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Original Paper

Teacher's Perceptions of Applying Artificial Intelligence in Education: A Systematic Review

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Abstract

Since the integration of AI in educational fields has gained significant attention in recent years, understanding educators' perspectives has become increasingly crucial for successful implementation. By synthesizing existing literature, this systematic review aims to explore the perceptions of teachers regarding the application of Artificial Intelligence (AI) in education. The review identifies and categorizes research into three key dimensions of perception: Knowledge and Experience, Attitude and Emotion, and Ethical Considerations. And the findings will inform the development of appropriate training and support AI-based curriculum to enhance teachers' readiness for the AI-driven educational environments.

Keywords

Artificial Intelligence (AI) in education, perceptions, teachers

1. Introduction

In recent years, AI has made significant strides, enabling machines to perform tasks that require human intelligence. Countless possibilities have been introduced in the field of education since AI tools and applications provide exciting opportunities to assist educators as well as students in enhancing teaching and learning experiences. Intelligent Tutoring Systems (ITS), which function as human guides and facilitators across diverse environmental contexts, have been systematically explored as potential solutions for delivering adaptive guidance and instruction, as well as for defining and updating learners' models. Similarly, other AI-driven tools, such as educational chatbots and adaptive learning platforms, demonstrate promising capabilities in various facets of teaching, potentially transforming the role of educators from knowledge transmitters to motivators and facilitators of teamwork and collaboration within the classroom (Loeckx, 2016). Previous studies and cases had highlighted the benefits teachers

gain from applying AI in education. AI-driven platforms offer personalized learning experiences that significantly enhance student outcomes, including achievement, satisfaction, engagement, and time management, through the provision of precise, tailored services.

The emergence of human-machine collaboration allows teachers to monitor and evaluate students' learning progress with greater objectivity, thereby reallocating their time and energy towards enhancing instructional quality and engaging in professional development. Nonetheless, significant debates have emerged regarding the impact of artificial intelligence on education. These debates chiefly concern the risks and challenges associated with the deployment of AI tools, as well as the ethical and moral dilemmas introduced by their integration into the educational sector. Concerns about data privacy and security complicate the acceptance of AI applications in the classroom, with some educators fearing that an over reliance on AI could undermine interpersonal relationships and impede the development of critical thinking and social skills. However, previous researchers carried out studies on ethical problems and solutions, finding that the core problems with AI in education lie more with the people than with the technology itself. As teachers are pivotal stakeholders in the implementation of educational technologies, their perceptions of AI's role in learning activities reflect, to some extent, their current use of emerging technologies (Ceha et al., 2022). As Artificial Intelligence (AI) has begun to penetrate all aspects of day-to-day life, the challenge of better preparing teachers' education for the effective and efficient employment of intelligent technologies in schools has become an enduring issue. Even though AI will not replace completely our traditional educational system, educational landscape is changing and reshaping by AI. While the conceptions of artificial intelligence in education range from simple AI-based knowledge transmission to the implementation of AI-powered tools aimed at enhancing teaching quality and student learning outcomes, how teachers view the application of AI in education is likely to shift their self-perception regarding their roles. And research on teachers' perception of applying AI in education allows educational institutions to gauge educators' readiness to embrace AI-driven teaching tools and determine the necessary support required for its implementation, which provides insightful guidance with policy makers and educational system on teachers' professional development and AI knowledge training. Moreover, by understanding how teachers perceive AI and AI application in education, researchers can identify potential barriers and concerns that may arise during its implementation, thus proactive measures can be taken to mitigate possible risks during teaching practices. Therefore, understanding teachers' perceptions of AI in education seem to be crucial for effective AI-related curriculum design and development, as teachers' perspectives, beliefs, and views significantly influence both the interpretation and execution of the curriculum (Velander et al., 2023).

Up to date, previous literature has focused on measuring and observing users' perceptions of AI in education as a certain dimension in order to explore its direct or indirect impact on AI applications in education, and there have been very few papers synthesizing relevant literature to provide a

comprehensive overview of perceptions studies based on AI adoption in education.

