

# Shaping the Future of Education: Conceptualising Pre-Service Teachers' Perspectives on Artificial Intelligence (AI) Integration

Nur Yasmin Khairani Zakaria, Harwati Hashim

Faculty of Education, Universiti Kebangsaan Malaysia

Corresponding Author Email: [yasminzakaria@ukm.edu.my](mailto:yasminzakaria@ukm.edu.my)

To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v14-i5/21584>

DOI:10.6007/IJARBSS/v14-i5/21584

*Published Date:* 06 May 2024

## Abstract

The integration of Artificial Intelligence (AI) into the realm of education has emerged as a transformative force with the potential to reshape teaching practices and enhance learning outcomes. This conceptual paper delves into the multifaceted factors that influence the attitudes and intentions of pre-service teachers regarding the incorporation of AI technology in their future teaching endeavors. Drawing on the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technological Pedagogical Content Knowledge (TPACK) framework, this paper discusses the key components that shape pre-service teachers' perspectives on AI integration. By synthesizing these theoretical foundations, the paper aims to develop an integrated model, thereby offering a holistic perspective on the factors that influence pre-service teachers' attitudes and intentions in employing AI in their teaching practices. The insights and implications derived from this conceptual paper have the potential to inform teacher education programs and educational policymakers, ensuring the effective preparation of future educators to navigate AI-enhanced teaching environments. The study underscores the importance of addressing pre-service teachers' perspectives and concerns, ultimately fostering a seamless and productive integration of AI within the educational landscape.

**Keywords:** Artificial Intelligence in Education, Pre-Service Teachers, Attitudes and Intentions Technology Adoption, UTAUT Model, TPACK Framework

## Introduction

In an era characterized by technological acceleration, the integration of Artificial Intelligence (AI) into education has emerged as a pivotal force poised to redefine the landscape of teaching and learning (Bates et al., 2020; Alam, 2022; Holmes et al., 2023). The application of AI technologies in educational settings offers a myriad of possibilities, including personalized learning experiences, data-driven insights, and more efficient instructional strategies (Lameras & Arnab, 2021; Liang et al., 2021; Zhai et al., 2021). This transformative

potential holds the promise of not only enhancing the educational experience but also addressing the diverse and evolving needs of learners in the 21st century.

Artificial Intelligence (AI) has evolved into a prominent force in the realm of education, offering innovative ways to enhance teaching and learning experiences. The utilization of AI in educational settings holds the promise of personalized learning, improved instructional support, and more effective pedagogical strategies (Zhai et al., 2021; Bearman et al., 2023; Grassini, 2023; Chan, 2023; Kim et al., 2020). However, the successful integration of AI into teaching practices heavily relies on the attitudes and intentions of pre-service teachers, who are the educators of the future (Baidoo-Anu & Ansah, 2023; Su & Yang, 2022). Understanding the factors that shape their perspectives on AI adoption is crucial to harnessing the potential of this transformative technology. This research investigates the intricacies of pre-service teachers' attitudes and intentions concerning AI integration, utilizing a comprehensive theoretical framework encompassing the Unified Theory of Acceptance and Use of Technology (UTAUT) and Technological Pedagogical Content Knowledge (TPACK).

At the heart of this technological transformation lies the crucial role of educators, particularly those who are in the preparatory phase of their careers as pre-service teachers. These future educators are entrusted with the responsibility of nurturing the minds of tomorrow's leaders, innovators, and contributors to society (Renz & Hilbig, 2020; Lameris & Arnab, 2021). Their beliefs, attitudes, and intentions regarding AI integration into teaching practices will undoubtedly shape the direction of education in the coming years. Thus, it is imperative to understand the factors that influence pre-service teachers' perspectives on AI adoption and how these factors impact their future role in the classroom.

