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RESEARCH PAPER

Experience of Academia with Artificial Intelligence as Adaptive Pedagogy

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ABSTRACT

This qualitative research investigates the experiences, perceptions, and challenges associated with the integration of artificial intelligence (AI) into teacher education. Through semi-structured interviews with a diverse group of educators, this study investigates teachers' experiences, perceptions, and challenges associated with the adoption of artificial intelligence (AI). The research aims to explore the potential influence of AI on teaching practices, student learning, and the overall effectiveness of teaching practices through narrative inquiry method. The findings reveal that teachers generally perceive AI positively, with many expressing enthusiasms for its potential to enhance teaching practices and individualize instruction for students. Teachers' experiences in implementing AI-powered tools vary. While some teachers have successfully integrated AI tools into their teaching practices. However, others face challenges such as difficulties using the tools or providing adequate support for differentiated instruction. Some teachers express concerns about the potential for AI to dehumanize education and exacerbate existing biases. The research suggests both the potential of AI to positively impact teacher education, student learning, and engagement, alongside challenges associated with its implementation. Addressing these challenges is crucial to ensuring effective AI integration into the field of teacher education.

| **KEYWORDS** | Artificial Intelligence (AI), Adaptive Pedagogies, Teacher Education, Teacher Perceptions, Student Learning |

Introduction

Artificial intelligence (AI) has the power to completely change education by transforming both teaching and learning. The use of AI to improve adaptive pedagogies in teacher education is one area of focus. Adaptive pedagogies entail modifying instructional tactics in response to changes in learners' individual characteristics, performance, and personal growth that are monitored in real-time (Ertmer, 2005; Harun et al., 2022). The advancement of artificial intelligence has made it possible to design intelligent learning settings that can successfully encourage the development of adaptable pedagogies (Luckin et al., 2007).

It is still unclear, though, how teachers may use AI more broadly for pedagogy and how it will actually affect teaching and learning in higher education. The goal of this study topic is to investigate how artificial intelligence (AI) can improve adaptive pedagogies and what its potential is in teacher education. The research on AI applications in education will be reviewed, along with the opportunities and problems they provide. The current state of artificial intelligence in education and its possible effects on teacher preparation will be covered in the parts that follow. The sources included in this

introduction offer a variety of viewpoints on the application of AI in education and can be useful resources for additional study.

Recent research has explored the potential of AI-supported adaptive learning, which leverages intelligent technology to personalize and adapt learning experiences based on individual learner characteristics and performance (Cradler, 2018). This aligns with the growing trend of integrating technology into education (Redalyc, 2023).

Traditional teacher education methodologies often struggle to adapt to the diverse learning styles, needs, and interests of individual students. This rigid approach, characterized by standardized instruction and inflexible learning environments, can hinder the effectiveness of teaching and limit student learning outcomes. Students' progress at varying paces and thrive in diverse learning contexts, yet traditional teacher education often fails to provide the flexibility and adaptability necessary to address these individual differences.

This lack of adaptive instruction can lead to several negative consequences. Students may feel disengaged and unmotivated as their learning experiences fail to resonate with their individual strengths and interests. Moreover, traditional teacher education may not adequately equip teachers to identify and address learning gaps or provide targeted support for students with diverse learning needs.

While AI offers the potential to address these limitations by enabling adaptive pedagogies, its integration into teacher education raises concerns regarding the potential for bias and dehumanization. Additionally, an overreliance on AI-powered tools could diminish the role of human empathy, judgment, and interaction in the learning process, potentially dehumanizing the education experience.

Despite the benefits of AI in education, knowledge gaps and challenges remain to be addressed (Hew & Brush, 2007). For instance, determining how educators can leverage AI to create broader pedagogical advantages and meaningfully impact teaching and learning in higher education requires further research (Hew & Brush, 2007). Additionally, ethical and societal considerations must be carefully navigated when integrating AI into education.

