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Application of Artificial Intelligence (AI) in Learning among Pre-service Teachers at Thu Dau Mot University: Current Status, Opportunities, and Challenges in the Context of Digital Transformation

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ABSTRACT: In the context of digital transformation in higher education, artificial intelligence (AI) is increasingly being utilized by pre-service teachers to support their learning. This study aims to analyze the current status, opportunities, and challenges of AI application at Thu Dau Mot University. A mixed-methods approach was employed, including a survey of 412 students and semi-structured interviews with 3 lecturers, 2 administrators, and 5 students.

The findings indicate that AI is widely used for information retrieval, learning support, and content generation, thereby enhancing learning effectiveness, fostering self-directed learning, and enabling personalized learning processes. However, several challenges remain, including over-reliance on technology, insufficient information evaluation skills, and risks related to academic integrity.

Based on these findings, the study proposes several recommendations to improve the effective integration of AI in teacher education, contributing to meeting the demands of digital transformation in higher education.

KEYWORDS: Artificial intelligence, Digital transformation, Higher education, Learning, pre-service teachers.

INTRODUCTION

In the context of the Fourth Industrial Revolution and the rapid advancement of digital transformation, artificial intelligence (AI) has been generating fundamental changes in higher education. AI not only serves as a supportive tool but also acts as a key driver of innovation in teaching and learning, fostering personalized and optimized learning experiences (Holmes et al., 2019; UNESCO, 2021). AI applications such as educational chatbots, recommendation systems, and learning analytics have contributed to the development of more flexible, adaptive, and effective learning environments (Luckin et al., 2016).

For pre-service teachers, the application of AI in learning is not only aimed at improving knowledge acquisition but also at developing professional competencies in the context of digital education, where future teachers are expected to effectively integrate technology into instructional practices (Redecker, 2017). At Thu Dau Mot University, the use of AI in student learning has been increasing, reflecting an initial adaptation to the demands of digital transformation in education.

However, alongside its opportunities, the adoption of AI also poses several notable challenges. Previous studies indicate that over-reliance on AI may reduce students' critical thinking and self-directed learning abilities (Selwyn, 2019). In addition, issues related to academic integrity, learning ethics, and students' digital competence have emerged as significant concerns in the current context (UNESCO, 2021).

Based on these considerations, this study addresses the following objectives: (1) to examine the current status of AI application in learning among pre-service teachers at Thu Dau Mot University; (2) to identify the opportunities and challenges associated with AI use; and (3) to propose solutions to enhance the effectiveness of AI integration in learning, in response to the requirements of digital transformation in higher education.

RESEARCH METHODS

This study employed a mixed-methods approach to comprehensively collect and analyze data on the application of artificial intelligence (AI) in the learning processes of preservice teachers.

(1) Survey Method: A questionnaire survey was conducted to gather quantitative data on the extent and characteristics of students' AI usage. The questionnaire was designed using a five-point Likert scale and focused on the following areas: (1)

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frequency of AI use; (2) purposes of use; (3) perceptions of benefits and risks; and (4) challenges encountered during use. The survey was administered to preservice teachers at Thu Dau Mot University. The collected data were analyzed using descriptive statistical methods to determine mean scores and standard deviations.

(2) Interview Method: Semi-structured interviews were conducted to supplement and clarify the quantitative findings. Participants included selected lecturers and students. The interviews focused on experiences with AI, perceptions of its effectiveness, and challenges encountered in practical learning contexts. Qualitative data were analyzed using content analysis to identify key themes.

(3) Document Analysis: A systematic review of domestic and international literature related to AI in education and digital transformation was carried out to establish the theoretical foundation of the study. Relevant materials were selected, analyzed, and synthesized to clarify key concepts, roles, and current research trends.

Overall, the integration of these methods ensured the reliability and comprehensiveness of the findings and provided a scientific basis for proposing appropriate interventions.

