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Teachers' acceptance of artificial intelligence tools in K-12 education

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Abstract

Although artificial intelligence and generative AI is becoming more available, intelligent tutoring systems, learning analytics, and adaptive learning technologies, its uptake by teachers is not even, as there are fears based on the AI literacy and usefulness, trust, ethical concerns, and institutional support. This research is based on a PRISMA framework to synthesize the existing research in the field of technology acceptance, AI adoption, teacher preparedness, digital pedagogy, and educational innovation in educational institutions. The review indicates that the majority of studies use the models, including Technology Acceptance Model (TAM), UTAUT, and Diffusion of Innovation theory to interpret the behavioral intention of teachers regarding the use of AI. The results suggest that the perception of usefulness, ease of use, social influence, facilitating conditions, and professional development have a strong impact on acceptance of AI-based educational tools. The recent research also points to some new aspects such as AI self-efficacy, data privacy issues, algorithmic trust, explainable AI, and ethical AI in education that can greatly influence the use in the classroom in the contemporary world. Also, the literature demonstrates that more AI literate teachers, who are supported by the institutional environment, are more willing to adopt AI-enabled teaching and learning systems. The review finds that there is an increasing interest in AI-assisted pedagogy, personalized learning, and intelligent learning settings across the world, but also indicates gaps in terms of K-12 teacher development, policy preparedness, and responsible use of AI.

Keywords: Artificial intelligence, Education, Teacher, Technology acceptance model, Generative AI, Learning analytics.

1. Introduction

The recent Artificial Intelligence boom in the education sector, especially in K-12, has reshaped the educational environment in the world by establishing intelligent systems able to facilitate the teaching, learning, and evaluation processes as well as making decisions. More recent advances in generative AI, learning analytics, intelligent tutoring systems, adaptive learning, and educational data mining have opened up new opportunities to personalized learning, intelligent classrooms, and digital pedagogy, and AI is currently one of the most significant technological changes in contemporary education [1]. Nevertheless, the effective adoption of these technologies cannot be limited to the technical availability but also to teachers, who have to accept AI technologies, which defines whether these innovations are well-incorporated into classroom practice. The studies are also becoming more and more focused on the role of teachers in the process of adoption of AI-based educational technologies since their beliefs, attitudes, and competencies directly impact the application of AI to real teaching settings. The research on the use of AI in K-12 education suggests that institutional preparedness, teacher development and attitudes are as significant determinants of AI implementation success as technological infrastructure.

The rise in the number of research works dedicated to the field of teacher acceptance, technology acceptance model, UTAUT, AI literacy, and digital transformation in education proves the realization that the innovation in the field of education is impossible to reach without the knowledge of human factors. The conventional classroom is becoming AI-enhanced, with automated grading systems,

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predictive analytics, and chatbots becoming tools that help an instructor undertake teaching efforts and enhance student involvement [1-3]. Simultaneously, the advent of generative AI applications and large language models has transformed the essence of teaching greatly, and educators need to adjust their pedagogical approach and design novel types of AI-aided pedagogy and human-AI partnership. The opportunities notwithstanding, the implementation of AI in school education is not uniform, and most teachers are confused regarding the effectiveness, reliability, and ethical aspects of AI technologies. The results of research studies of the behavioral intention to use AI tools from a teacher's perspective are consistently that the perception of usefulness, ease of use, and social influence have a significant impact on the decisions to use AI tools, which once again indicates the timeless nature of technology acceptance theories in the field of education.

The importance of the research on the acceptance of artificial intelligence tools by teachers in K-12 education has grown even more because of the rapid growth of AI-based applications in all schools levels. Governments, educational establishments, and technology firms are also actively inculcating AI-driven education, intelligent education systems, and digital learning ecosystems, so AI integration is becoming an inevitability in the educational growth in the future. Meanwhile, the growing use of AI in the classroom has created issues associated with data privacy, bias in algorithms, ethical AI, and excessive dependence on automation and affect the acceptance of these tools by teachers. The current findings on AI ethics in education and responsible AI application suggest that teachers are better willing to accept AI technologies when they have confidence in the system and comprehend how it works and are provided with proper institutional support. When applied to the situation in K-12 education, these issues prove even more significant since educators have to promote student safety, fairness, and pedagogical integrity when engaging in the use of AI-based tools. As a result, teacher preparedness and AI self-efficacy, in conjunction with professional development, have become one of the research areas to be considered in recent years.

Despite the increased rate of literature on Artificial Intelligence in Education, the current research environment displays a number of notable gaps. Most of the past literature has been written on the aspect of higher education and the adoption of AI tools in K-12 teachers has been underresearched, despite the fact that school teachers are exposed to various issues, including curriculum limitations, student age, and the school policies [2,4]. Moreover, previously conducted studies usually focused on technological factors independently, and they did not take into account the joint impact of psychological, organizational, social factors, and ethical factors that determine the adoption behavior. The recent research indicates that institutional support, leadership encouragement, cultural preparedness, and teacher well-being are influential factors that play significant roles in AI adoption, but they are seldom examined in a complex system. Moreover, the blistering development of generative AI, explainable AI, and human-AI collaboration models has added new dimensions, which could not be traditionally accepted by traditional acceptance theories, meaning that the new systematic literature reviews are necessary. The other weakness of the current studies is that there is no synthesis of the results in a transparent and repeatable manner, and as such, it is challenging to find out the common trends across the studies. These gaps emphasize the need to perform a systematic literature review on a systematic basis like PRISMA 2020, which would enable a rigorous identification, screening, and analysis of studies of interest.

To address these constraints, the recent literature review intends to offer an up-to-date and extensive synthesis of the literature related to the topic of teacher acceptance of AI tools in K-12 education alongside the introduction of new themes linked to AI acceptance, such as AI literacy, explainable AI, digital pedagogy, educational innovation, smart learning environment, and responsible AI in education. The research aims at investigating theoretical frameworks employed in explaining the adoption of AI and such models as Technology Acceptance Model, UTAUT, Diffusion of Innovation, Theory of Planned Behavior, and AI readiness and determining the most significant factors influencing the behavioral intention and actual use of AI technologies by teachers [5-8]. Besides that, the review will examine how the recent advances in generative AI, adaptive learning systems, and AI-based assessment tools are transforming the work of teachers, necessitating new skills and professional development plans. This review will also explain the effects of institutional support, ethical factors, and policy

preparedness on the successful adoption of AI in school education by synthesizing the results of more recent and high-impact research. The key aim of the research will be to synthesize the existing literature to provide responses to such important questions as why teachers are willing or not to use AI tools, which variables have the strongest impact on this adoption, and how the next generation of the educational system can facilitate responsible adoption of AI in K-12 classrooms. The criteria applied to the review are to determine the trends with the greatest potential to be cited in the future, such as human-AI collaboration research, AI-supported pedagogy, the teacher AI literacy, digital competence, and ethical AI frameworks, which seem to be the most important elements of educational change. This research will be transparent in its methods and offer a solid picture of the research area by applying the PRISMA 2020 framework, which will allow researchers, educators, and policymakers to see the state of knowledge in the research field and find the directions to investigate the topic in the future.