The evolving educational landscape demands a transformative shift in teacher education, embracing innovative approaches to prepare educators for the complexities of the 21st-century classroom. Artificial intelligence (AI) offers immense potential to revolutionize teacher education through its ability to personalize instruction, provide feedback, and analyze vast data sets. By harnessing the power of AI, teacher education can move beyond the "one-size-fits-all" approach and embrace personalized learning and adaptive pedagogies, tailoring instruction to the individual needs and learning styles of each student.

Artificial intelligence (AI) is developing at a quick pace, which presents a huge opportunity to transform teacher education by making it possible to create adaptive learning environments that meet each student's unique needs and learning preferences. Traditional teacher education practices often fail to personalize instruction effectively, leading to limited student engagement and outcomes (Amjad et al., 2020; Ertmer, 2005; Howard, 2017).

AI's ability to tailor instruction, provide real-time feedback, and analyze vast amounts of data presents exciting possibilities to address these challenges and

personalize the learning experience for each student (Cradler, 2018; Luckin et al., 2007a; Wang, 2021). This research delves into integrating AI-powered tools and personalized learning strategies within teacher preparation, aiming to enhance teacher effectiveness through adaptive pedagogies. This approach fosters engagement, reduces learning gaps, and promotes flexible and adaptive learning environments.

Additionally, the research prioritizes ethical considerations, advocating for the responsible integration of AI to complement human interaction and avoid biases (Hew & Brush, 2007). By ensuring equity and access, all students can benefit from effective personalized learning experiences. This holistic approach aims to transform teacher education and inform policies and practices for a more equitable and effective education system.

Theoretical Framework

Drawing upon diverse theoretical perspectives, this research delves into the integration of Artificial Intelligence (AI) and adaptive pedagogies within teacher education, constructing a framework for effective implementation that prioritizes ethical considerations and learner-centered learning.

Piaget's (1954) constructivism underscores the active role learners play in constructing knowledge through their experiences and interactions. AI-powered tools facilitate adaptive learning experiences by providing targeted interventions, creating engaging learning environments, and promoting self-directed learning, aligning with the core principles of tailoring instruction to individual needs and learning styles.

Vygotsky's (1978) sociocultural theory highlights the profound influence of social and cultural contexts on learning. AI-powered tools support the creation of inclusive and culturally responsive learning environments by identifying cultural patterns, facilitating collaboration and interaction, and providing culturally relevant resources.

Data-driven instruction, as emphasized by Martín-Satué et al. (2020), is crucial for informing instructional decisions and enhancing student learning. AI-powered data analytics within teacher education aligns with this principle by providing real-time insights into student progress, enabling personalized feedback, and informing instructional decisions to optimize learning effectiveness.

The theory of adaptive learning, described by Harun et al. (2022), emphasizes tailoring instruction to individual needs and preferences. AI-powered tools support this by dynamically adjusting learning paths based on real-time assessments, providing individualized learning recommendations, and promoting independent learning, empowering students to take control of their learning journey.

This research upholds responsible data practices, including data privacy and security, algorithmic bias mitigation, and transparency and explain ability, adhering to the ethical considerations outlined by Luckin et al. (2007) for integrating AI into education. It further emphasizes the importance of human judgment and interaction in the learning process, ensuring that AI complements rather than replaces teachers.

By embracing this framework, teacher educators can leverage the potential of AI to create personalized and adaptive learning environments. This focus on learner-centered learning has the potential to enhance teacher effectiveness, improve student outcomes, and promote equitable and inclusive learning experiences for all.

Literature Review

In the dynamic landscape of 21st-century education, adaptive pedagogies have emerged as a transformative approach to teaching, emphasizing real-time adjustments to instruction based on individual student needs and learning data. Unlike traditional teaching methods that employ a one-size-fits-all approach, adaptive pedagogies embrace the unique learning styles, strengths, and challenges of each student, tailoring instruction to optimize their learning outcomes (Amjad et al., 2023).

At the core of adaptive pedagogies lies the principle of continuous assessment and adaptation. AI-powered tools and data analytics platforms gather real-time information about student performance, engagement, and learning styles (Rose & Azevedo, 2005; Tabbasam et al., 2023). This data is then analyzed to identify patterns, predict potential difficulties, and inform personalized instructional decisions.

