The Impact of AI on Traditional Educational Resources

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Abstract. Traditional educational resources, such as printed textbooks, physical classrooms, and teacher-centered teaching methods, have already built the foundation of educational systems. However, those resources often face challenges including limited accessibility, uneven distribution, and difficulty in meeting the diverse needs of learners. The rapid development of Artificial Intelligence (AI) has opened up new possibilities for education, significantly enhancing efficiency, personalization, and interactivity. This article has referred to 11 recent research articles to explore the role of AI in education. Employing a literature review and comparative analysis methodology, it examines how AI optimizes hardware, enhances teacher capabilities, and improves curriculum scheduling. The study analyzes how AI reshapes the distribution mechanisms and value logic of educational resources, while also addressing the ethical and social challenges it presents. The research results indicate that AI can enhance teaching efficiency and quality, while promoting personalized and data-driven learning systems. However, it has also brought about new inequalities and ethical risks, such as privacy leaks and the threat to the core role of teachers in education. The study concludes that education systems should adopt a “human-centered” and sustainable approach to AI assistance, ensuring technology should help education, not replace the role of the people in it.

Keywords: Artificial Intelligence, Education Resources, Precision Education, Teacher Empowerment, Ethical Challenges.

1. Introduction

For a long time, education has been using physical materials such as books, notebooks and blackboards, which cannot be separated from the guidance and teaching of teachers neither. These traditional resources bring students a stable and orderly learning environment, but they are often difficult to meet the different needs of everyone, and it is hard to adjust flexibly, let alone ensure that everyone can have equal access to resources. With the acceleration of educational digital transformation, AI has become one of the most influential forces shaping the ways people learn and teach (Gillani et al., 2023).

AI includes many functions, such as machine learning, natural language processing and deep learning. These technologies enable computers to analyze data and make judgments independently. In education, AI can identify students' learning rules, predict their performance, and generate learning content which is suitable for everyone. Gillani et al. discovered that modern AI is not only about completing automated tasks, but also moving towards "people-centered", that is, AI not only analyzes data but also pays attention to people's cognition and emotions. (Gillani et al., 2023). This transformation emphasizes the need to redefine the ability of AI as an educational resource.

Hardware, teacher labor, and curricula are no longer static elements right now, but parts of an adaptive system guided by data. For example, smart classrooms use AI to manage lighting and equipment automatically, while adaptive learning platforms adjust exercises based on student performance (Wu, 2025). Textbook can now include QR codes that lead to animations or virtual simulations, blending physical and digital learning.

However, AI simultaneously introduces entirely new serious challenges. Kong et al. noted that the gap in AI literacy between teachers and students has created a new “digital divide,” where differing understandings of AI among students and educators generate novel teaching issues (Kong et al.,2025). Thus, even with technological access, individuals lacking training remain unable to fully benefit from AI-assisted instruction. Humble also found that higher education institutions lack unified systems regarding AI ethics, privacy, and accountability (Humble ,2025). These issues demonstrate that AI

holds potential for enhancing education while simultaneously introducing lots of complex risks that society cannot ignore.

The significance of this research lies in two key aspects. First, it reveals that AI not only transforms conventional teaching strategies but also reshapes the foundational resources of education, such as the materials, people, and structures that support learning. Second, it provides educational policymakers with an AI framework to optimize inefficiencies in traditional education, emphasizing the balance between technology and pedagogy. The goal is not only to introduce technology but to ensure that it strengthens human values and social fairness.

This paper aims to explore AI's dual impact on traditional educational resources, encompassing both educational empowerment and challenges. Key research questions include: How does AI empower and optimize hardware, faculty, and curricula? How does AI reshape the structure of educational resources and their interrelationships? What challenges may emerge as AI integrates into traditional education?

This research is based on a review and comparison of eleven peer-reviewed academic articles published between 2021 to 2025. The sources cover different fields including higher education, nursing education, public administration, and physical education. By examining AI applications across these disciplines, it summarizes AI's role within traditional education, and how AI can empower education nowadays. The following section will explore AI's empowering role, structural impacts, and potential challenges.

2. AI Empowerment and Optimization of Traditional Educational Resources

2.1. Hardware Resources

AI empowers educational hardware through intelligent and digital transformation. In the past, traditional educational hardware such as classrooms and teaching materials has always been the physical basis of learning activities. But their usage is often fixed, and it is difficult to update and upgrade. Nowadays, AI has brought new possibilities to these hardware. It makes hardware more intelligent and flexible by adding data analysis, automation and sensing technologies. Wu designed an AI-based human-computer interaction physical education system that integrates motion sensors, Augmented Reality (AR), and real-time feedback to deliver more personalized instructional guidance to students (Wu,2025). The system analyzes movements through computer vision, identifies incorrect student postures, and provides immediate corrections. Experimental results demonstrated significant improvements in both physical fitness and learning engagement among students, illustrating how AI can enhance utilization rates and teaching efficiency when updating educational hardware.