RESULTS

The role of Artificial Intelligence in higher education

The Concept of Artificial Intelligence in Education

Artificial intelligence (AI) in education is understood as the application of intelligent systems capable of simulating human cognitive activities to support and enhance teaching effectiveness (Holmes et al., 2019). AI enables functionalities such as personalized learning, problem-solving support, assessment, and feedback provision for learners. In practice, AI is implemented through tools such as intelligent tutoring systems, learning chatbots, and learning analytics, contributing to the adaptation of content and teaching methods to individual learners (Luckin et al., 2016; UNESCO, 2021). Moreover, AI facilitates innovation in testing and assessment through automation and data analysis (Zawacki-Richter et al., 2019).

Thus, AI serves not only as a technical tool but also as a driver of educational innovation, promoting personalized learning and the development of learner competencies in the context of digital transformation.

The Role of Artificial Intelligence in Student Learning

Artificial intelligence (AI) plays an increasingly significant role in supporting and enhancing student learning in higher education settings. Firstly, AI facilitates rapid information retrieval and processing, enabling learners to access knowledge efficiently and in a timely manner (Luckin et al., 2016). Moreover, AI contributes to the personalization of learning content, adjusting learning pathways to align with the individual competencies and needs of each student (Holmes et al., 2019). In addition, the use of AI promotes the development of self-directed learning skills, as students actively seek, evaluate, and utilize information throughout their learning process (UNESCO, 2021). Simultaneously, AI supports the enhancement of creativity and problem-solving abilities by suggesting ideas, analyzing data, and providing diverse approaches to learning challenges (Zawacki-Richter et al., 2019).

Therefore, AI serves not only as a technical support tool but also as a crucial factor in innovating learning approaches, aiming to foster the holistic development of students in the context of digital transformation.

Digital Transformation in Higher Education

Digital transformation in higher education is defined as the process of integrating digital technologies into teaching, management, and research activities to enhance the quality, efficiency, and adaptability of the education system (UNESCO, 2021). This process goes beyond mere technological adoption, encompassing comprehensive innovations in pedagogical approaches, university governance, and the development of learners' digital competencies (Redecker, 2017). In this context, digital transformation facilitates flexible and personalized learning models, fosters increased interaction, and contributes to improving the effectiveness of higher education (Holmes et al., 2019).

Thus, digital transformation in higher education is not only an inevitable trend but also a key driver of comprehensive innovation in teaching, management, and research. The integration of digital technologies, particularly AI, helps create flexible, personalized learning environments and enhances students' digital skills. This provides a foundational basis for improving educational quality and meeting contemporary educational demands.

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The Current Status of Artificial Intelligence Application in Student Learning at Thu Dau Mot University

To assess the current application of artificial intelligence (AI) in student learning, a survey was conducted among 412 preservice teachers at Thu Dau Mot University using a five-point Likert scale (1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree). The results were summarized using mean scores (Mean) and standard deviations (SD) as presented in Table 1:

Table 1. Current Status of AI Application in Learning among Preservice Teachers at Thu Dau Mot University

No.	Survey Item	Mean	SD	Level
1	Students frequently use AI in their learning.	4.17	0.73	High
2	Students use AI to search for learning materials	4.31	0.66	Very High
3	Students use AI to support completing assignments.	4.11	0.79	High
4	Students use AI to write reports and essays.	3.94	0.83	High
5	AI helps students understand lessons more quickly.	4.03	0.76	High
6	AI enhances students' learning effectiveness.	4.13	0.71	High
7	Students have sufficient skills to use AI in learning.	3.76	0.82	Medium level
8	Students know how to evaluate the reliability of information from AI.	3.51	0.86	Medium level
9	Lecturers provide guidance on using AI in learning.	3.42	0.91	Medium level
10	Students use AI responsibly and in accordance with academic regulations.	3.68	0.86	Medium level

The survey results presented in Table 1 indicate that the application of artificial intelligence (AI) in the learning processes of preservice teachers at Thu Dau Mot University reached a relatively high average level, reflecting a positive trend in accessing and utilizing technological tools within the higher education learning environment. Observed variables exhibited standard deviations ranging from 0.66 to 0.91, indicating an acceptable level of data dispersion and ensuring the reliability of the measurement scale.