Adaptive pedagogies encompass key characteristics that contribute to a dynamic and personalized learning experience. Leveraging AI and data analytics, these pedagogies provide teachers with continuous information about student progress, allowing real-time adjustments in instruction to address individual needs and prevent gaps in understanding. The personalized learning pathways created by adaptive pedagogies cater to each student's unique learning styles and preferences, enabling them to progress at their own pace and explore areas of interest, fostering a deeper engagement with the learning process. Immediate feedback and support are integral components, guiding students through challenging concepts and reinforcing areas of strength. This timely feedback not only helps students identify areas for improvement but also maintains motivation throughout their learning journey. Furthermore, adaptive pedagogies extend beyond traditional classrooms, embracing a variety of learning environments and modalities such as online courses, virtual labs, and blended learning experiences. This dynamic approach ensures that learning is not confined to a single setting but can adapt to the diverse needs and preferences of students (Amjad et al., 2022).

By customizing instruction to each student's needs and interests, adaptive pedagogies foster a more stimulating and engaging learning environment for pupils. This customization leads to heightened engagement, improved focus, better retention, and overall enhanced academic performance (Park, 2017). Furthermore, the implementation of adaptive pedagogies has demonstrated significant improvements in student outcomes, showcasing increased academic achievement, enhanced critical thinking skills, and improved problem-solving abilities (Amjad et al., 2023a; Luckin et al., 2007a). One notable impact is the reduction of learning gaps, as adaptive pedagogies effectively identify and address these gaps early on, preventing students from falling behind and ensuring that all students receive the necessary support to succeed. Additionally, adaptable pedagogies are essential for empowering self-directed learners because they let students take charge of their education and establish lifelong learning habits and self-directed learning skills (Ertmer, 2005).

By leveraging AI, data analytics, and personalized learning strategies, adaptive pedagogies have the potential to revolutionize teaching practices, enhance student engagement, and improve academic outcomes for all learners. As we navigate the complexities of 21st-century education, adaptive pedagogies offer a promising path towards a more personalized, effective, and equitable learning experience for all (Amjad et al., 2023b).

In teacher education, AI presents a transformative opportunity, empowering educators to navigate the complexities of 21st-century learning environments (Cradler, 2018). By leveraging AI's capabilities, teacher educators can equip their trainees with the tools and knowledge necessary to create dynamic and effective learning experiences for all students.

One key advantage of AI in teacher education is its ability to provide educators with comprehensive data on student performance, engagement, and learning styles (Harun et al., 2022). This real-time information offers valuable insights into individual needs, enabling teachers to make informed instructional decisions and adjust their approaches as needed (Martín-Satué et al., 2020). Analyzing student data allows AI to identify strengths, weaknesses, and learning patterns, permitting educators to tailor instruction to optimize individual learning outcomes.

AI further facilitates adaptive learning strategies, tailoring instruction to meet the specific needs of each student (Harun et al., 2022). Moving beyond traditional "one-size-fits-all" methods, this approach ensures that all students receive the most effective support and guidance (Park, 2017). By dynamically adjusting the learning environment based on real-time data, AI ensures constant engagement and challenge, preventing boredom and frustration.

AI also assists teachers with classroom management, streamlining tasks and freeing up valuable time for personalized interactions with students (Rose et al., 2016). AI-powered tools can monitor student behavior, identify potential disruptions, and provide targeted interventions. This enhanced efficiency allows teachers to focus on fostering a positive learning environment and building strong relationships with their students.

AI can revolutionize professional development for educators by providing personalized support and guidance (Cradler, 2018). AI-powered tools can assess individual strengths and weaknesses, recommend tailored learning resources, and facilitate collaborative learning communities.

Additionally, by closing accessibility gaps and guaranteeing that all students, regardless of background or learning style, have the chance to achieve, AI has the potential to advance educational equity (O'Neil & Perez, 2006). This approach fosters engagement and a sense of belonging for all students, empowering them to reach their full potential.

In conclusion, the integration of AI into teacher education presents a paradigm shift in pedagogical practices. By leveraging AI's capabilities, teacher educators can empower their trainees to create inclusive and effective learning environments. This transformative approach ultimately leads to improved student outcomes for all.