This review seeks to comprehensively analyze and consolidate various researches on how teachers perceive the use of AI in education, considering the increasing integration of AI in educational settings and the crucial influence of teachers on its implementation and impact. This review groups articles according to concepts and common themes based on perceptions of AI education. It identifies current understandings of AI educational perceptions among researchers, educators, and the education system as a whole, and discusses not only the specific dimensions of these perceptions that have been addressed in prior research, but also the purpose and significance of examining the coherence that is evident behind AI educational perceptions, thereby addressing the gaps in knowledge regarding teachers' perspectives on AI in education and leading to a more nuanced understanding of AI adoption and improved educational outcomes in the new digital era.

2. Overview of Studies on Teachers' Perceptions of AI in Education

Based on previous studies, research on teachers' understanding of AI adoption has been conducted since 2018. Elementary school teachers have primarily focused on the necessity and educational effects of AI in software education. Since 2021, there has been an increasing number of studies on teachers' perception of AI integration and implementation in education, making it a hot topic. Not only K-12 teachers, but pre-service teachers have also participated in these studies. The countries with the highest number of publications on this topic are South Korea and the United States. Multiple studies have shown that teachers' perceptions of the benefits of using AI technology, working with AI technology, and their level of trust in AI adoption vary between schools. Moreover, elementary school teachers tend to have lower perceptions of the benefits of using AI tools and collaborating with AI compared to high school teachers.

These results not only represent the perceptions of educators and learners regarding the application of artificial intelligence in the educational sector but, more importantly, researchers utilize them as quantifiable dimensions to assess and evaluate the challenges or opportunities that an AI course or system might encounter upon entering the education market. This approach effectively facilitates the ongoing design and development of curricula, aiming to achieve the goals of talent cultivation in the era of intelligence. Chiu and Chai (2020) underscored the inherently political nature of school curriculum planning, emphasizing the importance of deliberation over topics of value. Consequently, the beliefs and viewpoints of teachers inevitably influence the format and content of the curriculum. Recent studies that explore teachers' perspectives on critical considerations for the design, implementation, and revision of formal AI curricula for K-12 schools provide insights into the mechanisms and processes through which innovations may be effectively implemented. Prior research on AI curricula predominantly focused on identifying necessary content knowledge and skills,

neglecting the importance of considering teachers' viewpoints and interpretations, along with student agency in the learning process. Some investigations have focused on perspectives on human-AI collaboration, particularly on Student-AI Collaboration (SAC) and Teacher-AI Collaboration (TAC) in educational settings (J. Kim, 2023; J. Kim et al., 2022). Both sets of findings highlight the significance of curriculum design, interaction facilitation, and the creation of appropriate learning environments for effective collaboration between students/teachers and AI. The research conducted by Ceha et al. (2022) complements these findings by providing recommendations based on teachers' perspectives, offering insights for educational policies, AI design, and instructional strategies to foster successful human-AI collaboration in learning environments. Aparicio et al. (2018) investigated teachers' perceptions of active learning methods and intelligent systems, identifying key aspects of AI instructional material design, such as the integration of reliable information sources, bilingual support, and selective annotation of concepts. Therefore, it is clear that examining teachers' perceptions of AI teaching contexts and course design in human-computer interaction can significantly enhance teachers' design thinking and teaching efficiency, ensuring their ongoing ability to improve teaching practices and enhance innovation skills.

Despite the significant increase in understanding the field of artificial intelligence (AI) in education due to the diversification of research objects, research areas, and research purposes, there has been no precise and standardized definition of the term "perception of AI". As a result, when current studies focus on perception as a core dimension to examine its effectiveness, the specific dimensions involved vary, and the impact of differing interpretations of this dimension on the scientific validity of the results has not been widely evidenced or systematically studied. Therefore, this research synthesizes existing literature and identifies commonalities and differences by comparing perceptions research. It finds that current studies primarily analyze perceptions of AI applications in education from three dimensions: Knowledge and Experience, Attitude and Emotion, and Ethical Considerations.