Analyzing individual items, students reported the highest level of AI use in searching for learning materials (Mean = 4.31; SD = 0.66), followed by enhancing learning effectiveness (Mean = 4.13; SD = 0.71) and supporting assignment completion (Mean = 4.11; SD = 0.79). These findings suggest that AI is primarily utilized as a direct learning support tool, enabling students to access information rapidly and improve task performance. Additionally, AI usage for writing reports and essays reached a fairly high level (Mean = 3.94), indicating a growing trend toward employing AI in integrated and creative academic activities.

Students also rated the role of AI in facilitating faster understanding of lessons relatively high (Mean = 4.03; SD = 0.76), demonstrating AI's potential to personalize learning and enhance knowledge acquisition. The frequent use of AI (Mean = 4.17; SD = 0.73) further confirms that AI has become a familiar tool in the academic activities of preservice teachers.

However, indicators related to AI competence and pedagogical orientation only reached moderate levels. Specifically, students self-assessed their AI skills at a moderate level (Mean = 3.76; SD = 0.82), while their ability to evaluate the reliability of information from AI was even lower (Mean = 3.51; SD = 0.86). This indicates that, despite high usage frequency, students have not yet fully mastered the technology, particularly in verifying and critically selecting information—a core competence in higher education learning.

Notably, instructor support received a relatively low mean score (Mean = 3.42; SD = 0.91), reflecting that AI integration into teaching practices has not been implemented systematically or effectively. This may influence students' guidance in using AI, leading to potential misuse or lack of control. Moreover, the responsible and academically compliant use of AI achieved only a moderate level (Mean = 3.68; SD = 0.86), highlighting the existence of ethical risks in AI application.

Overall, the results indicate that AI application in the learning activities of preservice teachers is strong and increasing. Nevertheless, a significant gap remains between AI usage and effective AI competence, particularly in digital skills, critical thinking, and pedagogical orientation. This underscores the need for coordinated measures from universities and instructors to enhance students' capacity to use AI effectively, responsibly, and in alignment with teacher training objectives in the context of digital transformation.

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Opportunities in Applying Artificial Intelligence in Preservice Teachers' Learning

Enhancing Learning Effectiveness

The application of artificial intelligence (AI) contributes to improving students' learning effectiveness by saving time and accelerating access to knowledge. AI tools enable learners to rapidly search, synthesize, and process information from multiple sources, thereby reducing the time required to complete learning tasks (Luckin et al., 2016). Simultaneously, AI supports the provision of learning content tailored to individual needs, allowing students to engage with knowledge more flexibly and efficiently (Holmes et al., 2019).

Moreover, AI automates certain learning activities, such as suggesting resources, summarizing content, and supporting problem-solving, thereby allowing students to focus on higher-order thinking tasks (UNESCO, 2021). Consequently, learning effectiveness is significantly improved both in terms of time efficiency and knowledge acquisition quality.

Therefore, AI is an essential tool for optimizing learning processes by reducing information processing time and enhancing knowledge comprehension. However, to maximize its benefits, AI use should be guided to support rather than replace student thinking. Students need to be equipped with skills to exploit AI proactively, selectively, and responsibly, ensuring a balance between learning efficiency and the development of higher-order cognitive abilities.

Developing Self-Directed Learning Competence

AI also promotes the development of self-directed learning competence, encouraging autonomous and personalized learning. AI tools assist learners in setting learning goals, selecting relevant content, and adjusting learning pace according to personal needs, thereby enhancing self-regulation in learning (Zimmerman, 2002). Additionally, AI provides continuous and timely feedback, helping students identify strengths, weaknesses, and areas for improvement (Holmes et al., 2019).