Studies have demonstrated the effectiveness of adaptive learning platforms in enhancing student achievement and motivation (Taylor et al., 2021). Additionally, personalized recommendations have been shown to foster learner engagement and satisfaction.

The deep learning revolution has led to a recent resurgence of AI, which has sparked debates about how AI might change education and impact future policy (Tan & Lim, 2018). A large number of reviews (Abdellatif et al., 2022; Dieterle et al., 2022; Megahed et al., 2022; Moreno-Guerrero et al., 2020; Yu & Nazir, 2021) have examined the

application of AI in education. Furthermore, the revolutionary effects of AI on education are examined in two recent works by Holmes and Porayska-Pomsta (2023) and Holmes et al. (2019).

Challenges and Considerations

However, alongside these benefits, the integration of AI into teacher education also poses certain challenges. Ethical concerns arise, encompassing issues related to data privacy, potential biases, and the risk of dehumanization in the learning process (Luckin et al., 2007). Another challenge involves the need for comprehensive teacher training on the effective utilization of AI-powered tools and technologies to ensure their optimal integration into the educational framework (Luckin et al., 2007). Additionally, infrastructure costs pose a practical challenge, as the implementation of AI-powered tools and technologies can incur significant expenses (Hew & Brush, 2007). Despite these challenges, addressing them thoughtfully can pave the way for harnessing the full potential of AI in shaping the future of teacher education.

Addressing these challenges requires a multifaceted approach. Data Privacy and Security concerns associated with the data highlight the need for robust data governance practices to protect student information and ensure responsible data handling (Luckin et al., 2007). It is crucial to establish measures that prioritize privacy and security while utilizing AI in educational settings (Hew & Brush, 2007).

Teacher Training and Support emerge as critical components in overcoming challenges, emphasizing the necessity for comprehensive training for educators to effectively integrate AI-powered tools and strategies into their classrooms (Howard, 2017). This training should encompass an understanding of data-driven instruction, the ability to tailor instruction to diverse needs, and the capacity to provide individualized feedback (Ertmer, 2005).

Equity and Access considerations are paramount in the implementation of learning. Ensuring that all students have the resources and support needed to thrive in this dynamic learning environment requires addressing disparities in technology access, providing adequate professional development for teachers in underserved communities, and ensuring that learning strategies are culturally responsive (Cradler, 2018; Howard, 2017). By taking a comprehensive and inclusive approach, the challenges associated with integrating AI into teacher education can be navigated effectively, fostering an educational landscape that is both innovative and equitable.

Material and Methods

This qualitative study investigates the integration of AI into teacher education, exploring the experiences, perceptions, and challenges associated with this innovative approach. Through semi-structured interviews with a diverse group of teachers, the research seeks to uncover the impact of AI on teacher practices, student learning, and the overall effectiveness of teacher education.

This research will employ a qualitative research approach, utilizing in-depth interviews to explore the experiences, perceptions, and challenges related to the integration of AI into teacher education. This approach will provide rich and nuanced insights into the subjective perspectives of teachers, allowing for understanding of AI impact on teacher practices and student learning.

In qualitative research approach, the narrative inquiry method is used to gain the in-depth knowledge about experiences, perceptions, and challenges associated with the implementation of artificial intelligence (AI).

Semi-structured interviews will be conducted with a diverse group of teachers from different educational institutes to gather their in-depth experiences, perceptions, and challenges related to the integration of AI into their teaching practices. The interviews will follow a semi-structured format, allowing for flexibility to delve into emergent themes and explore individual experiences.

Purposive sampling will be employed to select participants who represent a diverse range of teacher experiences, perspectives, and teaching contexts. The sample will include teachers from different grade levels, subject areas, and school settings to ensure a comprehensive understanding of the integration of AI across various educational environments.

Thematic analysis, an iterative qualitative data analysis method, will be employed to extract patterns, themes, and emerging concepts from the semi-structured interviews. The procedure entails verbatim transcription of the interviews, acquainting oneself with the information, categorizing passages of text that illustrate important ideas, organizing codes into more general themes, and honing and analyzing the themes to make sure they appropriately capture the information and offer significant insights into the research question.