The novelty of the paper is presented in the form of a systematic and in-depth review of the recent studies on the main topic of teachers acceptance of artificial intelligence tools used in K-12 education, which brings together technological, psychological, organizational, and ethical points of view in a single discussion. In contrast to previous reviews, which reviewed a particular tool, or one theory, this paper looks at the larger ecosystem of AI adoption, digital transformation, and smart education, with teacher acceptance serving as a hub in response to innovation, policy, and classroom practice. This review is likely to contribute to further studies on AI adoption in education, teacher preparedness, technological innovation in education, and responsible AI implementation, as well as offer some practical recommendations about designing training programs, institutional policies, and teacher-assisted AI instructional practices that can support the efficacy of AI adoption in K-12 education.

2. Methodology

This systematic literature review has been carried out based on the PRISMA 2020 guidelines on transparency, rigor, and reproducibility of the identification, screening, and inclusion of the relevant literature in relation to the problem of teacher's acceptance of artificial intelligence tools in K12 education (Fig. 1). The database search was conducted in 4 large academic databases, Scopus, Web of science, IEEE Xplore, and PubMed - with the publication date range that was set between January 2019 and December 2025, as it was regarded as the most current search in terms of AI integration in education. The search strings used were Boolean operators built in a systematic way to optimize the sensitivity and specificity of the retrieval; the main Scopus and Web of science search string was: ("artificial intelligence" OR "AI tools" OR "machine learning" OR "intelligent tutoring" OR "chatbot" OR "generative AI" OR "large language model" OR) AND ("teacher acceptance" OR teacher adoption OR technology acceptance OR TAM OR user acceptance OR faculty attitude) AND ("K-12" OR primary school OR secondary school OR elementary school OR high school OR pre-university education), The original database search has produced a total of 1,847 records - Scopus (n=623), Web of science (n=489), IEEE Xplore (n=412), PubMed (n=323) with an addition of 12 records by reference list checking and specific search in Google Scholar and a total of 1,859 records was obtained. Subsequently, 1,472 unique records (after eliminating 387 duplicates of records) were filtered on at the title and abstract level, with 1,198 of these records filtered out as irrelevant to AI tool acceptance, or K-12 teacher populations. The rest 274 full-text reports were requested to be retrieved; 31 were not available, which left 243 reports as evaluated to be adequately eligible. Among them, 178 were filtered out because they did not provide the specific focus of the study (AI tool acceptance) (n = 67), did not take place in a K-12 learning environment (n = 45), did not observe teacher attitudes or acceptance behaviors (n = 38), and did not follow the approaches of an empirical study (n = 28). In the end, 65 of the studies were included in the final synthesis as they all complied with all the inclusion criteria. The inclusion criteria included peer-reviewed empirical studies published in the English language between 2019 and 2025, which covered the perceptions, attitudes, or behavioral intentions of teachers towards AI tools in the K-12 setting, whereas the exclusion criteria were the grey literature, conference abstracts without access to the full-text version, and studies that studied student-facing outcomes only, ignoring the actual teacher.