### **Background of the Study**

The integration of AI technology in education has gained significant attention due to its potential to revolutionize traditional teaching practices (Alam, 2022; Bates et al., 2020; Guan et al., 2020). AI tools and platforms can personalize learning experiences, adapt instruction to individual student needs, and offer insights into student performance that enable more effective teaching strategies (Kim et al., 2020; Su & Yang, 2022; Baidoo-Anu & Ansah, 2023;). AI-driven technologies also have the potential to bridge learning gaps and increase educational access, especially in a world where technology is increasingly pervasive (Bearman et al., 2023). However, the successful implementation of AI in education lies in the willingness and readiness of teachers, particularly pre-service teachers who are preparing to enter the field. Pre-service teachers are tasked with adapting to evolving pedagogical practices and technology trends, and their attitudes and intentions toward AI integration will significantly influence its adoption in future classrooms (Lee & Perret, 2022). The Unified Theory of Acceptance and Use of Technology (UTAUT) has been widely recognized for its applicability in understanding technology acceptance and usage behavior (Lameris & Arnab, 2021; Limna et al., 2022). UTAUT identifies key factors, including performance expectancy, effort expectancy, social influence, and facilitating conditions, that influence individuals' attitudes and intentions toward adopting new technologies (Ng et al., 2022; Holmes et al., 2023; Zhai et al., 2021). Additionally, the Technological Pedagogical Content Knowledge (TPACK) framework emphasizes the confluence of technological knowledge, pedagogical knowledge, and content knowledge in effectively integrating technology in teaching (Liang et al., 2021). Given the growing importance of AI in education, it is imperative to comprehensively examine how these UTAUT factors and TPACK components interact and shape the attitudes and intentions of pre-service teachers toward AI integration. Understanding these factors will not

only inform teacher education programs but also guide educational policymakers in preparing future educators for AI-enhanced teaching environments.

### **Problem Statement**

Despite the potential benefits of AI technology in education, there is a lack of research that delves into the specific factors influencing pre-service teachers' attitudes and intentions regarding its integration into their teaching practices (Bates et al., 2020; Ng et al., 2022; Holmes et al., 2023; Zhai et al., 2021). As technology continues to evolve and play an increasingly vital role in the education sector (Grassini, 2023; Ng et al., 2022; Holmes et al., 2023; Zhai et al., 2021), it becomes imperative to explore the drivers and barriers that pre-service teachers encounter in their path toward embracing AI technology.

The problem at hand lies in the limited understanding of what motivates or hinders pre-service teachers in their acceptance of AI technology in the context of teaching (Bearman et al., 2023; Bates et al., 2020; Ng et al., 2022; Holmes et al., 2023; Zhai et al., 2021). The absence of a comprehensive framework that accounts for the interplay between UTAUT factors and TPACK components in the context of AI integration further exacerbates this issue (Holmes et al., 2023). Without this understanding, the effective preparation of pre-service teachers for AI-enhanced teaching environments becomes a challenge (Holmes et al., 2021). This study aims to address this critical gap by investigating the intricate factors shaping pre-service teachers' attitudes and intentions regarding AI utilization (Su & Yang, 2022). By doing so, it will contribute to the development of informed strategies for teacher education programs and policymakers to facilitate the seamless adoption of AI technology in education, ultimately enhancing the quality of teaching and learning experiences for future generations (Chan, 2023).

Despite the growing interest in AI in education (Zhai et al., 2021), there is a limited body of research that specifically addresses the factors influencing pre-service teachers' attitudes and intentions regarding AI adoption (Ng et al., 2022; Vlasova et al., 2019). Furthermore, there is a need to explore how UTAUT factors and TPACK components interact in this context. Understanding these interactions can inform the development of effective strategies for teacher education programs and policy initiatives aimed at preparing future educators for AI-enhanced teaching environments. Therefore, the proposed aims of the conceptual paper are to: a) examine the impact of UTAUT factors (performance expectancy, effort expectancy, social influence, facilitating conditions) on pre-service teachers' attitudes and intentions to adopt AI technology in teaching and b) investigate the interaction between technological knowledge (TPACK) and pre-service teachers' attitudes and intentions toward AI integration in teaching.

