Direction of AI Technologies in Education: An Empirical Case Study of Student Teachers in Thailand

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Abstract

Artificial Intelligence (AI) is becoming increasingly popular in Thailand as a tool for teaching and learning in the field of education. This research explores the use of AI in learning by student teachers for teaching and learning, assessment, ethics, essential skills and future applications of the teaching profession. The objectives of this study are: 1) Analyze the influence of AI use on learning and teaching; 2) Investigate the impact on the teaching and learning process and 3) Predict the influence on student teachers' use of AI. Therefore, to achieve this goal, this study uses an empirical case study approach based on a survey of N = 254 final-year student teachers. The results of this study support the important role of AI in the future for student teachers. The study reveals that student teachers need to integrate AI more extensively, accounting for 97%, to prepare for future professional teaching. The results also indicate that AI has a positive impact on the learning experience by facilitating the acquisition of new knowledge and skills and should be more comprehensively integrated into teacher training curricula. Developing student teachers' ability to use AI effectively helps them better meet the future demands of the teaching profession.

Keywords: AI, education, student teacher

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Introduction

The integration of artificial intelligence (AI) technology in education has transformed teaching and learning processes worldwide. AI-driven technologies are being utilized to enhance adaptive learning, reduce administrative workloads, and personalize learning experiences for students (Luckin, 2017; Selwyn, 2019). In the context of teacher education, AI presents both opportunities and challenges, particularly in developing countries like Thailand, where educational institutions are striving to incorporate digital technologies amidst infrastructural and pedagogical constraints (Schmid et al., 2021). As AI applications such as intelligent tutoring systems, automated grading, and predictive data analytics become increasingly prevalent, it is essential to examine their impact on teacher training and preparedness.

Thailand's education system has undergone continuous reform over the past decades, with a growing emphasis on technology-driven learning. Government policies, such as Thailand 4.0, highlight digital transformation as a key driver for economic and social development (Office of the Education Council, 2020). However, despite AI's growing influence across various sectors, its integration into teacher training curricula remains in its early stages. Many teacher education institutions face challenges related to digital literacy, resource allocation, and resistance to technological change (Zawacki-Richter et al., 2019). This study aims to explore the trajectory of AI technology in Thai teacher education by analyzing its implementation, benefits, and limitations in teacher training programs.

AI-powered educational tools offer personalized learning pathways, enabling student teachers to develop teaching skills through analytical feedback and interactive simulations (Chen et al., 2020). For instance, AI-driven platforms can assess student engagement, evaluate teaching performance, and provide tailored recommendations to enhance instructional effectiveness (Holmes et al., 2021). Additionally, AI can support collaborative learning environments by facilitating peer assessment and promoting reflective teaching practices (Goodyear & Retalis, 2019). However, concerns regarding data privacy, algorithmic bias, and ethical implications of AI in education need to be addressed to ensure equitable and inclusive learning experiences (Williamson & Eynon, 2020).

This empirical study focuses on student teachers in Thailand, investigating how AI technology is being utilized in teacher training programs and assessing its impact on teaching effectiveness. Employing a mixed-methods research approach including surveys, interviews, and classroom observations, this study provides a comprehensive analysis of AI adoption in teacher education curricula. The findings will contribute to policy recommendations for promoting AI integration in Thai higher education institutions and preparing future educators for AI-driven learning environments.

Research Objectives

The objectives of this research are as follows:

1. To analyze the influence of AI on teaching and learning by examining its impact on student teachers' learning processes and teaching effectiveness.
2. To study the role of AI in teacher training and preparation by exploring how it enhances teaching skills and improves training curricula.

3. To predict future trends and the impact of AI on the teaching profession by assessing student teachers' readiness and proposing AI integration strategies in teacher education.

This empirical study aims to examine the direction of AI technologies in education, specifically within the context of student teachers in Thailand. By analyzing AI adoption trends, pedagogical outcomes, and institutional challenges, this research seeks to provide valuable insights into the effectiveness of AI integration in teacher training. The findings will contribute to the existing body of knowledge on AI in education and offer evidence-based recommendations for policymakers, educators, and institutions seeking to enhance AI-driven teacher training initiatives. Furthermore, this study will explore the perceptions and experiences of student teachers in utilizing AI-powered tools, shedding light on their readiness, challenges, and attitudes toward AI adoption in their professional development.