2.1 Knowledge and Experience

To equip teachers with the essential knowledge, skills, and confidence to integrate AI into their instruction, it is crucial for them to receive thorough training and education about AI—its nature and limitations—and its potential impact on K-12 education (Antonenko & Abramowitz, 2023). Therefore, prior to the implementation of specific AI tools or platforms, researchers will first concentrate on educators' understanding of artificial intelligence concepts, reflecting their grasp of content knowledge, pedagogical goals, and student learning outcomes. Yau et al. (2023) revealed six categories of teachers' conceptions of AI education and and elucidated the hierarchical relationships among these categories, providing insights into how teachers perceive AI education based on their experiences. The data were collected from participants involved in co-designing one of the initial AI curricula. Nonetheless, it is probable that many K-12 teachers have not received formal AI training, as previous reports indicate a

lack of AI knowledge or misconceptions among K-12 educators. Therefore, Antonenko and Abramowitz (2023) identified and detailed common misconceptions among in-service teachers, underscoring the necessity for broader general education about AI, in addition to the discipline-specific knowledge and skills developed through teacher education programs. Given that the emphasis on AI in education is bolstered by the general trend towards quantitative, evidence-based policies (Chounta et al., 2022)，it has not been practical for teachers to treat AI as a standalone subject, as it is not a traditional academic discipline within school curricula. Consequently, subject matter teachers may need to incorporate AI content into their discipline-specific lessons to help students understand its relevance and make meaningful connections, rather than presenting AI as a separate topic (Park et al., 2023). arious studies have investigated educators' experiences and perspectives on integrating AI tools or platforms into specific subjects or learning activities, exploring perceived benefits and challenges (N. J. Kim & Kim, 2022). For example, the AI-enhanced educational platform Smart-Learning Partner (SLP) was found to be beneficial in providing additional teaching resources and personalized assessments, particularly in less developed region (Niu et al., 2022). Researchers also examined the impact of AI-driven gamification during implementation, and the findings corroborated previous research, showing that AI technology offers more options and supports teaching and learning despite challenges related to professional development, technical access, and curriculum alignment.

2.2 Attitude and Emotion

When examining teachers' knowledge and experiences with AI in education, researchers often associate participants' conceptions with their attitudes and beliefs (Velander et al., 2023; Yau et al., 2023). Although findings may suggest a correlation between accurate perceptions and positive attitudes towards AI in education (Leoste et al., 2021), teachers' misconceptions do not necessarily reflect a lack of interest or enthusiasm for incorporating AI into their teaching practices (Antonenko & Abramowitz, 2023). This highlights the need for researchers to explore more deeply how emotions and attitudes influence teachers' perceptions of AI in education. In the study conducted by Chounta et al. (2022), several issues were discussed such as concerns about the effort as well as potential trust. This research pointed out that Estonian K-12 teachers, despite having some limited knowledge of AI, do not fully recognize its potential or usefulness in education. Nonetheless, these teachers still demonstrated generally positive attitudes towards AI. Similarly, in a study investigating the Web-Based Intelligent Tutoring System (WBITS), participants maintained positive views regarding their attitudes towards the system, its utility, and its pedagogical adequacy(Akyuz & Erdemir, 2022). Barrett and Pack (2023) reached a comparable conclusion, noting that perceived apprehension about AI in education appeared to be alleviated by the recognized utility of the tool. These findings suggest that teachers' attitudes towards integrating AI in education might not be significantly influenced by their understanding of AI itself. Instead, participants' emotional responses are linked to their perceptions and understanding of AI

and its limitations. According to previous studies, teachers' reluctance to use educational technology in the classroom is often due to insufficient knowledge and skills in implementing digital technologies for educational purposes (Lim, 2023). Additionally, feelings of fear and anxiety frequently arise from high expectations concerning the current and future capabilities of AI. Hence, when evaluating teachers' perceptions of artificial intelligence in education, merely focusing on attitudes or a specific emotional response as the dimensions of investigation may be insufficient or limited.