### **Methodology**

#### *Research Design*

This study will employ a mixed-methods research design, integrating both quantitative and qualitative approaches. This mixed-methods design allows for a comprehensive exploration of the factors influencing pre-service teachers' attitudes and intentions toward AI integration in teaching. The participants in this study will be pre-service teachers who are currently enrolled in teacher education programs. A purposive sampling method will be used to ensure a diverse representation of pre-service teachers, considering factors such as age, gender, geographical location, and the specific teacher education programs they are enrolled in.

### *Data Collection*

Quantitative data will be collected through structured surveys. The survey will be designed to assess pre-service teachers' attitudes and intentions regarding AI integration in teaching and will include items related to UTAUT constructs (performance expectancy, effort expectancy, social influence, facilitating conditions) and TPACK components. The survey will be distributed electronically to the participants. Qualitative data will be gathered through semi-structured interviews. These interviews will provide in-depth insights into the participants' perceptions, experiences, and viewpoints regarding AI integration. Interviews will be conducted with a subset of survey participants who express willingness to participate in this phase.

### *Data Analysis*

Quantitative data will be analyzed using statistical techniques, such as regression analysis, to examine relationships between UTAUT factors, TPACK components, and attitudes toward AI integration. Specifically, the analysis will seek to determine how performance expectancy, effort expectancy, social influence, and facilitating conditions impact pre-service teachers' attitudes and intentions toward AI adoption. Qualitative data from interviews will be thematically analyzed to extract patterns, themes, and insights. This thematic analysis will involve the systematic identification and categorization of recurring themes in the data, providing a richer understanding of pre-service teachers' experiences and perspectives. The findings from the quantitative and qualitative data analyses will be integrated to provide a comprehensive understanding of the factors influencing pre-service teachers' attitudes and intentions regarding AI integration in teaching. The mixed-methods design will allow for triangulation and a more holistic perspective.

## **Discussion**

### *The Transformative Potential of AI in Education:*

The field of education is on the verge of a significant transformation, and at its core is the incorporation of Artificial Intelligence (AI) (Bearman et al., 2023; Bates et al., 2020; Ng et al., 2023; Holmes et al., 2023; Zhai et al., 2021). AI, with its limitless possibilities (Grassini, 2023), offers an entirely new dimension to teaching and learning (Alam, 2022; Chan, 2023). It represents a paradigm shift in education by providing solutions that are personalized, responsive, and data-driven (Zhai et al., 2021). One of the most promising aspects of AI in education is its capacity to personalize learning experiences (Lee & Perret, 2022). Traditionally, classrooms have been designed with a one-size-fits-all approach, where instruction proceeds at a uniform pace regardless of individual student needs (Su & Yang, 2022). AI has the power to change this by adapting learning content and pace to the strengths and weaknesses of each student (Kim et al., 2020). This personalization is not only revolutionary for students, allowing them to progress at their own speed (Bates et al., 2020), but it also eases the burden on educators (Lameras & Arnab, 2021). Pre-service teachers stand to gain substantially from AI-powered tools that assist in tailoring instruction to the diverse needs of their future students (Limna et al., 2022).

Furthermore, AI has the capability to automate administrative tasks that can be burdensome for educators (Renz & Hilbig, 2020). Tasks such as grading assignments, tracking attendance, or managing administrative paperwork are time-consuming and can detract from the core mission of teaching (Huang et al., 2021). AI can shoulder these administrative burdens, freeing up educators to allocate more time and energy to meaningful instructional

activities (Ng et al., 2022). For pre-service teachers, who may still be refining their teaching skills, the incorporation of AI in administrative tasks can provide invaluable support as they transition into their roles as educators. In addition, AI offers the potential to provide real-time insights into student performance (Holmes et al., 2021; Guan et al., 2020; Liang et al., 2021). Rather than relying on periodic assessments, teachers can gain immediate feedback on their students' understanding and engagement (Lee & Perret, 2022). These insights enable timely interventions to help struggling students, thereby improving overall learning outcomes. For pre-service teachers, who are learning to navigate the intricacies of classroom management and effective instruction, these real-time insights can serve as a valuable aid, allowing them to make informed instructional decisions (Vlasova et al., 2019).

