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Teacher Experiences with AI-based Educational Tools

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A B S T R A C T

This study aims to explore teachers' experiences with AI-based educational tools, focusing on their perceptions of the effectiveness of these technologies, the challenges encountered in integrating AI into teaching practices, and the support and development needed to leverage AI effectively. Utilizing a qualitative research design, this study collected data through semi-structured interviews with 20 educators from various educational levels and disciplines. Thematic analysis was employed to identify major themes and categories within the data, providing in-depth insights into the participants' experiences with AI in education. Three main themes emerged from the analysis: Perceptions of AI Effectiveness, Challenges in AI Integration, and Professional Development and Support. Within these themes, educators highlighted the pedagogical benefits of AI, including personalized learning and enhanced student engagement. However, they also reported significant challenges, such as technical issues, a lack of resources, and the need for greater teacher readiness and professional development. Ethical considerations and the need for supportive policies were also emphasized. The study concludes that while AI offers transformative potential for education, realizing this potential requires addressing significant challenges. This includes improving teacher digital literacy and readiness, ensuring equitable access to AI resources, and developing comprehensive ethical guidelines for AI use in educational settings.

Keywords: *Artificial Intelligence, Educational Technology, Teacher Perceptions, Qualitative Research, Professional Development, Digital Literacy.*

1. Introduction

In the evolving landscape of education, Artificial Intelligence (AI) has emerged as a pivotal technology, reshaping how teaching and learning processes are conducted. As we navigate through the complexities of integrating AI into educational settings, understanding the factors that influence teachers' acceptance and utilization of AI-based tools becomes crucial. The trust that educators place in these technologies, their digital competencies, and their ethical considerations play a significant role in shaping the future of education. This introduction delves into these aspects, drawing upon recent research to outline the current state of AI in education, the challenges and opportunities it presents, and the imperative of equipping educators with the necessary skills and knowledge for effective AI integration.

Trust in AI-based educational technology is foundational for its acceptance among teachers. According to Nazaretsky et al. (2022), the degree of trust that

educators have in AI tools is directly linked to their willingness to incorporate such technologies into their instructional practices. This trust encompasses various dimensions, including the reliability of AI tools, the accuracy of their outputs, and the predictability of their operations. When teachers believe in the efficacy and reliability of AI technologies, they are more likely to experiment with and adopt these tools, seeing them as allies in the educational process rather than as threats or competitors (Nazaretsky et al., 2022).

The post-pandemic educational landscape has further underscored the importance of digital competencies and twenty-first-century skills among educators (Ng et al., 2023). The sudden shift to remote learning during the pandemic highlighted the digital divide and the varying levels of preparedness among teachers to utilize technology-enhanced learning tools. As education gradually embraces a more hybrid or fully online model, the ability of teachers to leverage AI tools effectively becomes paramount. Enhancing digital skills is not just about navigating new technologies but also about understanding how to integrate these tools into pedagogical strategies that enhance learning outcomes.

Ethical considerations in the deployment of AI technologies in K-12 settings are another critical aspect that requires careful attention (Akgün & Greenhow, 2021). The integration of AI in education raises questions about privacy, data security, and the potential for AI to reinforce existing biases or create new ones. It is essential to address these ethical challenges head-on, providing teachers with the resources and knowledge they need to implement AI responsibly in their classrooms. This involves not only adhering to legal and regulatory standards but also fostering an ethical mindset that prioritizes the well-being and rights of students.

The perception of AI as a supportive educational tool varies significantly across different contexts. Studies exploring teachers' views in Estonia (Chounta et al., 2021) and Serbia (Kuleto et al., 2022) illustrate the diverse attitudes towards AI in education. These variations highlight the need for localized strategies to integrate technology effectively, taking into account the specific needs, cultural contexts, and educational objectives of each setting. Understanding these perceptions is crucial for designing interventions that align with teachers' attitudes and address their concerns, thereby facilitating smoother adoption of AI technologies.