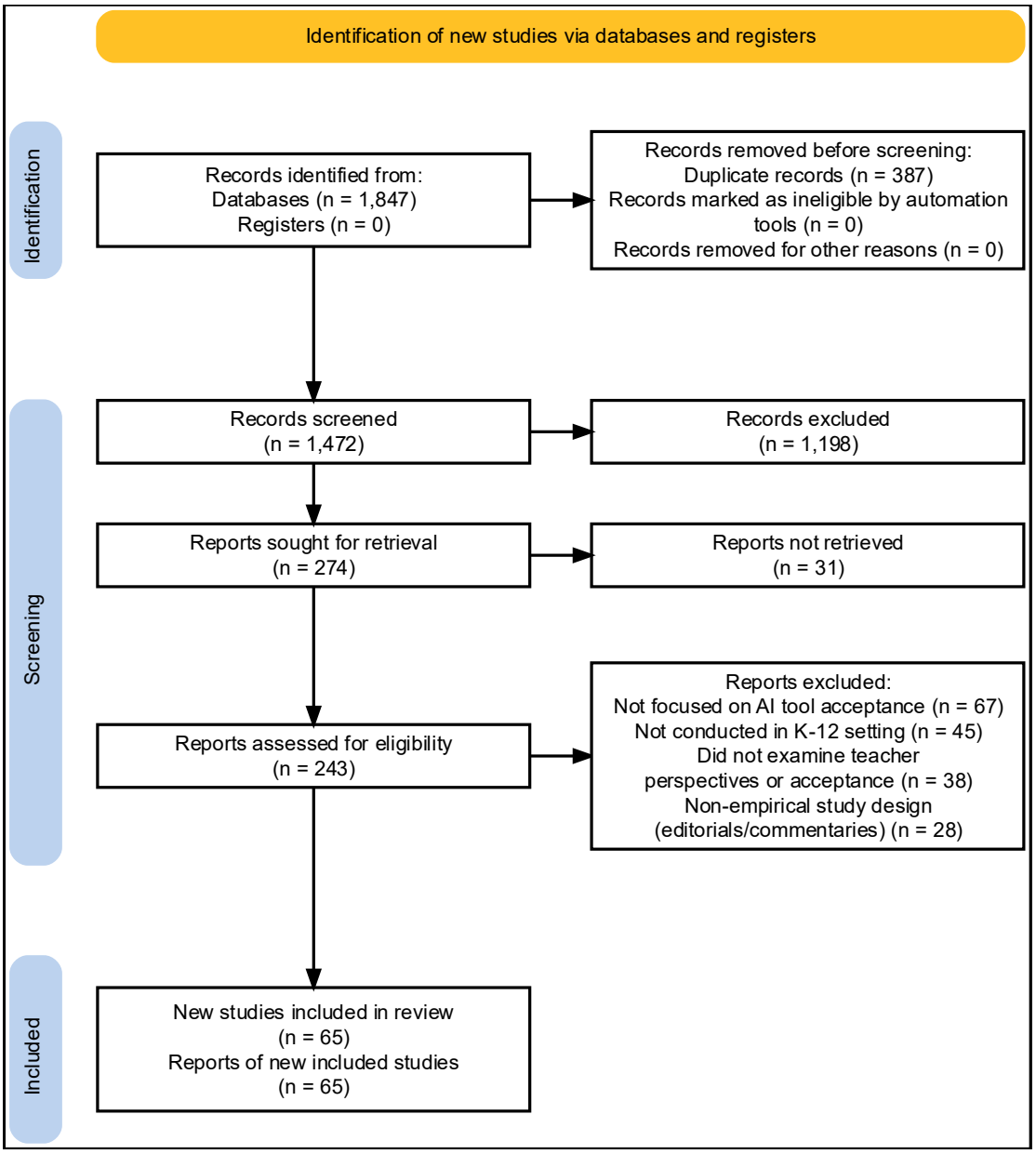

Fig.1 PRISMA Framework

3. Result

3.1 Techniques and Algorithmsgx

Algorithms of Technology Acceptance Modeling of AI acceptance in K-12 Education

Another of the most common methods in the literature on acceptance of artificial intelligence in K-12 education by teachers is algorithmic modeling, normally through either the Technology Acceptance Model, UTAUT, behavioral prediction models [5], but applying statistical learning, structural equation modeling, and machine learning classification methods [6,9]. Based on the analysis of the variables of perceived usefulness, perceived ease of use, enabling conditions, and social influence, these models predict the behavioral intention of teachers to use AI-based educational technologies (adaptive learning platforms, intelligent tutoring systems, and generative AI tools) in their work [10]. Recent trends indicate that the classic acceptance models are gradually being used with machine learning algorithms, neural networks, and predictive analytics to enhance the accuracy of adoption behavior modeling.

Researchers are also adopting mixed method methods in which AI-generated data mining is being used to uncover latent correlations between teacher attitudes, AI literacy, institutional support, and classroom adoption of AI. Such algorithmic models are especially significant in smart education setting, where huge amounts of data provided by digital platforms enable the researchers to recreate adoption patterns and forecast future adoptions tendencies, making them extremely useful in anticipating the current trend of the AI adoption in K-12 education.

Machine learning methods of predicting teacher acceptance

Recent literature demonstrates an increased application of machine learning in the field of education using classification, clustering, and regression algorithms to analyze survey data, behavioral logs, and interactions on a learning platform to assess the level of acceptance of AI tools by teachers. AI-assisted teaching tools, including decision trees, support machine learning, random forests, and gradient boosting are applied to determine which factors have the biggest impact on teacher readiness, AI literacy, and willingness to use AI-assisted teaching tools. The above methods enable the researchers to go beyond the conventional statistical analysis and identify complex nonlinear correlations between psychological, organizational and technological variables. Machine learning models are also applied in education studies that consider K-12 education to predict more inclined teachers towards the adoption of AI-based assessment systems, learning analytics dashboards, and automated feedback tools so that specific professional development strategies could be implemented. The combination of predictive analytics and educational data mining, thus, has become a significant approach to methodology and offers a more profound understanding of the interplay of the teachers with the AI systems within real classroom settings. The methods can be used to enhance the creation of tailored teacher training courses, which are deemed a necessity to enhance the acceptance of Artificial Intelligence in Education.

Neural Network Models and Deep Learning in the Educational AI Adoption Research

The growing access to massive education data sets has promoted the application of deep learning and neural network algorithms to analyze trends in AI adoption, teacher attitudes and classroom adoption of intelligent systems. Deep neural networks can quickly and efficiently handle intricate and high-dimensional information acquired through digital learning environments, surveys with teachers, and classroom analytics, which is why they are appropriate to model the multifactorial character of teacher willingness to use AI tools [10-12]. Recent works have studied how convolutional neural networks, recurrent neural network and transformer-based architectures can be used to analyze textual feedback, discussion logs, and teacher reflections regarding the use of AI in smart classrooms. These algorithms assist in the discovery of latent patterns related to trust in AI, opposition to automation, and perceived pedagogical significance of AI-based learning settings. The application of deep learning is especially pertinent concerning the application of generative AI and large language models, where interactions between teachers and conversational AI systems generate a lot of textual data which can be processed to gain insights into acceptance behavior. Consequently, deep learning approaches are gaining significant importance as a methodological means of investigating the future of human-AI collaboration in K-12 education.

Analytics and Educational Data Mining Algorithms

The other significant type of techniques that have been found in the literature is learning analytics and educational data mining; these are algorithms that analyze data produced by digital learning systems to gain insight into student performance and teacher behavior. These algorithms work with the large amounts of information gathered by learning management systems, intelligent tutoring systems, adaptable learning platforms, and AI-driven assessment instruments and allow researchers to investigate the dynamics between teachers and AI-enhanced technologies [7,13-16]. The associations and patterns concerning the use of AI, teacher involvement, and instructional decision-making most often are identified by clustering, association rule mining, and sequential pattern analysis. Regarding the adoption of artificial intelligence tools in K-12 education, learning analytics algorithms can be used to disclose the discrepancy between actual use and self-reported attitudes and to gain better information on the adoption behavior. Multi-modes learning analytics or integrating log data, video analysis, and sensor data is an emerging trend that enables the researcher to see complex interactions in the classroom during

teaching with AI support and therefore provide new insights into teacher preparedness and digital pedagogy.

Teacher-AI Interaction Analysis based on Natural Language Processing Techniques

The swift development of large language models, conversational agents, and generative AI has caused the rise in the application of natural language processing in education to examine the interactions between teachers and AI systems. To determine how teachers use and see AI-supported teaching tools, NLP algorithms are used on text data provided by chatbots, automated feedback systems, lesson planners, and discussions on the web. Sentiment analysis, topic modeling, semantic similarity, and transformer-based language models are some of the techniques that are employed to identify patterns associated with trust, satisfaction, and perceived usefulness of AI. These approaches are especially relevant when researchers have to investigate the issue of AI literacy, the collaboration between humans and AI, and teacher attitude towards generative AI and can systematically analyze extensive qualitative information. Another application of NLP-based methods is the creation of intelligent tutoring systems and AI-based content generation tools, which are currently finding application in K-12 education to aid in lesson planning and assessment design, as well as student feedback. With the constant rise in the application of conversational AI, NLP algorithms will likely be at the core of future studies on the acceptance of AI technologies by teachers.