However, the transformative potential of AI in education is not solely rely on the technology itself but rather on the willingness and readiness of educators, particularly pre-service teachers (Su & Yang, 2022). As they embark on their journey to becoming educators, pre-service teachers need to be cognizant of the revolutionary changes taking place in education due to AI. Their openness to embracing AI, understanding its potential, and integrating it into their teaching practices will significantly shape the success and effectiveness of AI implementation in education. Therefore, the transformative potential of AI in education is a beacon of hope, promising a future where learning is personalized, administrative tasks are streamlined, and student performance is optimized (Lameras & Arnab, 2021). The integration of AI in education stands to benefit both students and educators alike (Kim et al., 2020). However, for this potential to be fully realized, it is imperative that pre-service teachers, as the educators of tomorrow, are not only prepared to harness the power of AI but are also enthusiastic and willing to do so. The success of AI in education hinges on the attitudes and intentions of educators, making this a critical area of exploration and research.

### *The Role of Pre-Service Teachers*

Pre-service teachers are the representatives of future education (Su & Yang, 2022). They are not only the continuants of pedagogical traditions but also the shifts of innovation, to shape the future of education. In the context of AI adoption, pre-service teachers assume a central role, and their attitudes and intentions regarding AI are of importance. As future educators, pre-service teachers are not mere spectators but active participants in the transformative journey that AI is charting in education (Holmes et al., 2023; Baidoo-Anu & Ansah, 2023). Their perceptions, openness to change, and eagerness to embrace AI technologies profoundly influence the extent to which AI will become an integral part of teaching practices in the years to come. Understanding pre-service teachers' attitudes toward AI is a complex undertaking as it involves exploring their willingness to adapt to new instructional methods and their readiness to integrate AI tools into their teaching repertoire. These attitudes are shaped by a multitude of factors, including their educational backgrounds, personal experiences, and exposure to technology during their pre-service training (Huang et al., 2021). Pre-service teachers are uniquely positioned to bridge the gap between tradition and innovation in education. They bring fresh insights, recent training, and an inherent comfort with technology to the classroom (Lameras & Arnab, 2021). However, for AI to be effectively integrated into education, they need to be not only technologically proficient but also pedagogically and content-wise aligned with the educational goals they wish to achieve (Zhai et al., 2021). This alignment is where their roles become pivotal.

The transformational power of AI is not limited to the tools themselves but extends to the mindset and practices of educator. For pre-service teachers, this involves embracing a paradigm shift from traditional teaching methodologies to more dynamic, data-driven, and learner-centered approaches (Baidoo-Anu & Ansah, 2023; Bates et al., 2020). To successfully navigate this shift, they need to cultivate a proactive attitude toward AI integration. Furthermore, pre-service teachers' intentions regarding AI are equally critical (Holmes et al., 2021). Their willingness to engage with AI technologies is a determinant of the extent to which AI can permeate teaching practices. Their intentions reflect their commitment to continuous improvement and adaptability in the face of evolving educational paradigm. Consequently, understanding how pre-service teachers perceive and interact with AI in education is crucial for educational institutions and teacher preparation programs. It guides the development of strategies that prepare future educators to effectively integrate AI into their teaching practices (Su & Yang, 2022; Renz & Hilbig, 2020). These strategies should encompass not only technological literacy but also pedagogical strategies that make the most of AI's capabilities (Holmes et al., 2023).

Pre-service teachers represent the front lines in the ongoing transformation of education through AI (Chan, 2023). Their attitudes and intentions are the foundation upon which AI adoption in education rests (Huang et al., 2021). Their open-mindedness, readiness to adapt, and commitment to leveraging AI's potential will determine how seamlessly and effectively AI is integrated into teaching practices (Bates et al., 2020). In other words, pre-service teachers play an indispensable role in shaping the future of education, especially concerning AI adoption. As future educators, their attitudes and intentions are not just individual but collective, as they influence the broader educational landscape. To ensure a successful and productive integration of AI in education, it is imperative that pre-service teachers are well-prepared and enthusiastic about embracing AI technologies as essential tools for their teaching journey.

