and systems. This aids in bridging the gap between theoretical knowledge and practical applications. Students can experiment with different parameters and scenarios within the digital twin environment, facilitating hands-on learning experiences. They can analyze the effects of variations and interactions, fostering a deeper understanding of engineering principles. Engaging with digital twins cultivates critical thinking and problem-solving skills. Students are challenged to troubleshoot issues, optimize performance, and devise innovative solutions within a simulated environment. Interactive and immersive learning experiences captivate students' interest and engagement, making complex concepts more accessible and stimulating curiosity. Digital twins bridge the gap between academia and industry by providing a platform for students to apply theoretical knowledge to practical, industry-relevant scenarios. Students exposed to digital twins develop adaptive skills, preparing them to navigate rapidly evolving technological landscapes and contribute to innovative solutions in their fields.

Conclusion

The rapid evolution of technology necessitates continuous updates and advancements in digital twin platforms, requiring educational institutions to adapt swiftly. Overcoming implementation challenges through collaborative efforts and technological advancements will ensure that digital twins continue to play a pivotal role in shaping a highly skilled and future-ready workforce in engineering. Teaching and learning approaches based on digital twins represent a transformative opportunity for engineering education. By providing immersive, experiential, and industry-aligned learning experiences, digital twins equip students with the skills, knowledge, and adaptability needed to thrive in dynamic and technology-driven industries. While challenges exist, strategic investments, faculty development, and a commitment to innovation can pave the way for a robust and future-ready engineering workforce, poised to meet the evolving demands of industries worldwide.

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Address for Correspondence: Keriile Lesrb, Department of Biochemistry, La Trobe Institute of Molecular Science, La Trobe University, VIC 3086, Australia; E-mail: keriilel@gmail.com

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