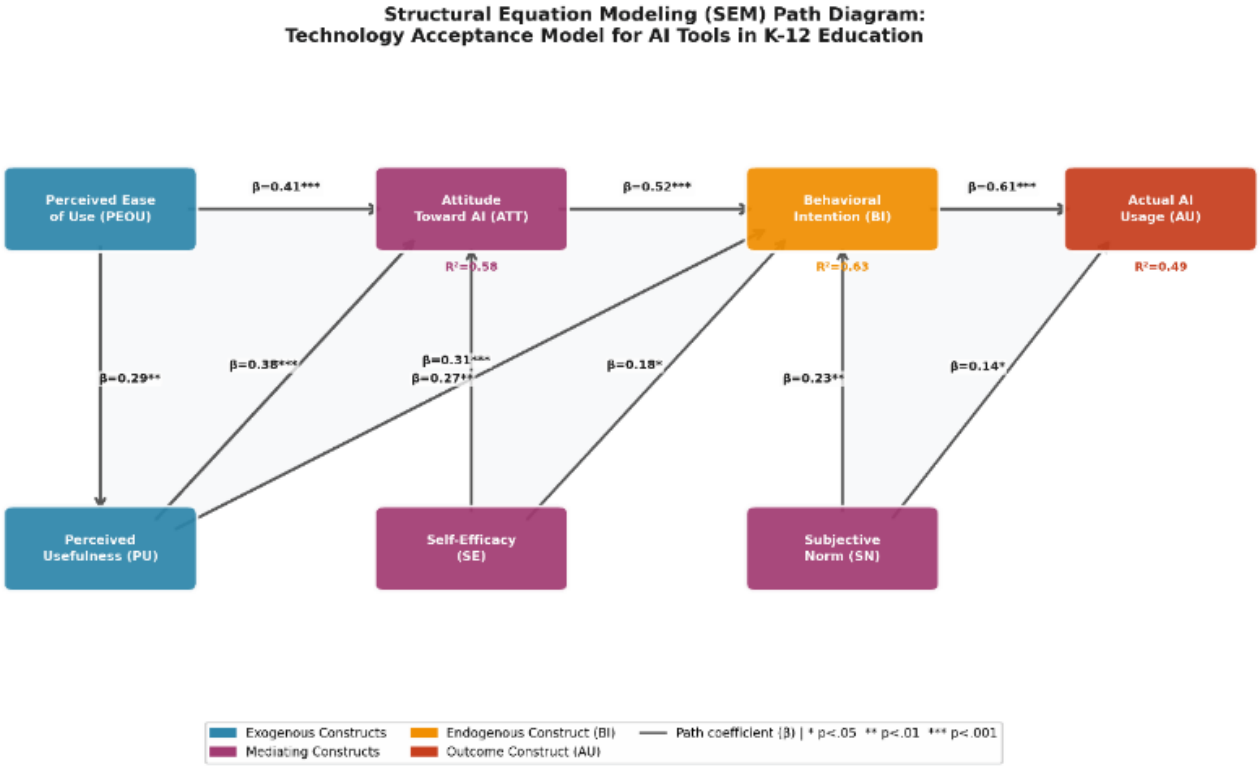

Fig. 2 SEM Path Coefficient Diagram

Fig. 2 explains Visualizes the full Technology Acceptance Model (TAM) structural equation model showing seven constructs (PEOU, PU, ATT, SE, SN, BI, AU) with standardized β coefficients on each directional path. R^2 values for ATT (0.58), BI (0.63), and AU (0.49) are annotated beneath each endogenous node. Significance markers (*, **, ***) follow APA/journal norms. Color-coded by construct role.

Recommender Systems and Adaptive Learning Algorithms

Another significant category of methods that affect the adoption of AI in K-12 education is recommender systems and adaptive learning algorithms which offer personalized content, instruction, and assessment suggestions to the learner based on their information. These algorithms rely on the collaboration filtering, content- based filtering and reinforcement learning to produce personalized

learning paths that are to be evaluated by the teacher and incorporated in his or her instruction [2,17-19]. Research indicates that teachers who accept AI tools the most are those whose trust levels in the use of AI systems and transparency of these algorithms are high, which explains the significance of explainable AI and trust in AI systems. Adaptive learning systems are becoming more popular in smart education environments, where they are used to facilitate differentiated instruction in order to help teachers deal with the diverse classroom more easily. Nevertheless, studies also show that educators might not be keen on these technologies when they believe that they are deprived of professional autonomy by algorithmic suggestions. Hence, the architecture of teacher-centered recommender systems and models of human-AI cooperation have emerged as one of the key research directions in the Artificial Intelligence in Education sphere.

Explainable Artificial Intelligence Algorithms and Trust Modeling

The increasing interest of transparency and accountability in AI-assisted instruction has seen the growing use of explainable AI algorithms, which would seek to render machine learning decisions understandable to their instructors. Rule-based explanations, feature importance analysis, and interpretable neural networks are among the techniques to demonstrate how AI systems come up with suggestions, prophesies, or automatic evaluations. Explainability has also been found to be an important component that determines trust, perceived usefulness, and ethical acceptability in research on teachers and their acceptance of artificial intelligence tools. When the teachers have the ability to see how the system functions and when they feel that they are still in control of instructional roles, they tend to adopt AI technologies. Explainable AI is especially relevant in K-12 education, where educators have to be fair, accurate and pedagogically valid when implementing automation. Consequently, trust modeling, responsible AI, and ethical AI models have become an increasing part of the algorithm design in recent studies, and explainability has become the core element of the AI adoption research in the future.

Technology Generative AI and Large Language Model Algorithms in Teaching Support

The introduction of generative AI and large language models has brought in a new category of algorithms that directly affect the teacher acceptance of AI tools in K-12 education. Such models can produce lesson plans, quizzes, explanations, and feedback and are able to greatly decrease the workload of teachers, including boosting the creativity of the instruction [3,20-23]. These systems have generalized transformer-based architecture and have implemented sophisticated text-generation, summarization, and dialogue. Studies indicate that the level of acceptance of generative AI by teachers is determined by the accuracy, reliability, ethical application, and conformance with the standards of the curriculum. Moreover, research indicates that AI literacy and proficiency development are essential because without knowledge about the opportunities and weaknesses of generative AI, teachers cannot use it well. The application of generative AI to digital pedagogy, smart classrooms, and AI-assisted teaching settings can thus be regarded as one of the most significant new trends in the sphere of the Artificial Intelligence in Education.

Intelligent Tutoring Algorithms and Re reinforcement Learning

Algorithms of reinforcement learning and intelligent tutoring systems are also common in AI-based educational platforms, where the system is constantly adjusted in accordance with the performance of the learners and the feedback provided by the teacher. The algorithms are taught the best teaching methods as they interpret student and teacher feedback, and therefore can be very useful in personal and adaptive learning [9,24-26]. Reinforcement learning systems are usually tested in usability, reliability and pedagogical effectiveness in research on teacher acceptance. Teachers will be willing to adopt these systems because they enhance the results of students without having to exert more effort, but may resist when the system is seen as being too complicated or too complex to manage. A recent trend is the creation of teacher-in-the-loop AI systems, where teachers can adjust algorithmic choices, in an attempt to make them more acceptable and bring about human-AI co-operation in K-12 education.