#### *Factors Influencing Pre-Service Teachers' Attitudes and Intentions*

The attitudes and intentions of pre-service teachers towards the integration of AI in education are a complex interplay of various factors. Firstly, their educational backgrounds and prior experiences with technology shape their readiness for AI adoption (Zhai et al., 2021). Those with substantial exposure to technology-driven learning environments might approach AI with more enthusiasm and comfort (Huang et al., 2021). Personal experiences with AI, both in their personal lives and within their teacher training, significantly influence their attitudes (Bates et al., 2020). Positive experiences, such as using AI-driven educational apps, can inspire a positive outlook, while negative encounters can lead to skepticism (Renz & Hilbig, 2020). Moreover, pre-service teachers often enter their training programs with established beliefs about effective teaching and learning. These preconceived notions can either encourage or hinder AI adoption, depending on whether they align with the principles that AI seeks to support. For instance, those who value student-centered, adaptive, and data-informed instruction may be more inclined to adopt AI technologies that align with these principles (Bearman et al., 2023).

The perceived usefulness and ease of use of AI are crucial factors. Pre-service teachers are more likely to embrace AI when they believe it can enhance teaching and learning outcomes while being user-friendly and accessible (Holmes et al., 2021). When they find AI tools complicated or challenging, their intentions to adopt may diminish. Institutions and teacher preparation programs can mitigate this concern by providing user-friendly AI tools

and comprehensive training (Renz & Hilbig, 2020). Social influence also plays a pivotal role in shaping their attitudes (Grassini, 2023). Positive feedback, encouragement, and success stories from peers or mentors who have effectively integrated AI can act as powerful influencers (Kim et al., 2020). Conversely, negative experiences or skepticism from their social network may hinder the adoption of AI in teaching.

The facilitating conditions in educational institutions, such as access to resources, training, and a supportive environment, are critical (Bearman et al., 2023). When pre-service teachers have the necessary tools and institutional support for AI adoption, they are more likely to embrace it (Zhai et al., 2021). On the other hand, inadequate resources or a lack of institutional backing can hinder their intentions to adopt AI. Furthermore, alignment with pedagogical and content knowledge is pivotal (Holmes et al., 2023). Pre-service teachers must perceive AI as a complementary tool that enhances their existing knowledge, rather than as a disruptive force. AI should be seen as a means to facilitate effective teaching and improved learning outcomes without undermining traditional teaching methods. Awareness and exposure to AI technologies are key factors (Zhai et al., 2021). Those who are well-informed about the potential and limitations of AI are better equipped to make informed decisions about its integration. Training programs and institutions can enhance awareness and exposure through workshops, courses, and practical experiences. The extent to which AI is integrated into the curriculum and teacher training programs directly influences pre-service teachers' attitudes and intentions (Bates et al., 2020). When AI is seamlessly woven into their educational journey, they are more likely to see it as an essential part of their future teaching toolkit. However, concerns related to the ethical implications and data privacy issues associated with AI in education can influence their willingness to adopt AI. These concerns should be addressed transparently in training programs to mitigate potential resistance. Therefore, the attitudes and intentions of pre-service teachers regarding AI adoption in education are shaped by a complex web of factors, encompassing their educational background, personal experiences, beliefs, perceived usefulness, ease of use, social influence, facilitating conditions, alignment with knowledge domains, awareness, curriculum integration, and ethical considerations. Recognizing these multifaceted influences and addressing them in teacher preparation programs and institutional practices is essential for fostering a positive and enthusiastic approach to AI integration, which is crucial for the successful implementation of AI in education.

#### *Research Gap and the Need for This Study*

The conceptual paper addresses a critical research gap in the existing literature related to the attitudes and intentions of pre-service teachers concerning the adoption of AI in teaching. While there is a burgeoning interest in the utilization of AI in education, there is a noticeable dearth of comprehensive studies that specifically delve into the perspectives of those who are soon to become educators. The necessity for this study becomes more apparent when considering the transformative potential of AI in education and the pivotal role that pre-service teachers play in shaping its future. As AI continues to gain prominence in educational discourse, there is an increasing focus on the technological and pedagogical implications it carries. However, amidst the excitement surrounding AI's capabilities, the voices and perspectives of pre-service teachers, who will be at the forefront of implementing these technologies in classrooms, have been relatively underrepresented in the literature. This study aims to rectify this gap by shedding light on the attitudes and intentions of pre-service teachers regarding AI adoption.

