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Editorial

Effectiveness and Sustainable Applications of Educational Technology

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Over the past few decades, the development and application of educational technology has drawn the attention of governments, academic organizations, educators, teachers, and parents around the world. With the advent of the Industry 4.0 era, the digital transformation of education has also been put on the agenda, making educational technology a popular topic in educational research. Due to the continuous innovation and development of educational technology, as well as the ongoing emergence and evolution of educational technology theories, coupled with the significant impact of the COVID-19 outbreak in early 2020 on education, there has been a widespread realization of the importance of issues related to educational technology.

Today, digital technology has become an important tool for achieving the goal of providing inclusive and equitable quality education [1]. Educational technology is considered to provide learners with opportunities to receive high-quality education. If used properly, these technologies can enable learners to study anytime and anywhere in a virtual environment, unrestricted by time and space, creating meaningful learning experiences for them. From the above, it is evident that new technologies in the field of education are transforming our ideas, perceptions, and educational goals, not just our methods [2]. With the increase in research on the use of educational technology, there is growing attention to the psychological processes involved in teaching and learning with these tools [3]. Since the success of educational technology is influenced by the features of human cognitive style, it is possible for the effectiveness of technology-based education used without reference to instructional design ideologies derived from human cognition to be random [4]. Therefore, to empower students for holistic development through technology, it is essential to understand how teachers can effectively apply technology-assisted teaching and how students can effectively utilize technology-assisted learning. This includes educational data mining and analysis, evaluation and feedback on teaching effectiveness, suggestions for learning progress and methods, the comprehensive recording of multidimensional learning journeys, multimodal learning/learning situation analysis, and providing personalized learning plans based on individual circumstances.

The modern world requires more efficient learning models that enable students to play a more active role in their education [5]. Moreover, these learning approaches need to be oriented towards competency development. Digital literacy encompasses a range of skills, knowledge, abilities, and attitudes related to digital technologies. Digital literacy is considered one of the core competencies essential for the 21st century, contributing to holistic development and lifelong learning. Therefore, how to effectively cultivate digital literacy among both teachers and students has become a key issue. Additionally, topics

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such as smart education, programming education, competency-based education, interdisciplinary education, online learning communities, blended learning communities, digital (evaluation) literacy of teachers, cloud-based textbooks, digital textbooks, teaching resource libraries, digital platforms, learning societies, lifelong learning, lifelong education, distance education, credit banks, multimodal analysis, educational data mining, big data analysis models, data evaluation, the misuse of technology, technology dependency, ineffective use of technology, long-term impacts of technology, technology transparency, user experience, core competency education, digital literacy, media literacy, and digital competence are also highly prominent research subjects in contemporary education.

With the rapid development of metaverse technology, educators urgently need to understand how to apply learning theories to technology-driven learning experience design. The design of effective metaverse technology learning experiences largely relies on a deep understanding and integration of learning theories. Incorporating educational theories into the design process aims to create meaningful and engaging learning experiences to attract students and promote more effective learning outcomes. The use or implementation of educational technology is not the sole determinant of educational outcomes. Factors such as curriculum design, teaching methods, student characteristics, tool effectiveness, and other variables also influence the educational experience. Thus, research topics on immersive learning, interactive learning, self-directed learning, personalized learning, collaborative learning, project-based learning, problem-based learning, mobile seamless learning, game-based learning, blended learning, inquiry-based learning, ubiquitous learning, ideological and political-based learning (IPL), information technology and interdisciplinary learning (i-STEAM), flipped classrooms, and other student-centered learning/teaching approaches, or online teaching/learning theory models, are receiving significant attention from educators and field scholars. They continuously explore effective practices, which in turn fosters ongoing innovation and development in digital learning theories.

In the theme of "Effectiveness and Sustainable Application on Educational Technology", there are numerous research topics worth referencing. These include online self-learning motivation among Chinese college students during the pandemic, nonlinear teaching methods in economics, self-assessment of teachers' use of mobile devices in the context of gender awareness, evaluation methods for sustainable enrollment planning in Chinese universities based on Bayesian networks, the impact of blended teaching strategies on first-year English majors' performances, a literature review on generative artificial intelligence in educational environments, the role of dynamic geometry software in teacher–student interactions, the meta-analysis of the effectiveness of educational robots in improving learning outcomes, challenges and opportunities in applying identification technology to biology courses, factors influencing Jordanian scholars' behavioral intentions to use sustainable cloud-based quality management systems, understanding students' views on sustainability using natural language processing techniques, a literature review on adaptive learning systems, and the impact of electronic human resource management. These studies expand our understanding of new applications in educational technology. Research findings related to this theme will help address questions about both the theoretical and practical applications of contemporary educational technology.

