

Editorial

The Use of Digital Technology for Sustainable Teaching and Learning

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Sustainable teaching and learning encompass practices where educators equip students with the skills and strategies needed for lifelong, independent learning beyond the confinement of a traditional classroom and independent of a sole knowledgeable instructor [1]. Teachers who foster sustainable learning engage students in experiential, project-based tasks that necessitate research, critical thinking, and collaboration [2–4]. These educators understand that students should leave their classrooms with an appreciation of how both formal and informal education are continually reshaped by emerging digital technologies [5–7]. This mindset must be instilled in learners from a young age, as they are now exposed to these technologies either independently or through parental mediation [8–10].

As state-of-the-art innovative educational technologies continue to emerge at a rapid pace, their affordances have offered a vast array of opportunities for sustainable learning and instruction [11]. Some of these emerging digital technologies include mobile tools [12–14], social media [15,16], virtual and augmented reality [17], online collaborative tools [18,19], and artificial intelligence [20–22], among others.

Students should recognize that these technologies offer opportunities for independent and autonomous learning practices that were unavailable to previous generations. They need to understand how to leverage these tools to their advantage [3,7,11,23]. There is a pressing need for research that demonstrates how technologies can be harnessed to help students acquire skills for lifelong learning. Thus, this Special Issue aims to highlight how digital technology can ensure sustainable teaching and learning practices in an era marked by uncertainties.

The objective of this Special Issue was to compile pioneering theoretical work and original applications related to the use of digital technology in sustainable teaching and learning. The focus was on learning models and theories that illuminate this crucial dimension, exploring their applications across various educational settings and demonstrating their effectiveness through systematic or empirical data.

For this Special Issue, we initially received 46 submissions from various countries and territories. These submissions were rigorously reviewed by well-known international experts in the field, with each article reviewed by at least three reviewers. After several rounds of thorough evaluation, we selected the twelve best articles that represent the highest quality, suitable for a prestigious journal like *Sustainability*. These selected articles offer original scientific contributions in the form of theoretical and experimental research, as well as case studies that provide new perspectives on sustainable teaching and learning using digital technology.

This Special Issue comprises the following twelve articles:

“A Meta-Analysis and Systematic Review of the Effect of Chatbot Technology Use in Sustainable Education” by Xinjie Deng and Zhonggen Yu. The authors investigated the



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effect of chatbot-assisted learning on various components and examined how different moderator variables influenced its effectiveness. To achieve this, they conducted a meta-analysis of 32 empirical studies involving 2201 participants, published between 2010 and 2022.

“A Study on Teachers’ Continuance Intention to Use Technology in English Instruction in Western China Junior Secondary Schools” by Yi Xie, Azzeddine Boudouaia, Jinfen Xu, Abdo Hasan AL-Qadri, Asma Khattala, Yan Li and Ya Min Aung. The authors investigated the factors influencing the continuance intention to use technology among English teachers in China. They examined the direct effects of help seeking, interest, effort regulation, growth mindset, facilitating conditions, perceived usefulness, and perceived ease of use on continuance intention. Additionally, they explored the indirect effects of these factors on continuance intention through self-efficacy. The study sample included 459 English language teachers from junior secondary schools in various regions of Western China. A questionnaire encompassing these variables was used and validated through exploratory factor analysis and confirmatory factor analysis.

“Applications of Reciprocal Teaching in Flipped Classroom to Facilitate High Level of Cognition for Sustainable Learning Practices” by Wu-Yuin Hwang, Tsu-Hsien Wu and Rustam Shadiev. The authors conducted two consecutive studies to enhance students’ opportunities to cultivate and develop high-level cognitive abilities for sustainable learning practices. In both studies, a flipped classroom approach was integrated into the project-based engineering education curriculum. Twelve junior graduate students majoring in Electrical Engineering participated in Study 1, while ten participated in Study 2. They all attended the Signal Processing of Power Quality Disturbances class and practiced their skills in a computer lab using LabView software. In Study 2, the reciprocal teaching method was introduced to help students manage cognitive load and develop advanced cognitive skills.

“A Bibliometric Analysis of Trending Mobile Teaching and Learning Research from the Social Sciences” by Chun Wai Fan, Jiayi Lin and Barry Lee Reynolds. The authors conducted a bibliometric analysis of trending mobile teaching and learning research in social sciences. They utilized two science mapping tools, CiteSpace 6.3.R3 and VOSviewer 1.6.18, to detect and visualize emerging trends in the mobile learning literature. A total of 528 mobile learning articles, published between 2003 and 2021 in 21 international educational technology journals indexed in the SSCI database, were retrieved for analysis and reviewed by the researchers.