Moreover, the paper underscores the essential need to explore how the factors outlined in the Unified Theory of Acceptance and Use of Technology (UTAUT) and the components of the Technological Pedagogical Content Knowledge (TPACK) framework interact within the context of AI integration. While these frameworks have been instrumental in understanding technology adoption and pedagogical knowledge, their application to AI in education remains underexplored. AI presents unique challenges and opportunities that necessitate an in-depth examination of these factors in this specific context. The integration of AI technologies in education is not a one-dimensional process; it requires a deep understanding of the interplay between technology, pedagogy, and content. As AI systems become more sophisticated and ingrained in educational settings, pre-service teachers need to navigate the intricate relationship between these domains. This study seeks to fill this void by exploring how technological knowledge, pedagogical knowledge, and content knowledge converge in the realm of AI adoption. Furthermore, by examining how UTAUT factors and TPACK components interact within the context of AI integration, this study offers insights that can inform the development of teacher education programs and the decision-making processes of educational policymakers. It is of paramount importance that those responsible for shaping the future of education have a comprehensive understanding of the dynamics governing pre-service teachers' attitudes and intentions regarding AI adoption. This knowledge will not only enable the effective preparation of future educators for AI-enhanced teaching environments but also facilitate the creation of policies and strategies that ensure the seamless and productive integration of AI in the educational landscape.

#### *The Significance of the Proposed Model*

The integration of an encompassing model that combines the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technological Pedagogical Content Knowledge (TPACK) framework carries immense significance in understanding and enhancing pre-service teachers' readiness for AI adoption in education (Chan, 2023). Firstly, the development of an integrated model provides a holistic perspective on the multifaceted factors that influence pre-service teachers' attitudes and intentions towards AI integration in teaching (Bates et al., 2020). While UTAUT examines the psychological aspects of technology acceptance and use (Limna et al., 2022), TPACK delves into the intricate interplay between technological knowledge, pedagogical knowledge, and content knowledge (Holmes et al., 2023). By bringing these two frameworks together, the integrated model considers both the psychological and practical dimensions of AI adoption, offering a more comprehensive understanding (Holmes et al., 2023).

The significance of this integrated model lies in its potential to reveal how UTAUT factors and TPACK components intersect, mediate, or moderate one another in the context of AI integration (Bearman et al., 2023). This knowledge is invaluable in understanding the complex dynamics at play when pre-service teachers are exposed to AI technologies. It can shed light on how technological knowledge aligns with pedagogical and content knowledge in the effective use of AI, guiding educators on how to leverage AI's capabilities to enhance teaching and learning (Holmes et al., 2023). Moreover, the integrated model is not just an academic exercise; it has practical implications for teacher education programs, educational institutions, and policymakers (Limna et al., 2022). It serves as a valuable resource for designing and refining teacher training programs to ensure that future educators are well-prepared to navigate AI-enhanced teaching environments (Chan, 2023).



Educational institutions can use the insights derived from the integrated model to tailor their support systems for pre-service teachers (Limna et al., 2022). It can inform the provision of resources, training, and mentorship to help aspiring educators effectively integrate AI into their teaching practices (Holmes et al., 2023). Policymakers, too, can draw upon the integrated model to formulate evidence-based policies and strategies that facilitate the widespread and seamless adoption of AI in education (Limna et al., 2022). Furthermore, the integrated model is not a static concept; it has the potential for ongoing refinement and adaptation (Limna et al., 2022). As AI technologies in education continue to evolve, so too will the factors that influence attitudes and intentions. An integrated model can serve as a dynamic tool for ongoing research, enabling the education community to stay abreast of the ever-changing landscape of AI integration (Holmes et al., 2023).