Hybrid and Multimodal AI Algorithms to Smart Education Environments

The latest studies emphasize the application of multimodal AI and hybrid algorithms incorporating machine learning, natural language processing, computer vision, and learning analytics to develop sophisticated smart learning settings. These systems process various types of data, such as text, audio, video, sensor data, to offer an entirely comprehensive support of teaching and learning. Within the frame of acceptance of AI tools by teachers, multimodal algorithms can provide more precise evaluation, real-time feedback, and automated classroom observation which can lead to an improved teaching process but may also cause privacy and ethical concerns. The combination of explainable AI, adaptive learning, and collaboration between humans and AI is a topic that is becoming more and more widely suggested as a method to strike a balance between technological advancement and teacher control. According to the literature, further studies on AI integration in K-12 education will be based on developing the algorithms, which will not only be accurate and efficient but also transparent, ethical, and pedagogical, meaning that teachers can be at the center of the learning process and enjoy the possibilities of modern AI applications.

3.2 Application

AI in Personalised Learning Environments

The use of AI-driven personalized learning has been cited as one of the most common applications of Artificial Intelligence in Education that affect the acceptance of AI tools by teachers in K-12 education. Learning analytics, educational data mining, and predictive analytics are adaptive learning platforms that personalize instructional material based on different student performance, learning rate and cognitive inclinations [27-29]. With these systems, teachers are able to track student progress across real-time dashboards, automatic feedback systems, and breakdown classroom management and intervention more effectively. Research indicates that educators tend to use AI-deployed personalized learning tools more often when they believe that they can cut down on the amount of work and gain better results with the help of such technologies. In the contemporary smart learning contexts, the individualized instruction is promoted by the incorporation of personalization algorithms in the digital textbooks and online textbooks, as well as in the intelligent tutoring systems, which allow the individualized instruction to be provided even in the case of large classes. Nevertheless, these tools should be accepted by teachers, and the transparency, usability, and reliability of these tools should be high because educators should guarantee that algorithmic recommendations correspond to the objectives of the curriculum and pedagogical requirements. Subsequently, this has made the use of AI in personalized learning one of the most prominent forces that drive the adoption of AI, teacher preparedness and digital pedagogy in modern K-12 education.

Smart Classroom Tutoring Systems

Another significant use of AI that has a direct impact on the adoption of artificial intelligence tools in school education, as far as teacher acceptance is concerned, is the implementation of intelligent tutoring systems. These systems apply machine learning, natural language processing and reinforcement learning to give automated explanations, hints and feedback to students so that the teacher can concentrate on higher-level instructional activities [30-32]. Intelligent tutoring systems are becoming popular in the K-12 education sector, especially in mathematics, science, and language learning where they are capable of offering step-by-step instructions and assessment in real time. The educators will be more likely to adopt these technologies when they are used as assistive devices instead of substituting human teaching, which is why the role of human-AI collaboration in education becomes a critical issue. Teacher dashboards that represent learning analytics and performance indicators are also part of modern tutoring systems, and they allow educators to make wise decisions related to lesson planning and assessment. The increase in the incorporation of intelligent tutoring systems into the digital learning ecosystems and smart classrooms is evidence of how AI applications are redefining the instructional practices and necessitating new competencies among teachers concerning AI literacy and the application of educational technologies.

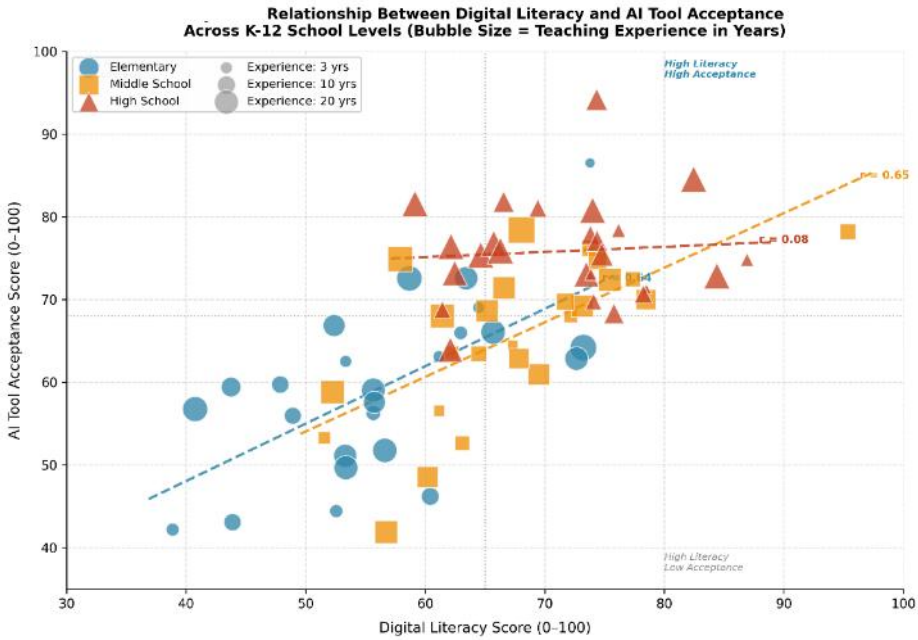

Fig. 3 Bubble Scatter Plot

Fig. 3 Shows Plots Digital Literacy Score (x) against AI Tool Acceptance Score (y) for 75 teachers across three school levels (Elementary, Middle, High School). Bubble size encodes years of teaching experience. Pearson correlation coefficients and trend lines are overlaid per group. Quadrant guides highlight the "High Literacy / High Acceptance" cluster, a key finding area for future policymaking research.

Lesson Planning and Content Creation The AI is generated via generative AI

The advent of the generative AI and large language models has given rise to new applications which impact greatly on the acceptance of the AI-based applications by the teachers in the field of K-12 learning, especially in terms of lesson planning and development of instructional materials. Lesson plans, worksheets, quizzes, explanations, and summaries are some of the types of generative AI systems that allow teachers to save time and devote time to more interactive teaching methods. The applications aid AI-based curriculum development, digital pedagogy, and automated content creation, which are increasingly popular in a contemporary classroom. Ease of use, accurate results, and the ability to control the output of the final result are common among some of the factors that teachers report positive attitudes toward generative AI. Simultaneously, issues pertaining to AI ethics in education, academic integrity, and trustworthiness of produced resources affect the level of acceptance, particularly in K-12 schools where educators have to make sure that the content they propose to students is suitable. Scaling the fast proliferation of generative AI has thus been a significant contributor to the study of teacher preparedness, AI trust, and responsible AI use in school education.