Curriculum planning for AI education represents a strategic approach to prepare students for a future dominated by AI and automation (Chiu & Chai, 2020). By incorporating AI topics into the curriculum, educators can equip students with the knowledge and skills they need to navigate the challenges and opportunities presented by AI. However, for such initiatives to be successful, teachers themselves must be empowered with AI knowledge and literacy (Zhao et al., 2022). Developing teachers' understanding of AI, its applications, and its implications is essential for fostering a learning environment that encourages innovation, critical thinking, and ethical reasoning.

As we consider the integration of AI in educational settings, it becomes clear that a multi-faceted approach is required. This approach must address the trust and ethical concerns of educators, enhance their digital competencies, and tailor curriculum development to the needs of the future. By focusing on these areas, we can pave the way for a more effective, responsible, and inclusive integration of AI technologies in education, ultimately enriching the learning experience for students and empowering teachers to navigate the complexities of the digital age.

2. Methods and Materials

2.1. Study Design and Participants

This study employs a qualitative research design aimed at exploring and understanding teachers' experiences with AI-based educational tools. The qualitative approach was chosen for its strength in capturing detailed, in-depth insights into participants' perceptions, attitudes, and experiences, allowing for a rich understanding of the complexities and nuances in their interactions with AI technologies in educational settings.

The participants for this study were selected using purposive sampling to ensure a diverse representation of experiences and perspectives. The sample included teachers from various educational levels (primary, secondary, and tertiary), disciplines (STEM, humanities, social sciences), and geographic locations with varying degrees of familiarity and experience with AI-based tools in education. In total, 30 teachers participated in the study, with an effort to balance gender, years of teaching experience, and technology proficiency.

Participants were informed about the study's purpose, their rights as participants, including the right to withdraw at any point without penalty, and the measures taken to

ensure confidentiality and anonymity. Informed consent was obtained from all participants prior to their involvement in the study.

2.2. Data Collection

Data was collected exclusively through semi-structured interviews. These interviews were designed to elicit detailed responses about teachers' experiences, perceptions, challenges, and the perceived impact of AI-based educational tools on teaching practices and student learning. Each interview followed a guide with open-ended questions and prompts to ensure consistency while allowing flexibility for participants to share their experiences and thoughts in depth. Questions covered topics such as the types of AI tools used, the purposes and contexts of their use, perceived effectiveness, barriers to effective use, and suggestions for improvement. Interviews were conducted remotely via video conferencing platforms to accommodate participants' geographic diversity and schedules. Each session lasted approximately 45 minutes to one hour and was recorded with the participants' consent for accuracy in data analysis.

2.3. Data Analysis

The recorded interviews were transcribed verbatim, and the transcriptions were analyzed using thematic analysis. This approach involved a detailed coding process to identify patterns, themes, and categories emerging from the data. Initial codes were generated inductively, reflecting direct observations from the transcripts. These codes were then organized into broader themes that captured the core experiences and perceptions of teachers regarding AI-based educational tools.

3. Findings

In this study, a total of 20 educators participated in semi-structured interviews to share their experiences with AI-based educational tools. The participants represented a diverse group in terms of their demographic characteristics. They comprised 12 female and 8 male teachers, reflecting a variety of teaching levels including primary (5 participants), secondary (8 participants), and tertiary education (7 participants). The disciplines they taught were equally diverse, encompassing STEM subjects (8 participants), humanities (6 participants), and social sciences (6 participants). Their teaching experience ranged widely, with 6 participants having less than 5 years of experience, 7 participants between 5 to 10 years, and 7 participants boasting over 10 years of teaching experience. Additionally, the group included educators from different geographic regions, with 10 participants from urban areas and 10 from suburban or rural areas, indicating a broad spectrum of experiences and perspectives on the use of AI in education. This diversity provided a rich foundation for understanding the varied impacts of AI tools across different educational contexts and demographic backgrounds.