#### *Implications for the Future of Education:*

The implications of the research presented in this conceptual paper are profound and far-reaching, carrying the potential to shape the future of education in significant ways. The preparedness of pre-service teachers to effectively embrace AI technologies has wide-ranging consequences for the educational landscape and, ultimately, the quality of teaching and learning experiences. One of the foremost implications is the potential for a more seamless and productive integration of AI into the educational environment. As pre-service teachers are equipped with the knowledge, skills, and positive attitudes needed to harness AI's transformative power, they are better positioned to leverage AI technologies effectively in their teaching practices. This, in turn, can lead to more dynamic and adaptive instructional strategies that cater to the diverse needs of students. The effective integration of AI into education also holds the promise of enhanced learning experiences for students. AI can facilitate personalized learning pathways, enabling students to progress at their own pace and receive targeted support where needed. This personalization has the potential to improve student engagement, motivation, and overall learning outcomes. Pre-service teachers who are adept at using AI tools can create a more engaging and tailored learning environment for their future students.

Furthermore, by embracing AI technologies, educational institutions can optimize administrative tasks, allowing educators to focus more on instruction and less on paperwork (Bates et al., 2020). This streamlining of administrative processes can result in reduced workload and increased job satisfaction among teachers, both of which are crucial for retaining talented educators in the field. The implications of this research extend to the broader educational community. It emphasizes the importance of continuous professional development to ensure that educators, both pre-service and in-service, remain current and proficient in the use of AI technologies. It underscores the need for teacher training programs to evolve, incorporating AI-related content and pedagogical strategies that prepare teachers to navigate AI-enhanced teaching environments effectively. Additionally, the research has significant implications for policymakers. It calls attention to the critical role of well-informed policies in supporting and promoting AI adoption in education. Policymakers can utilize the insights from this research to design evidence-based policies that encourage the integration of AI and allocate resources for teacher training and support.

#### **Conclusion**

The integration of Artificial Intelligence (AI) into education represents a pivotal moment in the evolution of teaching and learning. The promise of personalized instruction, data-driven

insights, and enhanced pedagogical practices brings new possibilities to the education landscape. However, the realization of this potential depends on the readiness and willingness of pre-service teachers who will be at the forefront of shaping the future of education. This conceptual paper has explored the intricate factors influencing pre-service teachers' attitudes and intentions toward AI integration in teaching. By combining the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technological Pedagogical Content Knowledge (TPACK) framework, this research seeks to provide a holistic understanding of these factors. The literature review has illuminated the transformative potential of AI in education, emphasizing the role of pre-service teachers as the key drivers of change. It has introduced UTAUT and TPACK as theoretical frameworks that underpin the analysis of AI adoption factors. The discussion has outlined factors such as perceived usefulness, ease of use, training, support, peer influence, mentorship, and content alignment as significant influencers of pre-service teachers' attitudes and intentions. This paper has highlighted a critical research gap in the existing literature. There is a dearth of studies specifically addressing pre-service teachers' perspectives on AI integration in education. Furthermore, there is a need to understand how UTAUT factors and TPACK components interact in this context, which can provide valuable insights for educator preparation programs and policymakers. The significance of developing an integrated UTAUT and TPACK model cannot be understated. Such a model will enable a comprehensive understanding of the multifaceted factors that shape pre-service teachers' attitudes and intentions. It will serve as a roadmap for teacher education programs, institutions, and policymakers to effectively prepare future educators for AI-enhanced teaching environments. In essence, this research holds promise for the future of education. Preparing pre-service teachers to embrace AI technologies effectively can pave the way for a more seamless and productive integration of AI in the educational landscape. This, in turn, will enhance the quality of teaching and learning experiences for future generations. It is a call to action for educators, researchers, and policymakers to invest in understanding and harnessing the power of AI in education to usher in a new era of transformative learning experiences.