This qualitative research approach, centered on semi-structured interviews, will provide a valuable source of insights into the integration of AI into teacher education. By exploring the lived experiences and perspectives of teachers, the research will contribute to a deeper understanding of the impact of AI on teacher practices and student learning, informing the development of effective teacher education programs and policies.

Results and Discussion

This research explored the integration of AI into teacher education, examining the experiences, perceptions, and challenges associated with this innovative approach. Through semi-structured interviews with a diverse group of teachers, the research sought to uncover the impact of AI on teacher practices, student learning, and the overall effectiveness of teacher education. The findings revealed that teachers generally perceived AI positively, with many expressing enthusiasms for its potential to enhance teaching practices for students. Many teachers expressed enthusiasm for the potential of AI-powered tools to enhance the learning experience, citing improvements in student engagement, motivation, and achievement. The personalized nature of AI applications was highlighted as a key factor contributing to these positive perceptions, as teachers noted the adaptability of AI to cater to individual learning needs.

However, some teachers also expressed concerns about the potential for AI to dehumanize education and exacerbate existing biases. Teachers' experiences with implementing AI-powered tools varied. While some teachers had successfully integrated AI tools into their teaching practices and implemented personalized learning strategies effectively, others faced challenges such as difficulties using the tools or providing adequate support for differentiated instruction. Teachers' perceptions of the impact of AI on student learning and engagement were generally positive, with many reporting improvements in engagement, motivation, and achievement. However, some teachers

expressed concerns about the potential for AI to create distractions and reduce student interaction.

School administrators can effectively leverage AI to support teacher preparation and enhance student learning outcomes by implementing AI-powered tools for personalized professional development tailored to individual teacher needs. These tools can analyze teaching styles, identify areas for improvement, and offer targeted resources. Additionally, administrators can integrate AI in the classroom to provide real-time insights into student progress, allowing for adaptive instruction and timely interventions. This facilitates a more tailored and responsive teaching approach, ultimately contributing to improved student learning outcomes.

In conclusion, this research highlights the potential benefits of integrating AI into teacher education, while also acknowledging the challenges associated with implementing these approaches. As AI continues to evolve, it is crucial to address these challenges and develop effective strategies for implementing AI in a way that maximizes its positive impact on teacher practices, student learning, and the overall effectiveness of teacher education. These findings suggest that AI has the potential to positively impact teacher education, student learning, and engagement.
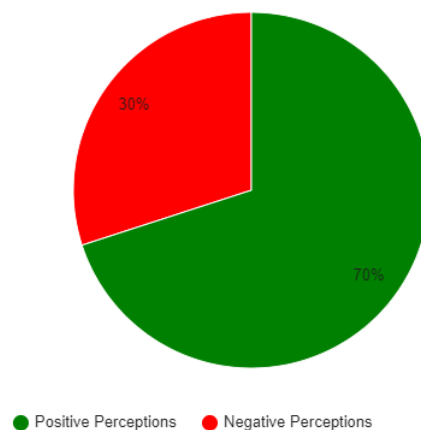

Figure 1. Teacher Perceptions of the Impact of AI on Student Learning and Engagement

Findings

Teachers generally perceive AI positively, with many expressing enthusiasms for their potential to enhance teaching practices and learning for students. However, some teachers also express concerns about the potential for AI to dehumanize education and exacerbate existing biases.

Teachers' experiences with implementing AI-powered tools vary. Some teachers have successfully integrated AI tools into their teaching practices and implemented personalized learning strategies effectively. Others face challenges such as difficulties using the tools or providing adequate support for differentiated instruction.

Administrators can enhance teacher preparation with personalized professional development through AI tools and improve student learning outcomes by integrating AI for real-time insights and adaptive instruction.

Discussion

The findings of this research suggest that AI have the potential to positively impact teacher education, student learning, and engagement. Teachers generally perceive these approaches favorably, recognizing their potential to enhance teaching practices and personalize learning for students. However, some teachers also express concerns about the potential for AI to dehumanize education and exacerbate existing biases. These findings align with the research question by demonstrating that AI hold promise for improving teacher preparation and student outcomes, while also acknowledging the need to address potential ethical and equity concerns.