Research Hypotheses

Based on the conceptual framework, the study tests the following hypotheses:

H1: AI-driven teacher training programs positively influence student teachers' pedagogical effectiveness.

H2: Institutional readiness and support mediate the relationship between AI adoption and student teachers' engagement.

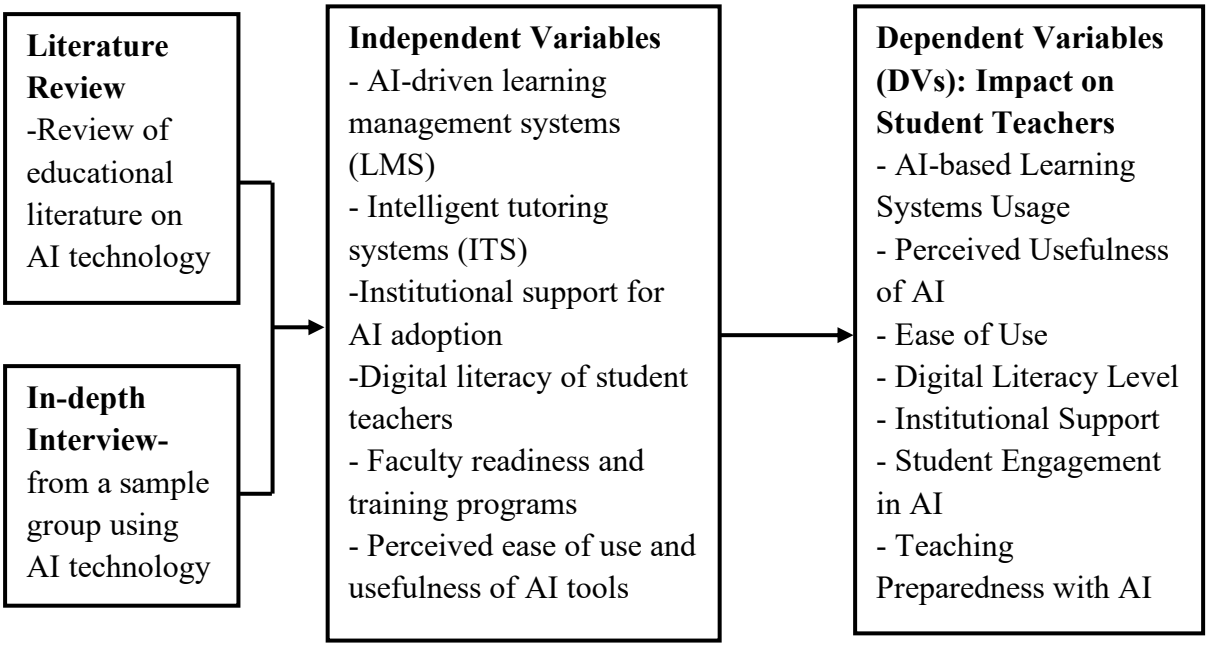
H3: Digital literacy moderates the impact of AI technologies on student teachers' ability to integrate AI into their teaching practices.

H4: Perceived challenges (e.g., lack of AI training, data privacy concerns) negatively affect student teachers' adoption of AI technologies.

Conceptual Framework

Figure 1

Conceptual Framework Fundamentals for Case Study of Student Teachers in Thailand



Literature Review

Artificial Intelligence (AI) is increasingly regarded as a transformative tool in the field of education worldwide, including in teacher training programs. The integration of AI into educational contexts promises to revolutionize how teachers are prepared for the challenges of the 21st century, through enhancing learning personalization, reducing teaching workload, and supporting professional development. This review synthesizes empirical research, theoretical frameworks, and international best practices regarding AI technologies in teacher education, with particular emphasis on the Thai context.