Also, AI can also help maintain hardware and extend their service life. For example, predictive maintenance algorithms can continuously monitor the working status of laboratory equipment, projectors and even library facilities with the help of sensors. When an abnormality is found in the device, the system will issue an alert to the administrator in advance. This active maintenance method reduces equipment failure and downtime, reduces maintenance costs, and makes hardware resources more stable and reliable.

Zhang applied a particle swarm optimization algorithm to recommend learning resources for English learners, demonstrating how AI can predict individual learning needs and intelligently allocate relevant materials (Zhang,2025). Such algorithms improve students' utilization efficiency and ensure each learner receives the most suitable content for them.

This approach enables more precise and equitable management of educational hardware and resources. The hardware empowerment provided by AI can be summarized in two dimensions. First, digitization transforms traditional equipment into interactive, personalized intelligent systems. Second, it dynamically adjusts resource allocation through optimized data utilization, thereby enhancing overall efficiency.

2.2. Teacher Resources

Teachers remain the core and disseminators of education, but AI is reshaping their roles and responsibilities in both practical and conceptual dimensions. On the practical level, AI can take over repetitive and administrative duties. Conceptually, it redefines teachers' roles as designers and interpreters of AI-generated content.

Gardan et al. found that most teachers believe AI help alleviate repetitive tasks—such as simple assignment grading and attendance managing—freeing educators to focus on enhancing curriculum innovation and student mentoring (Gardan et al,2025). However, teachers perceive a potential concern about AI undermining their autonomy and creativity on education.

Allgood and Musgrave introduced ChatGPT into a public administration course, observing that AI engagement fostered critical thinking and ethical discussions in the classroom (Allgood and Musgrave,2024). Teachers and students collaboratively explored AI functionalities, making lessons more novel and real-time, forming a "collaborative learning" teaching model. The process not only encourages students' critical thinking but also allowed teachers to act as mediators. Teachers transitioned from mere knowledge transmitters to facilitators and interpreters of AI-generated content, helping students enhance their AI literacy.

Furthermore, AI supports teacher professional development. AI-based classroom analytics systems evaluate instructional strategies through video data, assessing question-asking techniques, student interaction frequency, and pacing (Hwang et al., 2024). Teachers refine their pedagogy based on these insights, transforming AI into a tool for self-reflection practice and growth.

2.3. Course and Curricular Resources

AI can also transform course content and design. Yang proposed "precision education," a concept analogous to "precision medicine," which AI identifies learner differences, predicts risks, and delivers personalized interventions (Yang,2021). This approach mirrors the logic of "precision medicine", enabling each learner to receive targeted plans based on individual data rather than averages. Educators can leverage machine learning analytics to anticipate challenges early and make timely adjustments, continuously refining course plans. Research by Hwang et al. demonstrates that AI tutoring systems significantly enhance students' clinical reasoning and decision-making skills in nursing education (Hwang et al,2024). This proves AI's ability to flexibly adapt course structures based on individual student differences.

Another key trend is AI-generated content. With large language models, educators can randomly generate practice questions, reading summaries, and even videos explaining complex topics. After human verification and filtering, these materials not only save teacher time but also expand the range of available resources. Jacob found that multimodal AI systems combining text, audio, and visual explanations significantly boost learner engagement and memory retention, especially in medical and technical education (Jacob,2025).

Additionally, AI can promote interdisciplinary learning. Miranda et al. demonstrated how AI integrates multi-subject learning resources to construct teaching templates from different fields (Miranda et al.,2025). For instance, it combines biology, geography, and chemistry into the "environmental science" theme. Such integration helps cultivate students' comprehensive thinking skills. Through prior research experiments, AI enables curriculum systems to become more dynamic, flexible, and open to updates, truly achieving personalized instruction that is relevant to modern learners' needs.

3. Structural RECONSTRUCTIONS of Educational Resources

3.1. Resources Distribution Mechanisms

Resource allocation in traditional education is often determined by administrative hierarchies, leading to a concentration of resources in particular places. Better schools or those in metropolitan areas secure more qualified teachers and resources, while rural schools receive comparatively scarce educational resources. Even when talented teachers emerge in rural areas, they are highly likely to be recruited by urban schools, resulting in severe inequities in teaching resources. The introduction of AI makes resource allocation more data driven. Zhang proposed a recommendation algorithm allocates learning materials based on learner profiles rather than school enrollment and institutional rankings (Zhang,2025). Yang's precision education model also achieves equitable resource distribution through early intervention for students (Yang,2021).

