

Teacher Readiness for Technology-Enhanced Learning in the Era of AI

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Abstract

The rapid advancement of artificial intelligence (AI) and digital technologies has transformed teaching and learning practices across higher education and school education, creating new opportunities for personalized instruction, adaptive learning, and enhanced student engagement. As educational institutions increasingly adopt technology-enhanced learning (TEL) environments, teachers' readiness to integrate AI-powered tools and digital technologies into pedagogical practices has become a critical determinant of successful educational transformation. Teacher readiness extends beyond technical competence and includes pedagogical knowledge, digital literacy, positive attitudes toward technology, self-efficacy, and the ability to use AI ethically and effectively to improve student learning outcomes. This study examines teacher readiness for technology-enhanced learning in the era of artificial intelligence by exploring the factors that influence educators' preparedness to adopt AI-supported teaching practices. A quantitative research design is proposed using a structured questionnaire administered to school and higher education teachers. The study may assess teachers' technological competence, AI literacy, pedagogical readiness, digital self-efficacy, attitudes toward educational technology, institutional support, and perceived challenges in adopting AI-enabled teaching. Data can be analyzed using descriptive statistics, correlation analysis, and multiple regression techniques to determine the extent to which these factors predict teacher readiness for technology-enhanced learning.

Keywords: Teacher Readiness, Technology-Enhanced Learning, Artificial Intelligence, AI Literacy

Introduction

The rapid advancement of digital technologies and artificial intelligence (AI) has fundamentally transformed educational systems across the world. Traditional classroom instruction is increasingly being complemented by technology-enhanced learning (TEL), which integrates digital tools, online platforms, artificial intelligence applications, learning analytics, and interactive educational resources into teaching and learning processes. These developments have created new opportunities for personalized instruction, collaborative learning, flexible course delivery, and data-driven educational decision-making. As educational institutions continue to embrace digital transformation, teachers have become central to ensuring that technology is integrated effectively to improve student learning outcomes. Technology-enhanced learning refers to the purposeful use of digital technologies to support, enrich, and improve teaching, learning, assessment, and student engagement. It includes the use of learning management systems, virtual classrooms, intelligent tutoring systems, educational applications, digital collaboration platforms, multimedia resources,

virtual and augmented reality, and AI-powered teaching tools. Rather than replacing teachers, technology-enhanced learning aims to strengthen pedagogical practices by creating interactive, student-centered learning environments that encourage active participation, critical thinking, and lifelong learning. Artificial intelligence has emerged as one of the most influential technologies shaping modern education. AI-powered tools can automate routine administrative tasks, personalize learning experiences, provide real-time feedback, analyze student performance, and support instructional planning. Applications such as intelligent tutoring systems, adaptive learning platforms, automated grading software, virtual teaching assistants, generative AI tools, and predictive learning analytics enable educators to deliver more responsive and individualized instruction. These innovations have the potential to improve educational quality, increase learning efficiency, and support diverse learner needs. Despite these opportunities, the successful implementation of technology-enhanced learning depends largely on teachers' readiness to adopt and utilize digital technologies effectively. Teacher readiness refers to the combination of knowledge, skills, attitudes, confidence, motivation, and institutional support that enables educators to integrate technology into their teaching practices successfully. It encompasses not only technical competence but also pedagogical understanding, digital literacy, AI literacy, ethical awareness, and the willingness to adapt to changing educational environments. Teachers who are prepared to use technology effectively are more likely to create engaging learning experiences, encourage student participation, and improve educational outcomes. The concept of teacher readiness has become increasingly important as educational institutions respond to rapid technological innovation and changing student expectations. Today's learners are digital natives who regularly use smartphones, online learning platforms, social media, cloud-based applications, and artificial intelligence tools in their daily lives. Consequently, teachers must possess the competencies required to guide students in using technology responsibly while fostering critical thinking, creativity, collaboration, and digital citizenship. The transition from teacher-centered instruction to technology-supported learner-centered education requires educators to continuously update their professional knowledge and teaching strategies. The widespread adoption of online and blended learning has further highlighted the importance of teacher readiness. The expansion of digital education has demonstrated that effective technology integration requires more than access to technological infrastructure. Teachers must be able to design engaging digital learning experiences, facilitate virtual classroom interactions, assess student learning through online platforms, and provide personalized academic support using digital tools. These responsibilities demand a combination of technological proficiency, pedagogical expertise, and continuous professional development. Several theoretical frameworks provide a foundation for understanding teacher readiness in technology-enhanced learning. The Technological Pedagogical Content Knowledge (TPACK) framework emphasizes that effective technology integration requires teachers to combine technological knowledge, pedagogical knowledge, and subject-matter expertise. Similarly, the Technology Acceptance Model (TAM) suggests that teachers' willingness to adopt technology is influenced by their perceptions of its usefulness and ease of use. The Unified Theory of Acceptance and Use of Technology (UTAUT) further explains that factors such as performance expectancy, effort expectancy,