Studies have shown that AI-powered tools can provide teachers with valuable insights into student learning, enabling them to tailor instruction to meet individual needs (Harun et al., 2022). The findings of this research add to this body of literature by providing insights into the experiences and perceptions of teachers as these approaches are integrated into teacher education.

The research's conclusions have a number of ramifications for educational practice and teacher preparation. First, instruction on the efficient application of AI tools and techniques have to be included in teacher education programs. Teachers should leave this course with the information and abilities necessary to successfully incorporate these strategies into their lessons in a way that benefits every student. Second, academic institutions ought to create rules and regulations governing the moral and responsible application of AI to teacher preparation programs and instructional techniques. Concerns concerning prejudice, privacy, and the possibility that AI would dehumanize education should all be covered by these standards.

Third, educators should continue to explore innovative ways to use AI to enhance student learning and engagement. This includes developing new AI-powered tools and strategies, as well as researching the effectiveness of these approaches in different contexts. By addressing the limitations of this study and continuing to explore the potential of AI, we can maximize the benefits of these approaches for teacher education and student outcomes.

This research holds immense significance in addressing the limitations of traditional teacher education practices and harnessing the potential of AI to revolutionize teacher preparation. By exploring the integration of AI-powered tools, this research aims to enhance teacher effectiveness. Empowering teachers with AI-driven tools and data-driven insights can assist in tailoring instruction to individual student needs, fostering deeper engagement, improving learning outcomes, and reducing learning gaps.

Additionally, the study explores how to support teachers' learning. This entails giving educators the tools they need to design adaptable and flexible learning environments that accommodate a range of interests, preferences, and learning styles. The application of these strategies could improve students' overall educational experiences.

Addressing ethical concerns is another crucial aspect of this research. By acknowledging the potential for AI to dehumanize education and perpetuate biases, the study aims to promote the responsible and ethical integration of AI into teacher education. This involves ensuring that AI complements, rather than replaces, human judgment and interaction. Additionally, the research explores strategies to advance equity and access in education through the leverage of AI. The goal is to ensure that all

students, regardless of their background or circumstances, have access to effective experiences.

Ultimately, the research contributes to the transformation of teacher education. By addressing the limitations of traditional practices and embracing the potential of AI, this study prepares educators to effectively navigate the complexities of 21st-century learning environments. The findings have the potential to inform policy decisions, influence teacher education programs, and shape instructional practices. This holistic approach aims to improve student learning outcomes and foster a more equitable and effective education system for all.

Conclusion

The integration of AI into teacher education holds immense promise for transforming the way teachers are prepared to meet the diverse needs of 21st-century learners. This research has delved into the experiences, perceptions, and challenges associated with this innovative approach, providing valuable insights into the potential and pitfalls of AI in teacher education.

The key findings of this research suggest that AI are generally perceived favorably by teachers, who recognize their potential to enhance teaching practices for students. However, concerns about the potential for AI to dehumanize education and exacerbate existing biases highlight the need for careful consideration and ethical implementation of these approaches.

While the research has uncovered promising aspects of AI, further exploration is needed to fully understand their long-term effects on student learning and engagement. Additionally, research is warranted to develop effective strategies for implementing AI in a way that minimizes potential drawbacks and maximizes their positive impact on all learners.

Recommendations

The findings of this research underscore the significance of AI in shaping the future of teacher education. By addressing the challenges and maximizing the potential of these approaches, we can pave the way for a more engaging, personalized, and equitable learning experience for all students.

Conducting longitudinal studies is essential for comprehensively understanding the enduring effects of AI on student learning and engagement over an extended period. Additionally, research should delve into the impact of AI on equity and access to education, ensuring a thorough examination of potential disparities. To optimize implementation, there is a need for the development of effective strategies that not only harness the benefits but also mitigate potential drawbacks associated with AI. Ethical considerations should be a central focus, with dedicated exploration into the implications of integrating AI in education, emphasizing responsible and equitable practices for the benefit of all students.

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