Furthermore, AI enables access to diverse learning resources and supports learning anytime and anywhere, fostering lifelong learning habits (UNESCO, 2021). Interaction with AI systems also strengthens skills in searching, evaluating, and processing information—core competencies in the digital education context. Overall, AI plays a key role in enhancing student autonomy and self-directed learning. Sustainable effectiveness, however, requires positioning AI as a support tool while simultaneously developing students' self-regulation and critical thinking skills.

Innovating Learning Methods

AI contributes to the innovation of learning methods by promoting personalization aligned with students' needs, abilities, and learning styles. AI systems can analyze learning data to recommend content, learning pathways, and methods tailored to each student, thereby optimizing the learning experience (Holmes et al., 2019). This facilitates a shift from mass teaching models to adaptive, learner-centered approaches (Luckin et al., 2016).

Additionally, AI provides immediate feedback and diversifies learning modalities, including simulations, interactive platforms, and intelligent digital resources, increasing engagement and motivation (UNESCO, 2021). Personalization allows students to learn at their own pace, focus on areas needing improvement, and fully realize their potential. Thus, AI plays a pivotal role in promoting personalized learning and method innovation in higher education. Implementation, however, must be accompanied by appropriate pedagogical guidance to ensure a balance between individualized learning and overall learning outcomes, fostering comprehensive competence development.

Preparing Professional Competence for Digital Education

AI application in learning not only improves learning effectiveness but also directly supports the development of digital competence in preservice teachers, in line with national education guidelines. According to digital competence frameworks, students are expected to develop core competencies, including: (i) using information and communication technology; (ii) managing and exploiting digital information; (iii) communicating and collaborating in digital environments; (iv) creating digital content; and (v) ensuring safety and ethics in digital contexts.

The study results indicate that AI use enhances information and data competence, as evidenced by the ability to quickly search, select, and process information, while also supporting the development of digital content creation skills through lesson design, resource development, and idea presentation (Redecker, 2017). Furthermore, AI promotes self-directed and lifelong learning, enabling students to adapt proactively to digital education environments (UNESCO, 2021).

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Nevertheless, some aspects of digital competence remain limited, particularly the ability to evaluate information reliability, uphold digital ethics, and use AI responsibly. This underscores the need for systematic guidance and skill development to ensure students use technology effectively and ethically (Holmes et al., 2019).

In conclusion, integrating AI into learning plays a crucial role in developing digital and professional competencies for preservice teachers. To meet the requirements of digital education as mandated by the Ministry of Education and Training, a coordinated approach combining technology training, pedagogical orientation, and digital ethics education is essential, thereby preparing a teacher workforce capable of adaptation and innovation in the context of digital transformation.

Challenges in Applying Artificial Intelligence in Preservice Teachers' Learning

Technology Dependence and Reduced Independent Thinking

Despite its benefits, excessive reliance on AI in learning may lead to technology dependence, which can undermine students' independent thinking skills. When learners frequently depend on AI to find answers or complete tasks, the processes of analytical, critical, and problem-solving thinking may be shortened or replaced (Luckin et al., 2016). This directly affects the development of higher-order cognitive skills—a core objective of higher education.

Moreover, unverified information from AI can limit students' ability to critically evaluate and process knowledge, resulting in passive learning behaviors (Holmes et al., 2019). Some studies also indicate that excessive reliance on technology may decrease intrinsic motivation and problem-solving capacity (UNESCO, 2021). Therefore, while AI effectively supports learning, uncontrolled use may diminish independent thinking. It is essential to guide AI use as a tool for supporting cognition, alongside activities that foster critical thinking and autonomy to ensure sustainable learning quality.