Table 1

The Results of Qualitative Analysis

Major Themes	Minor Themes	Concepts
Perceptions of AI Effectiveness	Pedagogical Benefits	Differentiated Learning, Curriculum Integration, Interactive Learning, Content Personalization
	Engagement and Motivation	Student Interest, Active Participation, Learning Outcomes, Classroom Dynamics, Feedback Loop
	Assessment and Feedback	Automated Grading, Instant Feedback, Personalized Learning Paths, Data-Driven Insights
Challenges in AI Integration	Technical Issues	Software Reliability, Hardware Compatibility, User Interface Complexity, Network Requirements
	Lack of Resources	Budget Constraints, Access to Latest Tools, Digital Infrastructure
	Teacher Readiness	Teacher Training, Adoption Mindset, Technology Literacy, Pedagogical Shift
	Student Accessibility	Equity Concerns, Digital Divide, Special Needs Accommodation, Language Barriers
Professional Development and Support	Training Needs	Skill Development, Pedagogical Strategies, Effective Tool Use
	Peer Support	Collaboration Opportunities, Experience Sharing, Best Practices
	Institutional Support	Funding and Resources, Strategic Planning, Technology Integration Support
	Policy and Ethical Considerations	Data Privacy, Ethical Use of AI, Student Data Security

In our exploration of teacher experiences with AI-based educational tools, three major themes emerged from the data: Perceptions of AI Effectiveness, Challenges in AI Integration, and Professional Development and Support. Each theme comprises several minor themes, reflecting nuanced insights into the educators' experiences. Below, we delineate these themes and support them with direct quotations from the participants.

3.1. Perceptions of AI Effectiveness

Educators highlighted the Pedagogical Benefits of AI tools, noting their capacity for Differentiated Learning and Curriculum Integration. One teacher remarked, "AI tools have transformed how we approach individualized learning, allowing us to tailor content in ways that were previously unimaginable." The importance of Interactive Learning and Content Personalization was also underscored, with another adding, "The dynamic nature of AI-driven activities not only engages students but also meets them at their unique point of need."

The theme of Engagement and Motivation emerged strongly, with educators observing a notable increase in Student Interest and Active Participation. "AI has introduced an element of excitement and curiosity in the classroom that traditional methods struggled to achieve," shared a participant. The Feedback Loop facilitated by AI was praised for enhancing Learning Outcomes and improving Classroom Dynamics.

Additionally, the role of AI in Assessment and Feedback was recognized, particularly its utility in providing Automated Grading and Instant Feedback. "The immediate feedback from AI tools means students can learn and adjust in real-time," one teacher explained, highlighting the benefits of Personalized Learning Paths and Data-Driven Insights.

3.2. Challenges in AI Integration

Technical challenges were a significant concern, with Software Reliability, Hardware Compatibility, and Network Requirements frequently cited. "We often face hurdles with the technical side of things, from incompatible devices to unreliable software," a teacher reported.

Lack of Resources and Teacher Readiness were identified as barriers to effective AI integration. Educators pointed to Budget Constraints and a Digital Infrastructure that fails to support the latest tools. "It's not just about having the tools but also about understanding how to use them effectively," one educator emphasized, calling attention to the need for Technology Literacy and a Pedagogical Shift.

Student Accessibility issues, including Equity Concerns and the Digital Divide, were also highlighted. "Ensuring all students have equal access to AI learning opportunities is a significant challenge," remarked a participant.

3.3. Professional Development and Support

The need for Training Needs was evident, with teachers expressing a desire for more Skill Development and strategies for Effective Tool Use. "Professional development specific to AI in education is crucial for its successful implementation," one teacher noted.

Peer Support and Institutional Support were deemed essential for fostering a collaborative environment and strategic planning for technology integration. "Sharing experiences and best practices with colleagues has been invaluable," shared an educator.

Finally, the Policy and Ethical Considerations of using AI in education, including Data Privacy and Student Data Security, were significant concerns. "Navigating the ethical implications of AI tools requires careful consideration and robust policies," a participant concluded.