In the new era of rapid artificial intelligence development, future talent will need to possess interdisciplinary knowledge and skills, enabling them to innovate alongside AI and build diverse professional expertise. However, in recent months, there has been increasing concern in academia about the use of generative artificial intelligence (AI), with one of the main worries being that students may use generative AI tools to cheat or plagiarize their written assignments and exams [6]. Improper use of Artificial Intelligence Generative Content (AIGC) can lead to a lack of critical thinking, plagiarism, and complete reliance on technology by users. Therefore, in the era of artificial intelligence, it is important to consider how people can avoid being replaced by AI and robots and focus on developing high-quality, highly skilled talent. Education should increasingly aim to cultivate students' soft skills, such as innovation and critical thinking.

Technologies such as artificial intelligence and the metaverse have fundamentally changed the thinking, behavior, and lifestyles of stakeholders in the educational environment. This represents an irreversible trend. AIGC can generate human-like responses to interact with users, including answering questions, providing feedback, and guiding learners through their tasks. For teachers, AIGC tools can replace them in performing mechanical and repetitive tasks, such as quickly generating teaching resources, analyzing student progress, assisting with classroom discussions, and participating in assignment evaluations. This allows teachers to instinctively free themselves from routine teaching duties.

At the same time, using AIGC to create videos for visualizing instructional content represents a breakthrough in technology. It enables the possibility of virtual hosts acting as teachers, allowing people to exist in a virtual world. At the same time, it is crucial to pay special attention to individuals' personal rights, such as their likeness and voice. This underscores the importance of technology and digital ethics. Additionally, it is important to address how to effectively disseminate knowledge through online media while safeguarding privacy and intellectual property. This includes efficiently applying technology for knowledge sharing, cultural transmission and preservation, scientific knowledge popularization, and ensuring high-quality knowledge sharing, diffusion, transformation, innovation, and documentation. Strict respect for and emphasis on technological ethics are essential in managing educational data and privacy protection.

Research on individual differences among students helps understand the learning difficulties they might encounter during the learning process. This understanding can improve teaching methods, provide students with better learning advice, offer more suitable teaching content, and enhance teaching approaches [7]. Moreover, how to design data-driven teaching activities based on generative artificial intelligence to meet the needs of improving emotional experiences and promoting cognitive learning in online education has not yet been thoroughly discussed. Furthermore, not everyone is able to adapt to and use new technology effectively. Issues such as user behavior, user engagement, effectiveness of use, users' values regarding educational technology products, and their understanding of educational technology are important topics that deserve in-depth investigation. At the same time, user experience theories and related variable validations for metaverse technologies, including AR/VR/MR/SR/XR and AI, such as AI acceptance models, AI usage effectiveness, AI usage attitudes, AI usage expectations, AI experience value, AI trust, AI illusion, AI dependence, AI effectiveness, AI-related concerns, AI usage intentions, AI literacy, AI-TAPCK, AI learning partners, and other topics, also require ongoing exploration to address educational application issues in the era of technological advancement. Additionally, UNESCO released the "*Guidance for generative AI in education and research*" [8], which examines the significance of generative AI in education from aspects such as governance rules, educational regulation and application policies, and the design and evaluation of educational practices.

In the current educational field, data-driven educational management and digital leadership are increasingly becoming key factors in improving educational quality. Beyond traditional teaching and learning, it is also crucial for educational administrators to effectively use technology for management and for educational supervisors to leverage technology for evaluation. The effective application of technology can optimize the allocation of educational resources, enhance management efficiency, and provide more precise data support for evaluations, thereby advancing the overall development of the education system. Through in-depth data analysis and intelligent management tools, the education system can better address challenges, implement more scientific decision-making, and ultimately achieve comprehensive improvements in educational quality. Therefore, topics such as data-driven educational management and digital leadership are also among the current hot issues.

As we face the arrival of the AI era, education must play a key role in helping people develop global awareness, humanitarian concerns, and a sense of well-being. Technological innovations and transformations continuously reshape human society and civilization,

further promoting high-quality development across various industries. In China, for instance, the development of new quality productive forces (新质生产力) is significantly enhanced by educational digitalization, which plays a crucial role in building a strong digital nation and driving technological innovation. Therefore, exploring the digital transformation experiences of different countries or regions is essential for global sharing of insights, contributing to a more prosperous and harmonious world.

As technology continues to innovate, the effectiveness of many emerging media in educational applications still needs to be continuously explored and optimized. In summary, educational technology is an indispensable medium and learning channel for the future. Research on how to effectively apply it while avoiding misuse needs continuous updates and efforts to address research gaps. Besides focusing on positive impacts, it is equally important to explore and address negative effects or outcomes in order to develop better strategies for response and prevention.

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