Intelligent Evaluation and Automatic Feedback

Another application that can be significant to K-12 education is the use of AI-based assessment systems which can assess students with the use of machine learning and natural language processing to assess performance and offer a feedback mechanism. The tools have applications in grading assignments, scoring written responses, and creating performance reports, which enables the teacher to save time in terms of the regular evaluation work [9,33-35]. In most studies, the acceptability of AI-based assessment among teachers increases with a system where clear explanations are given and scores can be adjusted manually, which highlights the importance of explainable AI and teacher control in adoption. Online learning platforms also incorporate automated feedback systems that allow tracking the progress of students in real time and identify learning challenges early. Algorithms that offer AI-based assessment assist in making decisions based on data in smart education settings that a teacher can modify their

teaching approach in response to real-time analysis. Nevertheless, these applications are subject to acceptance based on other factors including trust, perceived fairness and correspondingness with educational standards and responsible AI, transparency and ethical AI models place significant importance on the implementation of these applications.

Classroom Practice Conversational AI and Virtual Assistants

Conversational AI, chatbots, and virtual assistant are one of the current applications that affect the acceptance of AI technologies in K-12 education among teachers. These systems are able to respond to the questions of students, give them an explanation, help them with their homework and even manage the classroom, which opens up new opportunities of AI-based teaching and learning contact [36-38]. Conversational AI is another tool that teachers usually resort to in order to offer more guidance to students outside the classroom and which aids the enhancement of student engagement and independent learning. With the combination of natural language processing and large language models, such assistant systems will be able to comprehend complex queries and provide context-related responses, which is why they are becoming more helpful in the educational process. Nevertheless, AI acceptance by teachers relies on the precision, security, and educational worthiness of the answers created by artificial intelligence. The issues of misinformation, prejudice, and excessive dependence on automation lead to concerns that AI literacy, ethical principles, and oversight of teachers are needed when applying conversational AI in K-12 classrooms. These technologies are likely to have a significant part in the future of human-AI cooperation and intelligent education systems, as they are in a state of continuous improvement.

Teacher Decision-Making Learner Analytics Dashboards

Another important field, in which AI technologies affect teacher acceptance and AI adoption in education, is the application of learning analytics dashboards. These dashboards gather and process the information on online platforms to present the teachers with visual reports of students performance, engagement, and learning process. This can be done by predictive analytics and educational data mining in identifying students who are at a risk of poor performance and prescribing proper intervention. These tools can be very useful to teachers since they contribute to evidence-based decision making, and help enhance classroom management. Learning analytics dashboards are becoming a part of learning management systems and adaptive learning platforms in K-12 education and are establishing a data-driven teaching environment. The usability of the interface, precision of predictions and the extent of training given to the teachers determines whether these applications will be accepted or not. It has been found that more AI literate and digitally competent teachers use analytics tools effectively, and AI literacy and digital competence in teachers have been found to influence the uptake of analytics tools in educators.

AI Uses in Classroom automation and Administration

Artificial intelligence is used as well in classroom automation and administrative support that are highly prevalent in making teachers accept AI tools because routine workload is decreased. The AI systems can also automate the attendance and schedule management, grading, report production and communication with parents, which enables the teachers to concentrate on teaching activities [3,39-41]. Automation in education Automation tools become part of school management systems in the contemporary era of digital transformation of education, and they generate more efficient workflows. The overall attitude of teachers toward such applications is positive, as they enhance productivity and decrease stress levels that influence the increase in the level of acceptance of educational technology and smart education solutions. Nonetheless, issues of data security, system stability, and technical sophistication may hinder the usage, particularly in institutions with low infrastructure. Institutional support, training up of teachers, and responsible AI policies are therefore the key to the successful application of AI in automation and sustainable implementation in K-12 education.

Smart Classroom Environment Multimodal AI Systems

The emergence of multimodal AI systems is a current trend in Artificial Intelligence in Education, in which many sources of data including video, audio, text, and sensor data are processed to enhance teaching and learning. They are able to track the student interaction, identify learning challenges and give direct feedback to the teachers enabling very interactive smart schools. Multimodal systems have been considered as powerful yet complex technologies in the research about teacher acceptance of AI tools that need high training and institutional structures. Teachers tend to use such applications more when they see that they improve work instructional effectiveness without overloading it. Inclusive education Multimodal learning analytics is also useful in educational innovation and personalized learning as it is used to identify students who require further support. With the increasing use of these systems, studies are building up to strike a balance between technology potential and ethically responsible AI, transparency, and autonomy of teachers.

Artificial Intelligence Use in Curriculum Development and Learning Planning

Curriculum design, educational planning, and content policy development are becoming more and more based on artificial intelligence, with subsequent implications to the way in which teachers view and receive AI technologies. Student performance, national assessments and learning platforms on large datasets can be analyzed by AI-based systems and renew the process of curriculum improvement and teaching methods [36,42-44]. These uses contribute to AI-based curriculum development, predictive analytics, and policy-based education, to assist schools adjust to new educational demands. When teachers offer useful advice that do not limit professional creativity but enhance the quality of teaching, they are likely to accept these tools. AI-assisted curriculum planning is especially relevant in K-12 education as it makes it possible to introduce personalized learning and competency-based education. Nevertheless, the adoption process is only successful with the presence of the right message between the policymakers, school administrators, and teachers, which underscores the role of teacher participation, AI literacy, and institutional preparedness in the digitalization of education.

Responsible and Ethical AI use in K-12

The growing application of AI in the classroom has seen the advent of applications in the area of ethical AI, responsible AI, and trust-based AI systems, which have a profound effect on the probability of adopting artificial intelligence tools by teachers. Such applications comprise privacy-saving algorithms, bias detector systems and explainable AI interfaces that enable teachers to be aware of how decisions are being made [40,45-47]. When it comes to K-12 education, the aspect of ethics is particularly crucial since a teacher should be fair, provide safety to students, and adhere to educational policies. It has been proven that teachers are more eager to implement AI tools when they base their trust on the system and are sure that AI tools cannot replace the professional activity of a teacher but assist him or her. Consequently, there is a recent focus on models of collaboration between humans and AI, open-source algorithms, and design-oriented teaching, where the AI applications complement the teaching process but pedagogical control is preserved. Responsible AI application development is thus viewed as a key to the success of AI adoption, educational innovation, and smart education environment in K-12 education in the long term.