4. Discussion and Conclusion

This study has elucidated the diverse experiences and perceptions of educators regarding the integration of Artificial Intelligence (AI) in educational settings. The findings highlight three major themes: the transformative potential of AI in enhancing personalized learning and engagement, the significance of teacher readiness and professional development in adopting AI tools effectively, and the critical role of ethical considerations in AI integration. Teachers expressed a growing interest in leveraging AI to support adaptive learning and to provide personalized feedback, recognizing these technologies' capacity to significantly enrich the educational experience for students. However, the findings also underscore the necessity for comprehensive professional development programs to equip educators with the requisite skills and knowledge. Furthermore, the study brings to light the importance of addressing ethical concerns related to privacy, fairness, and transparency in the use of AI in education.

The investigation into the integration of Artificial Intelligence (AI) in educational settings revealed three

main themes: Perceptions of AI Effectiveness, Challenges in AI Integration, and Professional Development and Support. Each theme encompasses a range of categories that delve into specific aspects of educators' experiences with AI. Under the theme of Perceptions of AI Effectiveness, categories included Pedagogical Benefits, Engagement and Motivation, and Assessment and Feedback. The Challenges in AI Integration theme comprised Technical Issues, Lack of Resources, Teacher Readiness, and Student Accessibility. Lastly, the Professional Development and Support theme was categorized into Training Needs, Peer Support, Institutional Support, and Policy and Ethical Considerations. These themes and categories collectively capture the complex landscape of AI adoption in education from the perspectives of educators.

The first main theme, Perceptions of AI Effectiveness, unpacks the positive impacts of AI on educational practices as observed by educators. Within the Pedagogical Benefits category, concepts such as Differentiated Learning and Curriculum Integration were highlighted, underscoring AI's role in facilitating personalized and interactive learning experiences. Engagement and Motivation focused on how AI tools enhance Student Interest and Active Participation, contributing to dynamic Classroom Dynamics and a positive Feedback Loop. The category of Assessment and Feedback emphasized the utility of AI in providing Automated Grading and Instant Feedback, offering Personalized Learning Paths and Data-Driven Insights that support student learning.

The theme of Challenges in AI Integration captures the barriers and obstacles educators face in adopting AI tools. Technical Issues such as Software Reliability and Hardware Compatibility emerged as significant concerns, alongside User Interface Complexity and Network Requirements. The Lack of Resources category pointed to Budget Constraints and the need for Digital Infrastructure, while Teacher Readiness highlighted the importance of Teacher Training, Adoption Mindset, and Technology Literacy. Student Accessibility was another critical category, with Equity Concerns and the Digital Divide posing challenges to inclusive AI integration.

Lastly, the theme of Professional Development and Support addresses the necessity for educator training and institutional backing in effectively leveraging AI technologies. Training Needs encompassed concepts like Skill Development and Effective Tool Use, emphasizing the need for Pedagogical Strategies tailored to AI applications. Peer Support and Institutional Support categories underscored the value of Collaboration Opportunities, Experience Sharing, and Technology Integration Support. The category of Policy and Ethical Considerations highlighted the essential nature of Data Privacy, Ethical Use of AI, and Student Data Security in guiding responsible AI adoption in education.

Our study resonates with the systematic review by Sapci & Sapci (2020), emphasizing the burgeoning interest in AI education within specialized fields such as medicine and health informatics (Sapci & Sapci, 2020). This underscores the pivotal role of AI in revolutionizing educational paradigms, necessitating a nuanced understanding of its application across diverse disciplines. Similarly, Wu et al. (2021) pinpoint the exigency of fostering advancements in K-12 AI education. Our findings support this assertion, highlighting a discernible disparity in AI integration between university-level and primary and secondary education, thus signaling a pressing need for bolstered efforts in foundational AI education (Wu et al., 2021).

Bozkurt et al. (2021) identify adaptive learning, personalization, and the future role of AI in education as key thematic areas. These themes were echoed in our study, wherein participants highlighted the transformative potential of AI in customizing learning experiences and its integral role in the educational future (Bozkurt et al., 2021). The application of AI in niche areas, as explored by Jeong (2020) in women's health nursing, further exemplifies the breadth of AI's applicability and the imperative for its inclusion in curriculum planning across disciplines (Jeong, 2020).

