


Chapter 4

Transforming Education in the Digital Age: An Analysis of Artificial Intelligence and Deep Learning Through Bibliometric and Systematic Literature Review

Qi Pan

 <https://orcid.org/0009-0006-2431-7725>

University Technology Malaysia, Malaysia

Nurul Farhana Jumaat

Independent Researcher, Malaysia

Hassan Abuhassna

 <https://orcid.org/0000-0002-5774-3652>

Independent Researcher, Malaysia

Liu Tao

Zaozhuang University, China

ABSTRACT

The integration of Artificial Intelligence (AI) and Deep Learning (DL) into education is advancing rapidly, but their impact requires further research. This study combines bibliometric analysis and a systematic literature review, guided by the PRISMA framework, to explore this area. The bibliometric analysis examines publication trends, key countries, institutions, journals, leading authors, and important keywords, providing a macro-level overview. The literature review analyzes 27 high-quality

DOI: 10.4018/979-8-3373-5550-4.ch004

academic articles, revealing that AI and DL have significant potential in education, such as personalized learning, real-time feedback, emotion prediction, and improving the overall learning experience. However, challenges like immature technology, high costs, limited human-computer interaction, data security, and ethical concerns remain. This study highlights both the vast potential and the hurdles of AI and DL in education, pointing to the need for continued research to overcome these issues and maximize their benefits in educational contexts.

1. INTRODUCTION

Education is undergoing a remarkable transformation in the digital era. Artificial intelligence (AI) and deep learning (DL) are widely used in several areas, especially in education, where they are gradually transforming traditional teaching models and learning experiences (Sarker, 2021). Many researchers in education have tried to integrate AI and DL into education to maximize their potential to enrich instructional strategies, provide personalized learning, and improve students' learning outcomes (Grassini, 2023). Natural language processing (NLP) is one of the major technologies of AI, which allows machines to understand and produce human language to provide real-time feedback and personalized tutoring for language instruction (T. Alqahtani et al., 2023). Moreover, to realize students' best learning outcome, another technology, Intelligent Tutoring Systems (ITS), has been developed to manage instructors' teaching content and difficulty based on students' interactions and performance (Alam, 2023). In addition, convolutional neural networks (CNNs) are a powerful instrument to help create virtual labs to improve students' learning experience (Ching et al., 2018).

Based on these technological foundations, AI-powered tools have been integrated into real classrooms in recent years. For example, Chatbots are used to provide personalized learning (Gudoniene et al., 2024). Moreover, adaptive learning platforms like Duolingo and Squirrel AI dynamically further adjust content and difficulty to suit the continuous needs of learners (Coşulean, 2024; Wang, 2025). In addition, AI-driven feedback systems and automated grading tools assist educators in managing instructional load and offering timely support (Vetrivel et al., 2025). In this case, students' learning habits, abilities, and preferences can be identified by these advanced technologies. Therefore, it is possible to provide students with customized personalized learning content and teaching methods. These technologies are likely to improve teaching quality and efficiency (L. Chen et al., 2020). For educators, the implementation of AI and DL can not only enrich learning content but also leverage their potential for prediction to help educators better monitor students' learning during the learning process. In this way, instructors are likely to know better stu-

28 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/transforming-education-in-the-digital-age/384254

Related Content

Artificial Intelligence and Fundamental Rights: The Role of Unions

Susana Beatriz Checa Prieto (2025). *The New Role of Labor Unions in the AI Era* (pp. 207-238).

www.irma-international.org/chapter/artificial-intelligence-and-fundamental-rights/381912

Leveraging Augmented Reality for Educational Outreach on Recycling Practices

M. Vishnu Priya and K. Rajaprian (2025). *AI Technologies for Enhancing Recycling Processes* (pp. 211-232).

www.irma-international.org/chapter/leveraging-augmented-reality-for-educational-outreach-on-recycling-practices/368176

From Emotion Recognition to Artificial Qualia: Bioethical Reflections on Affective AI in Education

Spyros Kontis and Sofia Anastasiadou (2026). *Philosophical Considerations of Computational Consciousness and AI Qualia* (pp. 355-384).

www.irma-international.org/chapter/from-emotion-recognition-to-artificial-qualia/401003

ResNet and PCA-Based Deep Learning Scheme for Efficient Face Recognition

Rajendra Kumar Dwivedi and Devesh Kumar (2023). *International Journal of Intelligent Information Technologies* (pp. 1-20).

www.irma-international.org/article/resnet-and-pca-based-deep-learning-scheme-for-efficient-face-recognition/329957

Comparison of the Hybrid Credit Scoring Models Based on Various Classifiers

Fei-Long Chen and Feng-Chia Li (2010). *International Journal of Intelligent Information Technologies* (pp. 56-74).

www.irma-international.org/article/comparison-hybrid-credit-scoring-models/45156