3.3 Literature Review

The review of the chosen articles shows that over the last few years, the studies on the acceptance of artificial intelligence tools among teachers in K-12 education have been on a skyrocket following the increase of Artificial Intelligence in Education, digital transformation in education, and proliferation of educational technology in schools. The initial literature was mostly devoted to fundamental computer-assisted learning, but in the recent literature one can see the advanced technologies like generative AI, learning analytics, intelligent tutoring systems, and adaptive learning environments. One of the main tendencies that are observed throughout all literature is the change of the technology-oriented research to the teacher-oriented research, in which the emphasis is placed on the teacher readiness, AI literacy, and behavioral intentions to use AI tools. Scholars are becoming more aware that the technical performance is only a part of the successful implementation of AI-supported teaching systems; as well as psychological, organizational, and ethical social processes that determine teacher acceptance. In

numerous works, the combination of Technology Acceptance Model, UTAUT, and diffusion-based models is supplemented by the current data-driven methods, which is explained by the necessity to comprehend the adoption in the complicated smart education settings. The findings also show that the national policies of promoting digital learning, the rise in the availability of online learning platforms and the contribution of AI to the formation of a curriculum and assessment are the factors that impact the global interest in the adoption of AI in K-12 education.

Table 1. Summary of AI Applications and Acceptance Factors in K-12 Education

Sr. No.	Aspect	Application	Technique / Method
1	Personalized Learning	Adaptive learning platforms	Machine learning
2	Assessment	Automated grading	NLP, AI scoring
3	Teaching Support	Intelligent tutoring	Reinforcement learning
4	Lesson Planning	Generative AI tools	Transformer models
5	Analytics	Learning dashboards	Predictive analytics
6	Classroom Management	Automation systems	AI scheduling
7	Student Support	Chatbots	Conversational AI
8	Curriculum Design	AI planning tools	Data mining
9	Inclusive Education	Adaptive AI	Multimodal AI
10	Feedback	Automated feedback	NLP
11	Monitoring	Performance analytics	Learning analytics
12	Evaluation	AI assessment	ML models
13	Collaboration	Human-AI teaching	Hybrid AI
14	Training	AI literacy tools	Simulation AI
15	Policy Support	AI governance tools	Decision AI
16	Ethics	Explainable AI	XAI
17	Security	Privacy AI	Secure ML
18	Content Creation	AI generators	LLM
19	Engagement	Smart classroom	Sensor AI
20	Decision Support	Predictive models	Data mining
21	Inclusion	Accessibility AI	Adaptive algorithms
22	Professional Development	AI training	e-learning AI
23	Smart Education	Integrated AI systems	Hybrid ML
24	Evaluation Research	Acceptance models	TAM / UTAUT
25	Future systems	Multimodal AI	Deep learning

Theoretical Models Comparison

The majority of the literature compares various theoretical frameworks applied to explain teacher acceptance of AI technologies, and the most commonly used frameworks are Technology Acceptance Model, UTAUT, Theory of Planned Behavior, and Diffusion of Innovation. The findings indicate that perceived usefulness, perceived ease of use, enabling conditions, and social influence are the best predictors of AI adoption in various educational settings [3,48-50]. Nevertheless, newer research builds on these models with the addition of several variables like AI literacy, AI trust, ethical issues, institutional support, and teacher self-efficacy that are more representative of the diverse AI-assisted teaching contexts nowadays. It is also suggested that the adoption behavior in K-12 education cannot be explained by any single model because teachers need to refer to not only to personal attitude but also to curriculum requirements, school policies, and student needs. The usage of hybrid models that unite psychological, technological and organizational variables thus is increasingly prevalent in AI adoption and digital pedagogy research. These results imply that in future research, there is the need to go on the creation of systematic frameworks that have the potential to explain acceptance in quickly dynamic smart systems of education.

Examples of AI Tools in K-12 Education

The literature reviewed represents several categories of AI tools that impact the acceptance of the artificial intelligence in teaching by teachers, such as intelligent tutoring systems, generative AI tools, adaptive learning platforms, learning analytics dashboards, conversational AI, and automated

assessment systems. Mathematics and science Intelligent tutoring systems are often deployed in mathematics and science learning as a way of offering step-by-step instructions, whereas adaptive learning platforms tailor learning to student achievement [5,8,51-52]. The appearance of generative AI and large language models have brought new uses of the models in lesson planning, content creation, and feedback generation, which in many ways influence the way teachers perceive the usefulness of AI. Learning analytics enable an educator to track the progress of students with the help of data visualization, whereas conversational AI and virtual assistants can supplement student support during the hours outside the classroom. Predictive analytics and automated grading systems are also common to save on the administrative workload. The outcomes show that educators will be more willing to use AI solutions that will not decrease their professional freedom, which explains the significance of human-AI collaboration and teacher-centered design in developing educational technologies.

Techniques of Teacher Acceptance of AI

According to the literature review, research methods to study teacher acceptance of AI tools in K-12 education are numerous: surveys, experiment, interview, classroom observation, and data-driven analytics. Quantitative research usually involves the use of questionnaires being constructed on the basis of Technology Acceptance Model and UTAUT constructs, whereas qualitative research involves interview and case studies being used to explore the perception of the teachers. The recent studies also rely more on machine learning, educational data mining, and predictive analytics to support the analysis of massive data received through the digital learning platforms. Mixed methods are also used frequently because it enables researchers to unite statistics analysis with in-depth awareness of teacher experiences. Learning analytics and multimodal data studies are better predictors of teacher-AI system interactions in actual classes, as opposed to self-reported views. The findings indicate that the adoption trends in AI-mediated instructional settings are becoming imperative to comprehend when more sophisticated tools are used in analyzing educational data.