2.3 Ethical Considerations

With the rapid deployment and widespread societal impact of AI, discussions around the ethics of AI and education have recently begun to emerge. Lin et al. (2022) noted that improper application of AI techniques and ethical concerns could lead to challenges in education. To address these challenges, educators propose avoiding social and moral issues during the teaching process, thus introducing a new perspective on AI ethics in education. Due to the limited understanding among individuals regarding the ethical consequences, benefits, and risks, Holmes et al. (2023) developed an ethical framework for AI in learning and examined the perceptions of key stakeholders—students, teachers, and educational institutions—regarding the ethical implications of AI in remote higher education. Beyond common data-related issues such as consent, privacy, and ownership, their study also identified concerns such as inadvertent biases, the conflict between commercial and academic interests, the potential replacement of teaching roles by AI, and the perception of AI profiling as a form of surveillance. Additionally, researchers have explored the evaluative and ethical challenges posed by specific AI tools or applications within educational and societal contexts. For instance, emerging Generative AI (GenAI) tools like large language models and chatbots allow users to generate content instantly from simple prompts (Barrett & Pack, 2023). Despite the generally positive public discourse about GenAI, there are substantial concerns in the education sector regarding assessment and ethical issues such as originality and plagiarism. Students with a history of academic dishonesty, such as through contract cheating or paper mills, might exploit GenAI tools like ChatGPT for similar purposes without hesitation. Conversely, other students will need guidance on avoiding unintentional cheating. As education inevitably evolves to incorporate Generative AI, it may be ineffective for governments and educational institutions to merely ban tools like ChatGPT in response to fears of AI-assisted cheating if student perceptions of academic dishonesty significantly differ from teacher expectations (Lim et al., 2023). By delving into their ethical perspectives, researchers can uncover shared anticipations and potential areas of agreement or disagreement. Understanding these dimensions can help in developing AI systems that are more aligned with the values and concerns of all stakeholders involved. This approach not only addresses the technical and pedagogical aspects but also ensures that the deployment of AI in education is ethically sound and socially acceptable.

3. Findings and Discussion

By exploring relevant studies in these areas, we can uncover valuable insights into how to address the needs of teachers and promote successful implementation of AI in education. The findings from the review highlight several key trends and implications, which are discussed below.

Studies consistently show that teachers with a higher level of knowledge about AI and its applications tend to view AI technologies more positively. These teachers are more likely to adopt AI tools and utilize them effectively in their teaching practices. However, there is a noticeable gap in AI knowledge among educators, particularly in contexts where professional development opportunities are limited. Many teachers express uncertainty about the practical applications of AI and its integration into existing curricula. This lack of familiarity often leads to resistance or reluctance to embrace AI technologies. The findings suggest that enhancing teachers' knowledge and experience with AI is crucial for successful implementation. Professional development programs should focus on providing practical training and hands-on experience with AI tools. These programs can help demystify AI, reduce apprehensions, and build confidence among educators. Integrating AI literacy into teacher education programs could ensure that future educators are better prepared to navigate and leverage AI in their classrooms. In addition, providing incentives such as certification and recognition for teachers who complete AI-focused professional development programs can create a culture of continuous learning and encourage the widespread adoption of AI in education.

Teachers' attitudes and emotional responses towards AI in education are varied and significantly influence their willingness to integrate these technologies into their teaching. Positive attitudes are often associated with perceived benefits such as personalized learning, increased engagement, and administrative efficiency. Conversely, negative attitudes stem from concerns about AI's potential to replace teachers, decrease job security, and lead to depersonalized learning experiences. Emotional responses, including anxiety and excitement, also play a critical role. For instance, some teachers feel enthusiastic about AI's potential to enhance their teaching practices and support diverse learning needs. However, others experience anxiety regarding the potential loss of control over the teaching process and the ethical implications of AI's decision-making capabilities. The variation in attitudes and emotional responses highlights the importance of addressing psychological and emotional factors when implementing AI technologies in education. To foster a positive reception, it is essential to engage educators in discussions about the benefits and limitations of AI. Providing reassurance about the supportive role of AI rather than viewing it as a replacement can alleviate concerns and build trust. Additionally, involving teachers in the design and implementation process can help tailor AI tools to their needs and preferences, increasing acceptance and enthusiasm. Ensuring equitable access to AI tools and resources is critical for teachers to effectively integrate AI into their teaching practices. Educational institutions should prioritize the provision of adequate technological infrastructure,