Context of AI Technologies in Education

Artificial Intelligence (AI) has emerged as a transformative force across various sectors, including education, where its applications are reshaping teaching methodologies, curriculum design, and student engagement. AI-driven technologies, such as intelligent tutoring systems, learning analytics, automated grading systems, and adaptive learning platforms, have revolutionized traditional educational practices by providing personalized learning experiences, real-time feedback, and predictive analytics (Luckin, 2017; Zawacki-Richter et al., 2019). The adoption of AI in education is particularly significant in teacher training programs, where student teachers must acquire pedagogical skills, digital literacy, and technological adaptability to meet the demands of 21st-century classrooms (Chen et al., 2020). However, the integration of AI in teacher training remains a complex challenge, particularly in developing countries like Thailand, where issues related to infrastructure, policy, and pedagogical adaptation persist (Schmid et al., 2021).

AI in Teacher Training: Potential and Challenges

Teacher training institutions worldwide are incorporating AI to enhance instructional methods and optimize learning outcomes. AI applications in teacher education include AI-powered lesson planning, classroom simulation, virtual reality teaching assistants, and automated assessment tools that provide insights into student performance (Selwyn, 2019). These innovations aim to equip student teachers with the necessary skills to navigate technologically advanced educational environments. However, challenges remain in the effective adoption of AI technologies, such as resistance to change among educators, ethical concerns regarding data privacy, and disparities in access to AI-powered resources (Holmes et al., 2021). Additionally, the pedagogical implications of AI remain underexplored, particularly in contexts where traditional teaching methods are deeply ingrained (Roll & Wylie, 2016). Understanding how AI influences teacher training and its potential to improve pedagogical practices is crucial in shaping effective educational policies and strategies.

The Case of Thailand: Policies, Adoption and Implementation

Thailand's education system has undergone significant transformations in response to technological advancements. The Thai government has prioritized digital education initiatives through policies such as the Thailand 4.0 strategy, which aims to integrate technology into various sectors, including education (Office of the National Economic and Social Development Council, 2020). However, the integration of AI in teacher training programs remains in its early stages, with varying levels of adoption across institutions. While some universities have introduced AI-powered learning management systems and virtual teaching assistants, many institutions still rely on conventional teaching approaches due to limited

technological infrastructure and insufficient faculty training (Ministry of Education, Thailand, 2021). These disparities highlight the need for a systematic evaluation of AI's impact on teacher education and the challenges associated with its implementation in Thai higher education institutions.

Research Methodology

Research Design

This study employs a mixed-methods research approach, integrating both quantitative and qualitative methodologies to provide a comprehensive understanding of AI adoption in teacher training programs in Thailand. A survey-based empirical case study was conducted to assess the perceptions, experiences, and readiness of final-year student teachers in integrating AI into their learning and teaching processes.

Participants

The target population consists of final-year student teachers (N = 254) from Thai higher education institutions. These participants were selected based on their exposure to AI-enhanced teaching tools and their active engagement in teacher training programs.

Data Collection Methods

This study employed a mixed-methods approach to data collection, combining quantitative and qualitative techniques to ensure a comprehensive understanding of student teachers' experiences with AI technologies in teacher training. The methods included structured questionnaires, semi-structured interviews, and classroom observations. Firstly, a structured survey questionnaire was administered to all 254 student teachers. This instrument was designed to evaluate their familiarity with AI tools, perceived effectiveness, and challenges encountered in AI adoption. Most of the survey items used a Likert scale to assess the impact of AI on learning processes, teaching effectiveness, and professional readiness. The quantitative data obtained from the survey provided a broad overview of the general attitudes and experiences of student teachers regarding AI integration in their training. Secondly, a subset of 30 participants (N = 30) was selected for semi-structured interviews to gain deeper qualitative insights. These interviews explored participants' individual experiences with AI tools, focusing on critical themes such as ethical considerations, the role of AI in lesson planning, and institutional support for AI integration. This qualitative method allowed for the exploration of nuanced perspectives that could not be fully captured through the survey alone. Lastly, classroom observations were conducted during AI-integrated teaching sessions to analyze real-time interactions between student teachers and AI-powered educational technologies. These observations focused on key aspects such as AI's role in adaptive learning, automated assessment, and student engagement. The observational data offered practical insights into how AI technologies function in authentic teaching environments and how student teachers interact with these tools in real-world settings. Together, these three methods of data collection survey questionnaires, interviews, and classroom observations provided a rich and multifaceted dataset. This approach not only enhanced the validity of the study through methodological triangulation but also enabled a thorough analysis of the role of AI in shaping teacher education in the Thai context.