“A Bibliometric Analysis of Augmented Reality in Language Learning” by Wenhe Min and Zhonggen Yu. The authors analyzed the use of AR tools in language learning contexts using the bibliometric tools VOSviewer 1.6.18 and CitNetExplorer 1.0.0., employing both qualitative and quantitative research methods. They identified the top ten authors, sources, countries, and organizations using VOSviewer and established citation networks using CitNetExplorer.

“Exploring Undergraduate Students’ Digital Multitasking in Class: An Empirical Study in China” by Qikai Wang, Fei Sun, Xiaochen Wang and Yang Gao. To gain further insights into the impact of smartphone-induced digital multitasking on the education process in higher education, the authors surveyed 519 students from a Chinese university in their exploratory descriptive study to investigate the magnitude of students’ digital multitasking, the motivation behind it, and their beliefs about reducing phone use.

“A Study on Technology Use for Sustainable Graduate Education Internationalization at Home: Chinese Teachers’ Experiences and Perspectives” by Qian Xu and Azzeddine Boudouaia. The authors explored the use of technology in promoting the sustainable internationalization of graduate education in China through teachers’ experiences and perspectives. They assessed how various aspects of technology-based education influence the internationalization of graduate education. The study involved 806 teachers from different universities across China, and data were collected using a questionnaire.

“Teachers’ Acceptance of Online Teaching and Emotional Labor in the EFL Context” by Renzhong Peng, Qiqin Hu and Bochra Kouider. The authors investigated the relationship between English as a Foreign Language (EFL) teachers’ acceptance of online teaching and their emotional labor in online teaching using the Technology Acceptance Model (TAM). A questionnaire was distributed to 338 EFL teachers from 19 middle schools and 24 high schools in China, and 10 teachers were interviewed. Through a series of data analyses, the authors developed and tested a structural relationship model that integrates acceptance of online teaching with online teaching emotional labor strategies.

“Presence and Flow as Moderators in XR-Based Sustainability Education” by Miriam Mulders and Kristian Heinrich Träg. The authors explored the role of presence and flow as moderators in XR-based sustainability education through a mixed-methods study of a VR- and AR-based learning application on biodiversity developed by Greenpeace. A total of 156 students tested the application, which focused on the Amazon rainforest, and rated its efficacy in terms of its effects on knowledge, interest, and attitude. Pre- and post-questionnaires, as well as focus groups, were used to uncover within-subject effects.

“Application of Business Simulation Games in Flipped Classrooms to Facilitate Student Engagement and Higher-Order Thinking Skills for Sustainable Learning Practices” by Ching-Yun Hsu and Ting-Ting Wu. The authors investigated the effectiveness of incorporating business simulation games with project-based learning in a flipped classroom setting. This approach was applied in a university cross-border e-commerce course to help students acquire 21st-century skills, such as higher-order thinking, in a rapidly changing educational landscape. A quasi-experimental method was used, involving 60 university students from Zhejiang Province, China. Participants completed an online questionnaire assessing their learning engagement across cognitive, emotional, and behavioral dimensions, as well as their higher-order thinking skills, including problem solving, critical thinking, and creativity.

“Constructing Sustainable Learning Ecology to Overcome Burnout of Teachers: Perspective of Organizational Identity and Locus of Control” by Zehra Altinay and Batuhan Bicentürk. The authors examined how organizational identity, locus of control, and their inter-relationships affect teacher burnout. Data were collected from 105 teachers using a quantitative survey. The Maslach Burnout Inventory measured three dimensions of burnout: emotional exhaustion, depersonalization, and personal accomplishment. Locus of control was assessed using Rotter’s scale. Organizational identity was measured with the Multiple Organizational Identification Scale, which assesses personal self-esteem, emotional professional identity, evaluative identification, self-classification, and team factors.

“Cultural Heritage for Sustainable Education Amidst Digitalisation” by Yianna Orphanidou, Leonidas Efthymiou and George Panayiotou. Given the role of integrating cultural heritage in education to enhance critical thinking, experiential learning, cross-cultural collaboration, and the overall quality of learning experiences, the authors conducted a study of mixed methods (questionnaires and interviews) in three European countries to examine digital and cultural heritage competencies among young learners. This investigation is particularly important in light of the increasing adoption of digital technology, the varying levels of digital literacy, high student dropout rates in some European Union countries, and the decline in cultural heritage awareness among young learners.

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