social influence, and facilitating conditions affect technology adoption within educational settings. These theoretical perspectives indicate that successful AI integration depends on both individual competencies and supportive institutional environments. Professional development plays a vital role in strengthening teacher readiness for technology-enhanced learning. Continuous training programs enable educators to develop digital competence, AI literacy, instructional design skills, and ethical awareness regarding the responsible use of emerging technologies. Workshops, mentoring, peer collaboration, online certification courses, and institutional learning communities provide opportunities for teachers to acquire practical experience in using AI-powered educational tools. Such initiatives increase teachers' confidence, reduce resistance to technological change, and promote innovation in classroom practice. Although artificial intelligence offers substantial educational benefits, its implementation also presents several challenges. Teachers may encounter concerns related to data privacy, cybersecurity, algorithmic bias, academic integrity, unequal access to technology, and the ethical use of AI-generated content. In addition, inadequate technological infrastructure, limited institutional support, insufficient training, and varying levels of digital competence may hinder effective AI adoption. Addressing these challenges requires comprehensive institutional policies, adequate technological resources, and evidence-based professional development programs that support teachers throughout the process of educational transformation. Educational institutions therefore have a shared responsibility to create environments that encourage innovation while maintaining educational quality and ethical standards. School leaders, university administrators, policymakers, and educational technology developers must collaborate to provide teachers with appropriate infrastructure, technical assistance, professional learning opportunities, and clear guidelines for responsible AI use. Strengthening teacher readiness not only improves instructional effectiveness but also ensures that students benefit from meaningful, inclusive, and high-quality technology-enhanced learning experiences.

Artificial Intelligence in Modern Education

Artificial intelligence (AI) has become one of the most transformative technologies in modern education, fundamentally changing the ways teaching, learning, assessment, and educational management are conducted. AI refers to computer systems capable of performing tasks that typically require human intelligence, including learning, reasoning, problem-solving, language understanding, pattern recognition, and decision-making. Advances in machine learning, natural language processing, computer vision, and data analytics have enabled the development of intelligent educational systems that support personalized instruction, automate administrative tasks, and improve educational outcomes. As educational institutions continue to embrace digital transformation, AI has become an essential component of technology-enhanced learning in schools, colleges, and universities worldwide. The integration of artificial intelligence into education has shifted traditional teacher-centered instruction toward more learner-centered and personalized educational experiences. Conventional teaching methods often deliver the same instructional content to all students regardless of their individual abilities, learning preferences, or pace of learning. In contrast, AI-powered educational technologies analyze learner behavior, monitor academic progress, identify knowledge gaps,

and provide customized learning pathways that address individual educational needs. This personalized approach helps students achieve better learning outcomes while allowing teachers to provide more targeted academic support. AI in modern education is the use of **intelligent tutoring systems (ITS)**. These systems simulate the role of human tutors by providing individualized instruction, adaptive feedback, and continuous assessment based on students' performance. Intelligent tutoring systems identify areas where students experience difficulty and recommend additional learning resources or practice activities to strengthen understanding. Unlike traditional classroom instruction, these systems allow learners to study at their own pace while receiving immediate guidance, thereby enhancing learning effectiveness and knowledge retention. Another important application is **adaptive learning technology**, which utilizes artificial intelligence to personalize educational content according to each learner's strengths, weaknesses, interests, and progress. Adaptive learning platforms continuously collect and analyze student performance data to modify instructional materials, assessments, and learning activities in real time. This individualized approach improves learner engagement, reduces frustration, and enables students to focus on concepts requiring additional attention while progressing more rapidly through areas they have already mastered. The emergence of **generative artificial intelligence** has introduced new possibilities for teaching and learning. AI-powered conversational systems, writing assistants, coding assistants, and content-generation tools help students explain difficult concepts, summarize academic literature, generate practice questions, translate languages, develop computer programs, and support academic writing. Teachers also use these technologies to prepare lesson plans, create instructional materials, design assessments, and generate classroom activities more efficiently. When used responsibly, generative AI enhances creativity, productivity, and access to educational resources while supporting independent learning. Artificial intelligence has also transformed **assessment and evaluation** in education. Automated grading systems evaluate objective assessments quickly and consistently, while increasingly sophisticated AI tools provide feedback on essays, programming assignments, and written responses. Immediate feedback enables students to identify mistakes, improve their understanding, and modify learning strategies without waiting for manual evaluation. Automated assessment also reduces teachers' administrative workload, allowing them to devote more time to instructional planning, mentoring, and student support. AI-powered **virtual assistants and educational chatbots** have become valuable tools for supporting both students and teachers. These systems provide immediate responses to academic and administrative questions, offer reminders regarding assignments and examinations, guide students through institutional procedures, and facilitate communication between learners and educational institutions. Continuous availability and instant support improve student satisfaction while reducing the administrative burden on faculty and staff. Artificial intelligence also plays an important role in promoting **inclusive education**. AI-assisted technologies support students with disabilities through speech recognition, text-to-speech systems, real-time captioning, language translation, predictive text, and personalized accessibility features. These innovations enable learners with diverse educational needs to participate more effectively in classroom activities and online learning environments. Consequently, AI contributes to greater educational equity and accessibility by