This shift marks a transition in educational governance from top-down planning to bottom-up prediction and intervention. However, Gillani et al. raised concerns that AI algorithms, trained on inherently biased data, could exacerbate educational inequality (2023). Consequently, establishing policy mechanisms for algorithmic transparency and accountability becomes paramount in subsequent implementation.

3.2. Resource Value Logic

AI has reshaped the value logic of educational resources. Traditional textbooks primarily emphasized knowledge dissemination and acquisition, whereas AI places greater emphasis on cultivating and applying competencies, particularly critical thinking and creativity. The AI sustainability model proposed by Miranda et al. integrates educational, technological, and societal values, emphasizing resource adaptability and sharing (Miranda et al.,2025). They believe that the true value of educational resources lies in its adaptability and inclusiveness. Gillani et al. also note that AI propels education from “computation” to “cognition”, transforming students from passive knowledge recipients into co-creators of knowledge (Gillani et al.,2023). Educational value no longer flows unidirectionally. It is continually renewed through the dynamic interaction between AI and humans.

3.3. Resources Subject Relationships

AI has redefined the relationship between teachers, students, and learning materials. Hwang et al. summarized three roles of AI in nursing education: learner profiling, tutoring, and personalized assessment, forming a triangular collaborative relationship of “teacher-AI system-student” (Hwang et al. ,2024). Teachers establish learning goals, AI assists in developing learning plans, and students provide feedback on learning outcomes.

Wu observed in physical education research that AI systems provide data feedback, while teachers offer emotional encouragement and guidance based on data analysis—a complementary approach that enhances students' athletic development (Wu,2025). Jacobs noted in medical education that multimodal AI narratives enhance learning immersion through video, images, and text (Jacobs,2025).

These examples illustrate the collaborative ecosystem emerging in education. The teacher-AI system-student relationship bridges human empathy with automation, boosting efficiency while providing emotional support.

4. Challenges and Ethical Considerations

4.1. Digital Divide and AI Literacy

Although AI has expanded educational accessibility, gaps of technological resources and skill persist, limiting AI's advancement in education. Kong et al. emphasize the concept of “AI literacy,” asserting that the ability to understand and apply AI is crucial (Kong et al. ,2025). Teachers lacking

AI training struggle to effectively utilize AI for instructional innovation, significantly diminishing students' learning experiences. Similar to digital literacy, students must discern credibility from unreliable information. The internet, representing the most significant technological leap before AI's emergence, offers valuable lessons. By leveraging experience in cultivating digital literacy, people can help educators and students enhance their AI literacy. While harnessing AI's potential to empower education, it is equally vital to guide teachers and students on how to use AI responsibly.

Wu (2025) and Gillani et al. (2023) both highlight that inadequate infrastructure, such as unstable internet connections and hardware shortages, also constrains AI adoption in education. Therefore, to address this issue, policies should invest simultaneously in hardware and teacher training, ensuring everyone can experience the convenience and efficiency AI brings (Wu ,2025 and Gillani et al. ,2023).

4.2. Ethical and Security Risks

Given AI's heavy reliance on data, it may raise numerous privacy, bias, and accountability concerns. Humble found significant disparities among universities in managing AI ethics (Humble,2025). Some institutions lack clear regulations regarding data storage and consent. Such inconsistencies could lead to misuse of student information.

Gillani et al. argue that educators must understand how algorithms make decisions to trust and evaluate them. Without transparency, teachers and students may blindly follow AI recommendations (Gillani et al.,2023). Bias in training data represents another critical issue requiring resolution. If algorithms are trained on biased data, they may accelerate existing inequalities, such as more frequently labeling certain groups as low-ability learners. Schools should implement fairness testing and more rigorous algorithmic audits to mitigate these risks.

4.3. Weakening of Traditional Resources

While AI can enhance educational efficiency, people cannot overlook that it may undermine traditional values. Allgood and Musgrave observed that some students uncritically accept AI-generated answers, highlighting the risks of excessive dependence (Allgood and Musgrave,2024). Teachers may also become mere operators of AI systems rather than creative professionals.