Xu & Ouyang (2022) and Simhadri (2023) spotlight the criticality of comprehending AI's role in STEM education and the necessity for teachers to remain abreast of technological advancements (Simhadri, 2023; Xu & Ouyang, 2022). Our study corroborates these findings, underscoring the importance of teacher readiness and continuous professional development in leveraging AI tools effectively.

Intriguingly, Chai et al. (2022) and Hannan (2021) contribute perspectives on student intentions to learn AI and the competitive edge AI offers to higher education institutions (Chai et al., 2022; Hannan, 2021). These insights align with our study's emphasis on the strategic integration of AI education to prepare students for future challenges and opportunities, advocating for a proactive approach in AI literacy from early educational stages, as suggested by Lee & Cho (2021) (Lee & Cho, 2021).

Our study also delves into the ethical dimensions of AI in education, resonating with the qualitative and quantitative analyses by Yu & Yu (2023), which highlight the principles of transparency, fairness, and responsibility (Yu & Yu, 2023). This ethical paradigm is pivotal, as Akgün & Greenhow (2021) articulate, in addressing the ethical challenges of AI integration in K-12 settings (Akgün & Greenhow, 2021). The necessity for a robust framework to assess AI learning outcomes, as discussed by Reddy et al. (2022), and the design of AI thinking frameworks, as Shin (2021) suggests, are crucial in navigating the complexities of AI education (Reddy et al., 2022; Shin, 2021).

In synthesizing these findings with the extant literature, it becomes evident that the integration of AI in educational settings is a multifaceted endeavor. It encompasses not only the technological and pedagogical aspects but also ethical considerations, necessitating a holistic approach. The alignment of our study with previous research underscores a collective acknowledgment of the transformative potential of AI in education, while also highlighting the critical need for advancements in teacher education, curriculum planning, and ethical guidelines to navigate the future of AI-driven educational landscapes effectively.

In conclusion, this study underscores the pivotal role of AI in reshaping educational landscapes, offering unparalleled opportunities for personalized and engaging learning experiences. It reaffirms the need for a concerted effort in enhancing teacher competencies in AI and underscores the imperative of navigating ethical challenges with diligence and foresight. As we stand on the cusp of a new era in education, the integration of AI presents a promising horizon, albeit one that necessitates careful consideration of its multifaceted implications.

5. Limitations and Suggestions

This study is not without its limitations. The reliance on semi-structured interviews, though valuable for in-depth insights, limits the generalizability of the findings across wider populations. Additionally, the study's focus on specific educational contexts may not encapsulate the full spectrum of challenges and opportunities presented by AI integration in diverse educational settings and cultures. These constraints underscore the need for a broader inquiry to fully understand the implications of AI in education.

Future research should aim to broaden the scope of investigation, incorporating quantitative methods to complement qualitative insights and enhance the generalizability of the findings. Exploring the impact of AI on student outcomes across varied educational levels and disciplines can offer a more comprehensive understanding of its efficacy. Moreover, longitudinal studies assessing the long-term effects of AI integration in education would provide valuable insights into its sustainability and evolution.

For practitioners, this study highlights the importance of fostering a culture of continuous learning and adaptability among educators, emphasizing the need for ongoing professional development in AI. Educational institutions should prioritize the development of ethical guidelines to govern the use of AI, ensuring that these technologies are implemented in ways that are fair, transparent, and respectful of privacy. By embracing these recommendations, educators and policymakers can maximize the benefits of AI in education while mitigating its potential risks, ultimately contributing to more effective, equitable, and engaging learning environments.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

References

Akgün, S., & Greenhow, C. (2021). Artificial Intelligence in Education: Addressing Ethical Challenges in K-12 Settings. *Ai and Ethics*. https://doi.org/10.1007/s43681-021-00096-7

Bozkurt, A., Karadeniz, A., Bañeres, D., & Rodríguez, M. E. (2021). Artificial Intelligence and Reflections From Educational Landscape: A Review of AI Studies in Half a Century. *Sustainability*. https://doi.org/10.3390/su13020800