Academic Ethics: Plagiarism and Academic Misconduct

AI application in learning poses significant challenges for academic ethics, particularly regarding plagiarism and misconduct. AI tools can rapidly generate content, and some students may be tempted to use AI-produced outputs without citation or verification, violating academic standards (UNESCO, 2021). This undermines the integrity and substantive value of the learning process.

Dependence on AI for assignments and essays can blur the line between learning support and academic misconduct, complicating the assessment of students' actual competence (Holmes et al., 2019). Studies also show that students' awareness of responsible AI use remains limited, especially regarding source citation and adherence to academic regulations (Luckin et al., 2016). Hence, while AI is an effective learning aid, it carries ethical risks if misused. Strengthening academic integrity education, responsible AI use guidelines, and clear regulations is crucial to maintain transparency and fairness in assessments.

Limited Skills in Effective AI Use

Although students increasingly access and use AI in learning, their skills in exploiting AI effectively remain limited. Many students are not proficient in crafting prompts, selecting appropriate tools, or verifying information reliability, resulting in passive and inaccurate AI use (Holmes et al., 2019). This reduces AI's supportive value and impacts learning quality.

Additionally, insufficient understanding of AI's underlying principles and limitations may lead students to accept unverified or misleading information, affecting critical thinking and information processing skills (UNESCO, 2021). Some studies also indicate uneven digital competence among learners, particularly in evaluating, using, and creating digital content (Redecker, 2017). Therefore, limited AI skills constitute a major barrier to effective learning. Targeted AI skill development, combined with digital competence and critical thinking training, is essential for sustainable and effective technology utilization.

Limitations in Instructor Control and Assessment

The rapid development of AI presents challenges for instructors in monitoring and assessing student learning in higher education. Students' use of AI to support or partially replace task completion makes it difficult for instructors to determine learners' actual contributions, affecting the accuracy and fairness of assessments (Holmes et al., 2019).

Moreover, traditional assessment methods have not yet adapted to AI, limiting the detection of misconduct or inappropriate AI use (UNESCO, 2021). Some instructors also lack the skills and tools to integrate AI into assessment design, reducing the effectiveness of monitoring and feedback (Redecker, 2017). Consequently, limitations in control and assessment represent a significant challenge in AI integration. Updating assessment methods to focus on competency development and strengthening instructors' digital skills are essential to improve management effectiveness and ensure transparency and fairness in student evaluation.

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Solutions to Enhance the Effectiveness of AI Application for Preservice Teachers at Thu Dau Mot University

Developing Policies for AI Use in Learning

Establishing policies to guide AI use in learning is an urgent requirement to ensure transparency, fairness, and effectiveness in higher education. With the increasing prevalence of AI, the absence of specific regulations may lead learners to uncontrolled use, academic misconduct, or technology dependence (UNESCO, 2021). Therefore, clear guidelines on the scope, purpose, and methods of AI application are necessary to direct appropriate learning behaviors. These policies should specify AI use in assignments, essays, and examinations, as well as requirements for transparency in citing and utilizing AI-assisted outputs (Holmes et al., 2019). Simultaneously, integrating digital ethics and academic responsibility education can enhance students' awareness and competence in using AI (Redecker, 2017).

Thus, developing AI usage policies represents a critical strategy to ensure guided and ethical application of technology, improving learning quality while maintaining academic standards in higher education.

Enhancing Digital Skills and Information Evaluation Competence

In the context of digital transformation, strengthening digital skills and information evaluation competence is essential for students to exploit AI effectively and responsibly. The rapid growth of digital information requires learners to identify, verify, and process data, minimizing dependence on AI and reducing exposure to inaccurate information (UNESCO, 2021). Digital competence encompasses not only technical skills but also critical thinking, the ability to assess information reliability, and awareness of technological limitations (Redecker, 2017).