Jacob warms that highly immersive AI tools may boost student engagement but could also reduce deep reflection (Jacob,2025). Empowerment doesn’t mean replacement, and the goal is to establish collaborative relationship between teacher and AI. Wu notes that in physical education, automation should not replace teachers' roles in motivation and emotional support, as excessive automation in PE weakens teachers' capacity for emotional encouragement (Wu,2025). AI can be effective in some aspects like analysis and repeated working, but it cannot replicate empathy, intuition, or moral reasoning.

To avoid these risks, AI integration must proceed in a “human-centered” manner. Teachers should continue serving as interpreters and mentors, guiding students in critically using AI. Traditional materials like textbooks and lectures retain significant value in cultivating reasoning and empathy. AI should enhance these experiences rather than eliminate them entirely.

5. Conclusion

This paper explores how AI impacts traditional educational resources by using evidence from recent academic research findings. Firstly, the results indicate that AI can enhance hardware capabilities through advanced digitalization and intelligent management. AI strengthens classroom hardware and enables predictive maintenance systems, making educational environments more efficient and interactive. Secondly, AI empowers educators by automating routine tasks and providing analytical tools, reducing repetitive workloads while expanding their capacity for analysis and creativity. Furthermore, AI achieves personalized curricula through adaptive and precision learning models. Via precision education, adaptive tutoring, and intelligent recommendation systems, AI tailors learning materials to each student's goals, progress, and interests.

Moreover, AI is reshaping the entire educational system's structure. Resource allocation becomes more data-driven, educational value emphasizes adaptability and collaboration, and relationships among teachers, students, and educational resources evolve toward teamwork supported by intelligent systems. Collectively, these developments demonstrate how AI transforms education from a static entity into a dynamic, data-driven ecosystem.

However, the convenience of AI comes with challenges. The digital divide persists due to uneven infrastructure and disparities in AI literacy. Ethical issues such as privacy protection, algorithmic bias, and accountability remain unresolved. Overreliance on AI risks diminishing the creativity of both students and teachers while weakening the emotional connection between them in the educational process.

To move forward, education systems must blend technology's precision with humanity's emotional needs. Schools should ensure AI is both intelligent and inclusive. Simultaneously, teachers require ongoing training to become thoughtful AI users and knowledge guides rather than passive technology consumers, helping students utilize AI more effectively and appropriately.

In the future, the relationship between AI and traditional educational resources should be viewed as complementary. Machines can analyze data faster, but humans remain positioned to imbue it with meaning, ethics, and inspiration. When carefully guided, AI can make education more equitable and engaging while preserving the humanistic qualities that give learning purpose. AI must become a tool serving the dissemination of human knowledge, not a threat to replace humanity.

References

[1] Allgood, M., & Musgrave, P. (2024). Leveraging ChatGPT in public sector human resource management education. Journal of Public Affairs Education, 30 (3), 494–510.

[2] Gardan, D. A., Andronie, M., & Gardan, I. P. (2025). Adopting AI in education: Optimizing human resource management considering teacher perceptions. Frontiers in Education, 10, 1488147.

[3] Gillani, N., Eynon, R., Chiabaut, C., & Finkel, K. (2023). Unpacking the “Black Box” of AI in Education. Educational Technology & Society, 26 (1), 99–111.

[4] Humble, R. (2025). Higher education AI policies: A document analysis of university guidelines. European Journal of Education, 60 (1), 112–128.

[5] Hwang, G.-J., Tang, K.-Y., & Tu, Y.-F. (2024). How AI supports nursing education: Profiling the roles, applications, and trends of AI in nursing education research (1993–2020). Interactive Learning Environments, 32 (1), 373–392.

[6] Jacobs, C. (2025). Examining multimodal AI resources in medical education: The role of immersion, motivation, and fidelity in AI narrative learning. JMIR Medical Education, 11, e72190.

[7] Kong, S., Liao, J., & He, J. (2025). AI literacy: An argument for AI literacy in education. Innovations in Education and Teaching International, 62 (2), 180–195.

[8] Miranda, J., Costa, P., & González, M. (2025). Design for sustainability of open education resources in the era of AI: A case study. IEEE Revista Iberoamericana de Tecnologías del Aprendizaje, 20 (2), 1–9.

[9] Wu, J. (2025). Design and development of AI dynamic physical education teaching resources in human–computer interaction mode. Journal of Educational Computing Research, 63 (5), 1219–1248.

[10] Yang, S. J. H. (2021). Guest Editorial: Precision education—A new challenge for AI in education. Educational Technology & Society, 24 (1), 105–108.

[11] Zhang, W. (2025). An automatic recommendation method for English language education resources based on particle swarm algorithm. International Journal of Emerging Technologies in Learning, 20 (3), 45–59.