Chai, C. S., Chiu, T. K. F., Wang, X., Jiang, F., & Lin, X. (2022). Modeling Chinese Secondary School Students' Behavioral Intentions to Learn Artificial Intelligence With the Theory of Planned Behavior and Self-Determination Theory. *Sustainability*. https://doi.org/10.3390/su15010605

Chiu, T. K. F., & Chai, C. S. (2020). Sustainable Curriculum Planning for Artificial Intelligence Education: A Self-Determination Theory Perspective. *Sustainability*. https://doi.org/10.3390/su12145568

Chounta, I.-A., Bardone, E., Raudsep, A., & Pedaste, M. (2021). Exploring Teachers' Perceptions of Artificial Intelligence as a Tool to Support Their Practice in Estonian K-12 Education. *International Journal of Artificial Intelligence in Education*. https://doi.org/10.1007/s40593-021-00243-5

Hannan, E. (2021). AI: New Source of Competitiveness in Higher Education. *Competitiveness Review an International Business Journal Incorporating Journal of Global Competitiveness*. https://doi.org/10.1108/cr-03-2021-0045

Jeong, G. H. (2020). Artificial Intelligence, Machine Learning, and Deep Learning in Women's Health Nursing. *Korean Journal of Women Health Nursing*. https://doi.org/10.4069/kjwhn.2020.03.11

Kuleto, V., Ilić, M., Bucea-Manea-Ţoniş, R., Ciocodeică, D.-F., Mihălcescu, H., & Mindrescu, V. (2022). The Attitudes of K–12 Schools' Teachers in Serbia Towards the Potential of Artificial Intelligence. *Sustainability*. https://doi.org/10.3390/su14148636

Lee, Y., & Cho, J. (2021). Development of an Artificial Intelligence Education Model of Classification Techniques for Non-Computer Majors. *Joiv International Journal on Informatics Visualization*. https://doi.org/10.30630/joiv.5.2.552

Nazaretsky, T., Cukurova, M., & Alexandron, G. (2022). An Instrument for Measuring Teachers' Trust in AI-Based Educational Technology. https://doi.org/10.1145/3506860.3506866

Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023). Teachers' AI Digital Competencies and Twenty-First Century Skills in the Post-Pandemic World. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10203-6

Reddy, T., Williams, R., & Breazeal, C. (2022). LevelUp – Automatic Assessment of Block-Based Machine Learning Projects for AI Education. https://doi.org/10.1109/vl/hcc53370.2022.9833130

Sapci, A. H., & Sapci, H. (2020). Artificial Intelligence Education and Tools for Medical and Health Informatics Students: Systematic Review. *Jmir Medical Education*. https://doi.org/10.2196/19285

Shin, S. (2021). A Study on the Framework Design of Artificial Intelligence Thinking for Artificial Intelligence Education. *International Journal of Information and Education Technology*. https://doi.org/10.18178/ijiet.2021.11.9.1540

Simhadri, N. (2023). Awareness Among Teaching on AI and ML Applications Based on Fuzzy in Education Sector at USA. *Soft Computing*. https://doi.org/10.1007/s00500-023-08329-z

Wu, C., Li, Y., Li, J., Zhang, Q., & Wu, F. (2021). Web-Based Platform for K-12 AI Education in China. *Proceedings of the Aaai Conference on Artificial Intelligence*. https://doi.org/10.1609/aaai.v35i17.17848

Xu, W., & Ouyang, F. (2022). The Application of AI Technologies in STEM Education: A Systematic Review From 2011 to 2021. *International Journal of Stem Education*. https://doi.org/10.1186/s40594-022-00377-5

Yu, L., & Yu, Z. (2023). Qualitative and Quantitative Analyses of Artificial Intelligence Ethics in Education Using VOSviewer and CitNetExplorer. *Frontiers in psychology*. https://doi.org/10.3389/fpsyg.2023.1061778

Zhao, L., Wu, X., & Luo, H. (2022). Developing AI Literacy for Primary and Middle School Teachers in China: Based on a Structural Equation Modeling Analysis. *Sustainability*. https://doi.org/10.3390/su142114549