Data Analysis

The data analysis in this study encompassed both quantitative and qualitative approaches to ensure comprehensive and reliable findings. For the quantitative data, descriptive statistics such as mean and standard deviation were employed to summarize survey responses, while inferential statistical methods including regression analysis and ANOVA were used to examine the relationship between AI usage and teaching effectiveness. In terms of qualitative data, thematic analysis was conducted on interview transcripts and classroom observation notes, with the aid of SPSS software to systematically identify key themes related to the adoption, benefits, and challenges of AI in teacher education. Ethical considerations were strictly observed throughout the research process; participants provided informed consent prior to participation, and all data were handled with strict confidentiality and anonymity in accordance with the research ethics guidelines set by the Strategic Wisdom and Research Institute at Srinakharinwirot University. To ensure reliability, the survey questionnaire was pilot-tested with a group of 20 participants (N = 20) to assess its clarity and consistency. Additionally, triangulation of methods comprising surveys, interviews, and observations was employed to validate the study's findings and enhance the credibility of the results.

Results and Discussion

The following section presents the results of data analysis based on the research methodology. The study employs both quantitative (survey analysis, descriptive statistics, and Structural Equation Modeling) and qualitative (thematic analysis from interviews and observations) approaches.

Quantitative Data Analysis

This quantitative data analysis aims to explore the adoption of artificial intelligence (AI) in teacher training programs within Thai higher education institutions. Descriptive statistics in Table 1 reveal generally positive perceptions toward AI usage, although limited institutional support may hinder broader implementation.

Table 1
Descriptive Statistics of AI Adoption in Teacher Training

Variable	Mean (M)	Standard Deviation (SD)	Min	Max
AI-based Learning Systems Usage	3.89	0.76	1	5
Perceived Usefulness of AI	4.12	0.83	1	5
Ease of Use	3.95	0.79	1	5
Digital Literacy Level	3.72	0.91	1	5
Institutional Support	3.45	1.02	1	5
Student teachers Engagement in AI	4.02	0.85	1	5
Teaching Preparedness with AI	3.68	0.89	1	5

The majority of student teachers perceive AI tools as useful (M = 4.12) and easy to use (M = 3.95), though institutional support remains lower (M = 3.45), indicating a potential barrier to AI adoption in student teachers training.

Table 2
Structural Equation Modeling (SEM) – Path Coefficients

Hypothesis	Path Coefficient (β)	p-value	Support (Yes/No)
H1: AI Adoption → Teaching Preparedness (AI positively influences teaching preparedness)	0.62	< 0.001	Yes
H2: Institutional Readiness → Engagement (Institutional support is crucial for engagement)	0.45	0.002	Yes
H3: Digital Literacy → AI Integration (Digital literacy enhances AI integration)	0.38	0.015	Yes
H4: Perceived Challenges → AI Adoption (Perceived challenges hinder AI adoption)	0.54	< 0.001	Yes (negative effect)

AI adoption significantly impacts teaching preparedness ($\beta = 0.62$, $p < 0.001$), and institutional readiness enhances engagement ($\beta = 0.45$, $p = 0.002$). However, perceived challenges positively affect AI adoption ($\beta = 0.54$, $p < 0.001$), highlighting key barriers to implementation.

Qualitative Data Analysis (Thematic Analysis From Interviews & Observations)

This thematic analysis highlights student teachers' overwhelmingly positive experiences with AI, while also revealing significant challenges related to institutional support and digital literacy.