including hardware, software and connectivity, to support the integration of AI into the classroom. In addition, schools should invest in user-friendly AI tools and resources to meet the needs of different skill levels and ensure accessibility for all teachers. Collaborating with industry partners to utilize open-source AI resources can also make a wider range of tools and technologies more accessible.

Ethical considerations emerged as a significant dimension in teachers' perceptions of AI in education. Concerns related to data privacy, algorithmic bias, and the potential misuse of AI were frequently highlighted. Teachers are particularly concerned about how AI systems handle student data and the transparency of AI decision-making processes. There is a strong demand for clear guidelines and policies to address these ethical issues and ensure that AI is used responsibly in educational settings. Addressing ethical considerations is vital for the responsible integration of AI in education. Educational institutions and policymakers must establish robust frameworks to safeguard student data and ensure that AI systems are transparent and unbiased. Providing teachers with clear guidelines and involving them in ethical discussions can help build trust and ensure that AI tools are used in ways that align with educational values and principles. Moreover, ongoing dialogue about the ethical implications of AI can help educators feel more confident and informed about their use of these technologies. Also, creating a supportive policy and infrastructure environment is crucial for encouraging the adoption and sustained use of AI in education. In order to create an enabling environment, policymakers should consider incorporating guidelines for the integration of AI into curricular frameworks and provide clear guidance on how to effectively integrate AI technologies into teaching and learning.

4. Conclusion

Drawing upon the insights gleaned from the perspectives of educators, this review has comprehensively analyzed and consolidated various researches on teachers' perceptions of applying artificial intelligence in education. By grouping articles according to concepts and common themes, this review has identified current understandings among researchers, educators, and the education system as a whole. The findings reveal that perceptions of AI in education are multifaceted and complex, encompassing knowledge and experience, attitude and emotion, and ethical considerations.

Firstly, this review highlights the significant role of teachers' perceptions in shaping the integration and impact of AI in educational settings. As key stakeholders in the educational process, teachers' attitudes and understanding of AI are critical to its successful implementation. Their perceptions influence how they engage with and utilize AI tools, which in turn affects student learning and overall educational outcomes. The findings remind us that the continuous design and improvement of AI curricula should not only focus on content knowledge and skills but also take into account teachers' perspectives, interpretations, and students' agency in their learning. Recognizing the political nature of school curriculum planning, where teachers' beliefs and viewpoints shape the form and content of the

curriculum, is essential for creating meaningful and effective AI educational programs. Secondly, the review underscores the importance of examining the coherence behind AI educational perceptions. By exploring the specific dimensions addressed in prior research, this review reveals patterns and trends that inform our understanding of teachers' views on AI. Addressing teachers' knowledge and experience in utilizing AI is essential for enhancing their confidence and competence in integrating AI technologies into their teaching practices. Also, there should be a focus on addressing misconceptions and promoting a culture of continuous learning and development in AI adoption. This study also emphasizes the importance of ethical considerations when implementing AI in education. Teachers need to be aware of the ethical implications of AI techniques and strive to avoid social and moral dilemmas in the teaching process. By incorporating AI ethics into the teaching process, educators can ensure responsible and ethical use of AI technologies for the benefit of students and society. By addressing knowledge, attitudes, and ethical considerations, and involving teachers' viewpoints in curriculum design, we can enhance the effective integration of AI in education, ultimately leading to improved educational outcomes in the digital era.

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