removing barriers to learning. For teachers, artificial intelligence serves as a powerful instructional support tool rather than a replacement for professional expertise. AI assists educators in curriculum planning, instructional design, classroom management, assessment development, and analysis of student learning data. Routine administrative activities such as attendance management, scheduling, grading, and report generation can be automated, allowing teachers to devote greater attention to student engagement, mentoring, critical thinking activities, and individualized instruction. Effective integration of AI therefore enhances the professional role of teachers while improving educational efficiency. the implementation of artificial intelligence in education also presents significant challenges. Concerns have been raised regarding data privacy, cybersecurity, algorithmic bias, academic integrity, unequal access to digital technologies, and excessive dependence on AI-generated content. Students may become overly reliant on AI tools for completing assignments, potentially reducing opportunities to develop independent thinking, creativity, and problem-solving skills. Similarly, teachers require adequate professional development to integrate AI ethically and pedagogically while maintaining academic standards and encouraging original intellectual work. AI in modern education therefore depends on responsible implementation supported by appropriate institutional policies, technological infrastructure, and continuous professional development. Educational institutions should establish clear guidelines governing the ethical use of artificial intelligence, protect student data, promote digital and AI literacy, and encourage critical evaluation of AI-generated information. Teachers should guide students in using AI as a learning aid that complements rather than replaces independent reasoning, research, and creativity.

Conclusion

The rapid advancement of artificial intelligence and digital technologies has transformed the educational landscape, creating new opportunities for innovative teaching, personalized learning, and improved student engagement. Technology-enhanced learning has become an integral component of modern education, enabling educators to utilize digital platforms, intelligent tutoring systems, learning analytics, virtual classrooms, and generative AI tools to enrich instructional practices. However, the successful integration of these technologies depends largely on teachers' readiness to adopt and apply them effectively within diverse educational settings. teacher readiness is a multidimensional construct encompassing digital competence, AI literacy, pedagogical knowledge, technological skills, self-efficacy, positive attitudes toward innovation, and continuous professional development. Teachers who possess these competencies are better equipped to design engaging learning experiences, personalize instruction, support student-centered learning, and use technology to improve educational outcomes. Frameworks such as the Technological Pedagogical Content Knowledge (TPACK) model and the Technology Acceptance Model (TAM) further demonstrate that effective technology integration requires a combination of technical expertise, sound pedagogy, and confidence in using emerging technologies. The discussion also emphasizes that artificial intelligence offers significant benefits for modern education, including adaptive learning, automated assessment, intelligent tutoring, learning analytics, and administrative efficiency. These technologies can enhance teaching effectiveness, reduce routine workloads, provide

timely feedback, and improve learning experiences for students with diverse educational needs. Nevertheless, challenges such as inadequate digital infrastructure, insufficient professional training, resistance to technological change, data privacy concerns, algorithmic bias, unequal access to technology, and ethical issues surrounding AI-generated content must be addressed to ensure responsible implementation. Educational institutions play a central role in strengthening teacher readiness by providing continuous professional development, AI literacy programs, mentoring opportunities, technical support, and access to modern educational technologies. School leaders and university administrators should establish supportive institutional policies that encourage innovation while maintaining academic integrity, ethical technology use, and student privacy. Faculty development initiatives should focus not only on technological proficiency but also on pedagogical strategies that integrate AI meaningfully into teaching and learning. Future research should explore teacher readiness for AI integration across different educational levels, disciplines, and cultural contexts using longitudinal and comparative research designs. Additional studies may investigate the effectiveness of AI-supported professional development programs, the long-term impact of AI on teaching practices, and the evolving competencies required for educators in increasingly digital learning environments. Research on emerging technologies such as immersive learning environments, intelligent virtual assistants, and AI-driven assessment systems will also provide valuable insights into the future of teacher education. teacher readiness is a critical factor in the successful implementation of technology-enhanced learning in the era of artificial intelligence. By developing digital competence, pedagogical expertise, AI literacy, and ethical awareness, teachers can effectively harness technological innovations to improve teaching quality and student learning outcomes. Investing in teacher readiness through comprehensive training, institutional support, and responsible AI integration will enable educational institutions to build resilient, innovative, and future-ready education systems capable of meeting the evolving demands of the digital age.

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