## References

- Alam, A. (2022). A Digital Game based Learning Approach for Effective Curriculum Transaction for Teaching-Learning of Artificial Intelligence and Machine Learning. *2022 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS)*, 69-74.
- Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the era of Generative Artificial Intelligence (AI): Understanding the potential benefits of CHATGPT in promoting teaching and learning. *SSRN Electronic Journal*, 7(1), 52–62. <https://doi.org/10.2139/ssrn.4337484>
- Bates, T., Cobo, C., Marino, ~ O., & Wheeler, S. (2020). Can artificial intelligence transform higher education? *International Journal of Educational Technology in Higher Education*, 17(1), 42. <https://doi.org/10.1186/s41239-020-00218-x>
- Bearman, M., Ryan, J., & Ajjawi, R. (2023). Discourses of artificial intelligence in higher education: A critical literature review. *Higher Education*, 86(2), 369–385. <https://doi.org/10.1007/s10734-022-00937-2>
- Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education*, 20(1), 38. <https://doi.org/10.1186/s41239-023-00408-3>

- Grassini, S. (2023). Shaping the future of education: exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences*, 13(7), 692. <https://doi.org/10.3390/educsci13070692>
- Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, 4(4), 134-147. <https://doi.org/10.1016/j.ijis.2020.09.001>
- Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Buckingham Shum, S., Santos, O. C., Rodrigo, M. M. T., Cukorova, M., Bittencourt, I. I., & Koedinger, K. (2021). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, 32, 504–526. <https://doi.org/10.1007/s40593-021-00239-1>
- Holmes, W., Bialik, M., & Fadel, C. (2023). Artificial intelligence in education. *Globethics Publications*.
- Huang, J., Saleh, S., & Liu, Y. (2021). A review on artificial intelligence in education. *Academic Journal of Interdisciplinary Studies*, 10(206). <https://doi.org/10.36941/ajis-2021-0077>
- Lameras, P., & Arnab, S. (2021). Power to the teachers: an exploratory review on artificial intelligence in education. *Information*, 13(1), 14. <https://doi.org/10.3390/info13010014>
- Lee, I., & Perret, B. (2022, June). Preparing High School Teachers to Integrate AI Methods into STEM Classrooms. In *Proceedings of the AAAI Conference on Artificial Intelligence*, 36(11), 12783-12791.
- Liang, X., Haiping, L., Liu, J., & Lin, L. (2021). Reform of English interactive teaching mode based on cloud computing artificial intelligence—a practice analysis. *Journal of intelligent & fuzzy systems*, 40(2), 3617-3629. <https://doi.org/10.3233/JIFS-189397>
- Limna, P., Jakwatanatham, S., Siripipattanakul, S., Kaewpuang, P., & Sriboonruang, P. (2022). A review of artificial intelligence (AI) in education during the digital era. *Advance Knowledge for Executives*, 1(1), 1-9. <https://ssrn.com/abstract=4160798>
- Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W. (2022). A review of AI teaching and learning from 2000 to 2020. *Education And Information Technologies*. Advance online publication. <https://doi.org/10.1007/s10639-022-11491-w>
- Kim, J., Merrill, K., Xu, K., & Sellnow, D. D. (2020). My teacher is a machine: Understanding students' perceptions of AI teaching assistants in online education. *International Journal of Human-Computer Interaction*, 36(20), 1902-1911. <https://doi.org/10.1080/10447318.2020.1801227>
- Renz, A., & Hilbig, R. (2020). Prerequisites for artificial intelligence in further education: Identification of drivers, barriers, and business models of educational technology companies. *International Journal of Educational Technology in Higher Education*, 17(1), 1-21. <https://doi.org/10.1186/s41239-020-00193-3>
- Su, J., & Yang, W. (2022). Artificial intelligence in early childhood education: A scoping review. *Computers and Education: Artificial Intelligence*, 3, 100049. <https://doi.org/10.1016/j.caeai.2022.100049>
- Vlasova, E. Z., Goncharova, S .V., Kuzin, Z. S., Karpova, N. A., Iljina, T. S., Gosudarev, I. B., Avksenteva, E. Yu. (2019). Artificial intelligence. the area of adaptive possibilities for methodological innovations in pedagogic education. *Dilemas contemporáneos: Educación, Política y Valores*, 7(S10), 9
- Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., ... & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, 2021, 1-18. <https://doi.org/10.1155/2021/8812542>