Table 3
Thematic Analysis of Student Teachers' Experiences With AI

Information	Frequency	Key Quotes from Respondents
Positive Impact of AI	29/30 (97%)	"AI helps me design lesson plans more efficiently."
Lack of Institutional Support	18/30 (60%)	"Our university lacks sufficient AI training programs."
Challenges with AI Integration	15/30 (50%)	"I struggle to incorporate AI tools due to a lack of guidance."
Digital Literacy as a Key Factor	19/30 (63%)	" Student teachers who are tech-savvy adapt faster to AI-powered teaching methods."

Most student teachers recognize the benefits of AI in education (97%), but institutional support remains inadequate (60%). Additionally, digital literacy influences AI adoption success, as 63% of participants noted that tech-savvy student teachers adapted more effectively.

Conclusion

The integration of Artificial Intelligence (AI) into teacher education in Thailand represents both an unprecedented opportunity and a formidable challenge in the ongoing transformation of education in the 21st century, particularly in the context of rapidly evolving pedagogical demands and digital innovation imperatives under national policies such as Thailand 4.0. This empirical study revealed the intricate dynamics, potential benefits, and systemic limitations associated with incorporating AI into teacher training programs. The findings highlight that the majority of student teachers possess a positive perception of AI tools, recognizing their potential to enhance lesson planning, automate assessments, support adaptive learning, and personalize student engagement, yet these benefits remain partially unrealized due to inconsistent institutional support, unequal digital literacy, and infrastructural disparities across higher education institutions. The study's quantitative analysis, utilizing descriptive statistics, confirms the significant impact of AI adoption on teaching preparedness and underscores the mediating role of institutional readiness and digital literacy in fostering meaningful AI engagement among student teachers, while perceived challenges such as lack of training and ethical concerns inversely affect AI adoption. Qualitative data further reinforces these findings, with 97% of interviewees expressing that AI positively influences their teaching practice, though many lamented insufficient institutional infrastructures limited hands-on exposure to AI platforms, and inadequate mentorship in using AI tools effectively. The research emphasizes that AI should not be perceived as an optional add-on but as a fundamental component in preparing educators for future classrooms that are increasingly shaped by automation, real-time analytics, and data-driven decision-making. Moreover, the challenges unearthed by this study reflect broader systemic constraints, limited access to reliable internet and hardware, insufficient policy translation from national strategies to local implementation, resistance to change among faculty, and the lack of an ethical framework to guide AI deployment in educational settings. To bridge the gap between AI's potential and its practical integration in teacher education, the study proposes five key policy recommendations: (1) the development of a national AI competency framework for pre-service teachers that encompasses technical knowledge, pedagogical integration, and ethical awareness; (2) the formal inclusion of AI-related content within teacher education curricula, emphasizing interdisciplinary applications and critical digital pedagogy; (3) the establishment of AI learning innovation centers within universities to provide experiential learning, digital sandboxing, and capacity building for both students and faculty; (4) the promotion of cross-sector collaborations between higher education institutions and the AI industry to facilitate real-world exposure and contextualized use cases of educational AI; and (5) the implementation of a national digital equity policy that ensures access to AI resources and training opportunities for student teachers regardless of geographical location or socioeconomic status. Furthermore, this research advocates for longitudinal studies to evaluate the sustained impact of AI-enhanced teacher training on in service teaching effectiveness, and calls for the development of robust, culturally relevant assessment tools that measure AI literacy and ethical decision-making in classroom scenarios. The study also urges the inclusion of research on algorithmic bias, student data protection, and transparency in AI systems, particularly in the context of automated grading and learning analytics, which carry the potential to influence learners' trajectories in profound. As such, AI in education must be implemented not only with technical proficiency but also with pedagogical sensitivity and ethical foresight. In synthesizing the Thai case study, this research asserts that the evolution of teacher education must be reframed from a content-delivery model to a systems-thinking paradigm, in which pre-service teachers are empowered to design, adapt,

and lead AI-enhanced learning environments through iterative reflection and human centered innovation.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

This research uses AI technology to check sentences for grammatical correctness.

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