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Editorial: Emerging technologies and digitalization in education for sustainable development

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Editorial on the Research Topic

Emerging technologies and digitalization in education for sustainable development

Welcome to this Research Topic on “*Emerging technologies and digitalization in education for sustainable development*.” This Research Topic brings together an insightful array of research that explores the intersection of technology and education, with a focus on fostering sustainable development. Education for Sustainable Development (ESD) faces a double challenge in terms of implementation and awareness. This Research Topic explores the dynamic landscape of innovative technologies and their potential to shape education in ways that can integrate Sustainable Development and Sustainable Development Goals (SDGs) more effectively. Further, ESD is recognized as a key driver for achieving the SDGs, embodying a deliberate, dynamic, and interdisciplinary approach to learning and teaching. It underscores the importance of transformative pedagogies and learning environments that empower stakeholders to address systemic sustainability challenges and drive positive change toward more just, prosperous, and sustainable societies.

As the world faces a planetary crisis and increasingly complex challenges related to environmental, social, and economic sustainability, education plays a crucial role in achieving awareness about these issues (Sevilla-Pavón and Nicolaou, 2022) and equipping future generations with the knowledge, skills, and values needed to accelerate actions for green and digital transition. The need to move forward with the twin transition is more pressing after COVID-19 which has indicated the fragility of human existence (Amankwah-Amoah et al., 2021). Especially, in the education sector, the COVID-19 experience revealed the urgency to move fast-forward to a twin transition that will render learning environments more resilient while at the same time enhancing digital education, encompassing accessibility, peer learning, and connectivity, placing, thus, Sustainable Development Goal 4 “Leave no one behind” at the forefront of teaching and learning (UNGA Resolution, 2015).

Digital Education emerges as a powerful tool in advancing ESD objectives, offering opportunities to integrate SDGs across all levels and forms of education while responding to evolving needs and challenges (Veckalne and Tambovceva, 2022).

The strategic directions for ESD as defined by numerous regional mechanisms and processes such as UNESCO Roadmap2030 and the new implementation framework of the UNECE ESD Strategy 2021–2030 which emphasizes the pivotal role of digital education and technologies in fostering behavioral shifts toward sustainability and expanding inclusive educational opportunities, particularly for the youth (United Nations Economic Social Council, 2005).

The four high-quality submissions accepted for this Research Topic offer valuable insights into various aspects of this theme:

“Investment opportunity of blockchain technology in the education sector of Saudi Arabia.” This article takes a systematic approach to analyse the potential benefits and challenges of integrating blockchain technology into the Saudi education system, highlighting its potential to improve learning assessment, maintain student records, enhance trust, and reduce costs (Alshareef).

“Extending unified theory of acceptance and use of technology to understand the acceptance of digital textbooks for elementary school in Indonesia.” This study investigates the factors influencing the adoption of digital textbooks among Indonesian elementary school students, contributing to understanding the dynamics of technology acceptance in specific cultural contexts (Hermita et al.).

“An experimental study on the influence of instructional mobile applications in enhancing listening comprehension of rural students in India.” This research explores the effectiveness of mobile applications in improving the listening comprehension skills of rural Indian students, showcasing the potential of technology to overcome geographic barriers and address educational equity concerns (Raj and Tomy).

“Exploring the intersections of TAM and TRI models in middle school VR technology acceptance.” This article examines the acceptance of virtual reality (VR) technology in middle school education through the lens of two established technology acceptance models, offering valuable insights into user perceptions and factors influencing VR adoption in educational settings (Lin et al.).

These four diverse contributions represent the wide range of opportunities and challenges presented by emerging technologies on ESD. They collectively shed light on the potential of technologies to enhance educational access, improve learning outcomes, and promote sustainable practices. Along with the aforementioned technologies, the revolution of emerging technologies can speed up the efforts for digitalization for sustainable development (Mondejar et al., 2021; Bradu et al., 2023; Lee et al., 2023; Deepana and Vani, 2024). In addition to blockchain technology, Artificial intelligence (AI) can offer data-driven insights and tailor learning experiences (Guan et al., 2020). Big data analytics can support evidence-based decision-making (Nisar et al., 2021), Internet of Things (IoT) devices can monitor energy consumption and encourage environmental sustainability (Albreem et al., 2021). 3D printing makes it easier to have hands-on learning experiences (Hsiao et al., 2019), and cloud computing makes it possible to share instructional content seamlessly (Siddiqui et al., 2019). Open educational resources (OER) facilitate equitable access to high-quality educational resources (McGreal, 2017), while machine learning algorithms tailor learning routes (Janiesch et al., 2021). These technologies, when thoughtfully integrated under a sound learning design, entail the potential to foster innovation, engagement, and ultimately an enhanced learning

experience. Particular emphasis should also be placed not only on emerging technologies, but also on emerging practices, concepts, and approaches that entail opportunities to reconsider how learning and teaching are structured and carried out. This resonates Veletsianos (2016) arguments on the need to understand evolving behaviors and technologies. To better conceptualize, develop, critique, improve, and comprehend education we need to collect and map global experiences, distributed information, and interdisciplinary viewpoints that practitioners and members of research communities can utilize. This Research Topic has contributed to this goal by providing a scope toward the intersection of technology and education, focusing on fostering sustainable development.

This Research Topic also highlights the importance of critical reflection and careful implementation to ensure that technology serves as a tool for equity, inclusion, and responsible development. Addressing topics such as digital access, pedagogical integration, and ethical considerations remains crucial for harnessing the full potential of these technologies for transformative change.

We believe that this Research Topic of papers will serve as a valuable resource for researchers, educators, policymakers, and practitioners interested in harnessing the power of emerging technologies to promote inclusive and equitable quality education for all, as outlined in the United Nations’ Sustainable Development Goal 4.

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