To meet these demands, students should be equipped with knowledge of source retrieval, data verification methods, and the operational principles of AI systems, using AI as a cognitive support tool rather than a substitute for thinking (Holmes et al., 2019). Implementation should be integrated into digital skills courses, combining practical exercises, case studies, and AI application projects to develop real-world competencies.

Therefore, enhancing digital skills and information evaluation capabilities is a core solution to improve AI application effectiveness while fostering self-directed learning, critical thinking, and sustainable technology use in higher education.

Integrating AI into the Curriculum

Integrating AI into curricula is an inevitable trend to meet the demands of digital-era education. Beyond early exposure to emerging technologies, AI contributes to the development of core competencies such as computational thinking, creativity, and problem-solving, enhancing students' adaptability to the labor market (UNESCO, 2021). Curriculum integration should follow an interdisciplinary approach, aligned with the specific characteristics of each field of study, thereby supporting practical technology application (Holmes et al., 2019).

Effective implementation requires universities to establish courses on basic and applied AI, while also enhancing instructors' digital competence to improve guidance and the organization of technology-integrated teaching (Redecker, 2017). Combining theoretical instruction with practical projects, simulations, and digital learning experiences further promotes applied skills and innovative thinking.

Overall, AI integration into curricula is a strategic solution to improve educational quality and professional competency. Systematic implementation, aligned with pedagogical orientation and professional practice, is essential to ensure sustainable outcomes in the context of digital transformation.

Enhancing Assessment for Competency Development

With the growing application of AI, innovating assessment toward competency development is critical to accurately reflect learners' actual abilities. Traditional assessments focusing on knowledge recall are insufficient when AI can support many learning tasks (UNESCO, 2021). In line with Vietnam's education reform, assessment should shift from content-based to competency-based approaches, emphasizing the application of knowledge in practice (Bộ Giáo dục và Đào tạo, 2018).

Implementation may include project-based evaluation, case studies, learning products, or presentations, requiring students to demonstrate critical thinking and problem-solving skills (Holmes et al., 2019). Continuous formative and summative assessment with timely feedback supports sustainable competency development (Bộ Giáo dục và Đào tạo, 2020).

Thus, competency-based assessment reform aligns with AI integration trends and educational innovation in Vietnam, promoting fairness, accuracy, and comprehensive development of students' competencies in a digital learning environment.

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Strengthening Collaboration between Universities and Technology Enterprises

Collaboration between educational institutions and technology enterprises is a key solution to build an AI application ecosystem in education, enabling students to access modern technologies and professional practices. Such partnerships help bridge the gap between education and labor market demands, enhancing learners' adaptability in the digital era (UNESCO, 2021). According to Vietnam's higher education strategy, collaboration with enterprises is essential for improving training quality and human resource development (Bộ Giáo dục và Đào tạo, 2019).

Implementation can involve inviting industry experts to teach, organizing workshops, internships, collaborative projects, and mentorship programs, thereby developing students' practical skills and innovative thinking (Holmes et al., 2019). Co-developing curricula, laboratories, and applied research projects further embeds AI in learning environments effectively.

In conclusion, strengthening university-industry collaboration is a strategic solution to enhance education quality, professional competency, and adaptability of students, meeting labor market requirements in the digital era.

CONCLUSION

This study confirms the significant role of artificial intelligence (AI) in enhancing learning effectiveness, fostering self-directed learning, personalizing the learning process, and developing professional competencies for preservice teachers within the context of digital transformation in higher education. However, the application of AI also presents challenges, including the risk of technology dependence, academic misconduct, limited proficiency in AI usage, and difficulties in assessment and evaluation.

Based on these findings, the study proposes targeted solutions, including: developing students' digital competence and information evaluation skills, establishing clear policies for AI use in learning, integrating AI into teacher education curricula, innovating assessment toward competency development, and strengthening collaboration with technology enterprises. Overall, guided and controlled utilization of AI can contribute to improving the quality of teacher training, meeting educational reform demands, and enhancing learners' competencies in the digital era.

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