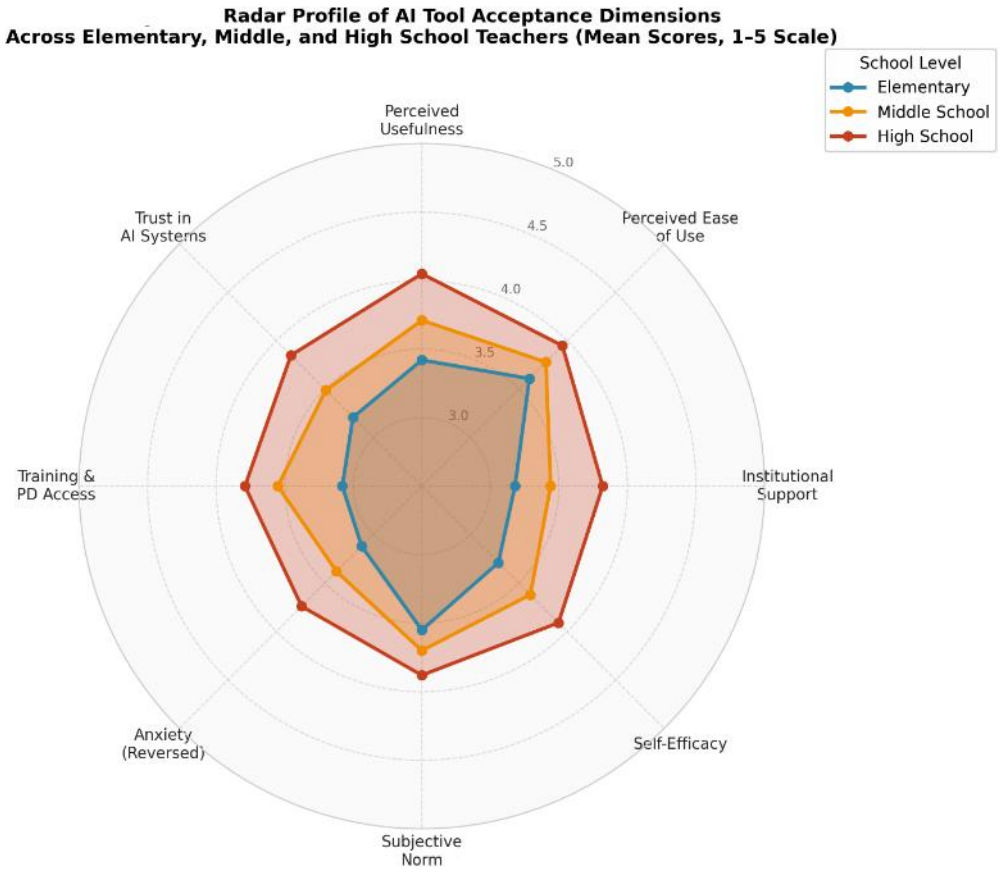

Fig. 4 Radar/Spider Chart

Fig. 4 Shows Compares eight acceptance dimensions (Perceived Usefulness, Ease of Use, Institutional Support, Self-Efficacy, Subjective Norm, Anxiety, Training Access, Trust) across three school levels on a 1–5 scale. High school teachers consistently score higher across all dimensions; Elementary teachers score lowest on Training Access and Institutional Support, highlighting infrastructure gaps for targeted interventions.

Issues that Threaten the Adaptation of AI Tools by Teachers

Among the most recurring results throughout the literature, the existence of several barriers hindering the adoption of AI in the K-12 educational process can be mentioned despite the presence of complex technologies. The most common challenge is the absence of AI literacy and professional training, as it is a situation where teachers are unsure of how to make effective use of AI tools [9,53-55]. Inadequate infrastructure, technical issues, and institutional underpinnings also decrease the level of acceptance especially in less resourceful schools. The growing significance of responsible AI and ethical AI in education is reflected in recent research mentioning such ethical issues as data privacy, algorithmic bias, academic integrity, and over-reliance on automation in their study. Another reason why teachers are worried about the use of AI systems is that they can lead to the loss of professional autonomy or more work without adequate design. The findings show that the acceptance is enhanced in case teachers are provided with clear guidelines, training programs, and are given an opportunity to be involved in designing AI-assisted teaching systems. These results show that technological innovation is not a sufficient condition to make the implementation of Artificial Intelligence in K-12 education a success.

Opportunities Generated by AI Implementations in K-12 education

Nevertheless, regardless of these difficulties, the literature describes numerous opportunities that AI adoption has brought to the education sector, which have a positive impact on how teachers accept AI tools. Personalized learning, real-time feedback, automated assessment, and better classroom management can be facilitated by the AI technologies, and teachers can devote their attention to the higher-level levels of instruction [56-58]. AIs assist in differentiated instruction in intelligent learning settings, and various learning needs can be accommodated more easily in that case. Generative AI tools are useful in assisting teachers to generate materials more rapidly, and learning analytics present them with informed information to make decisions. These benefits lead to the rise of interest towards AI-assisted learning, online pedagogy and learning innovation. Research also indicates that teachers who show positive results when utilizing AI tools are more willing to use them in the future, which implies that early success is also significant in terms of adoption. The findings suggest that with appropriate alignment of AI applications with curriculum objectives and training, they may contribute to the improvement in teaching performance and student learning, and thus have become a significant part of digital transformation in education to come.

AI in School Education Implementation Strategies

To achieve success in the implementation of Artificial Intelligence in K-12 education, the efforts of teachers, school administrators, policymakers, and technology developers have to be coordinated. Literature indicates that schools that have established implementation plans which may comprise training programs, technical support and ethical rules record high levels of teacher acceptance and AI adoption. The importance of professional development programs devoted to AI literacy, digital competence, and pedagogical integration is also specific since it enables teachers to learn more about the advantages and disadvantages of AI tools. It is also advised to use pilot programs and implementation in a gradual process, to enable the teachers to get experience before implementation in large scale. Another strategy that has been effective is the collaboration of the teacher and developers since they make sure that AI-built systems address actual classroom requirements. These findings indicate that technology is only one of the many aspects that should be implemented but also the establishment of trust, confidence and institutional preparedness, without which sustainable integration of AI-supported teaching systems would not occur.

Effects of AI Tools on Teaching Practice and Teaching Roles

Artificial intelligence technologies are altering the role of teachers in K-12 education, who will not teach but facilitate, guide, and make decisions based on data. In the classroom with AI, learning analytics dashboards, adaptive learning platforms, and automated evaluation tools are used by teachers to track their students and modify instruction [59-60]. The change necessitates the acquisition of new abilities associated with AI literacy, digital pedagogy, and human-AI interaction, which are associated with the attitude towards AI tools. Research has indicated that educators who perceive AI as a collaborative technology instead of a replacement are more prone to using new technologies. Nonetheless, the shift of responsibilities is also problematic, and teachers have to reconcile technological advancement with the teaching accountability. The findings showed that effective AI integration requires keeping teacher autonomy during AI utilization to improve instructional performance, and teacher-based AI design and accountable AI implementation are also important.

Regulations and Policies that will affect the use of AI in education

The institutional regulations and government policies are influential in determining the acceptance of artificial intelligence tools by teachers, as they dictate the potential ways of applying AI in classrooms. Most nations have implemented reforms that facilitate the use of digital learning, AI-based curriculum implementation, and smart learning, which motivate schools to embrace emerging technologies. Simultaneously, laws regarding data protection, privacy, and ethical AI affect the perception of the safety and reliability of AI systems by the teachers. When schools are structured to have policies and guidelines, the level of teacher acceptance is likely to be higher since an educator will be more empowered to use AI tools. Another theme brought out in the literature is the need to involve teachers in policymaking since their experience in practice would allow them to establish realistic and workable policies. The findings indicate that a combination of policies ensuring innovations and protection to students will be key to the success of AI application in K-12 education in the long term.

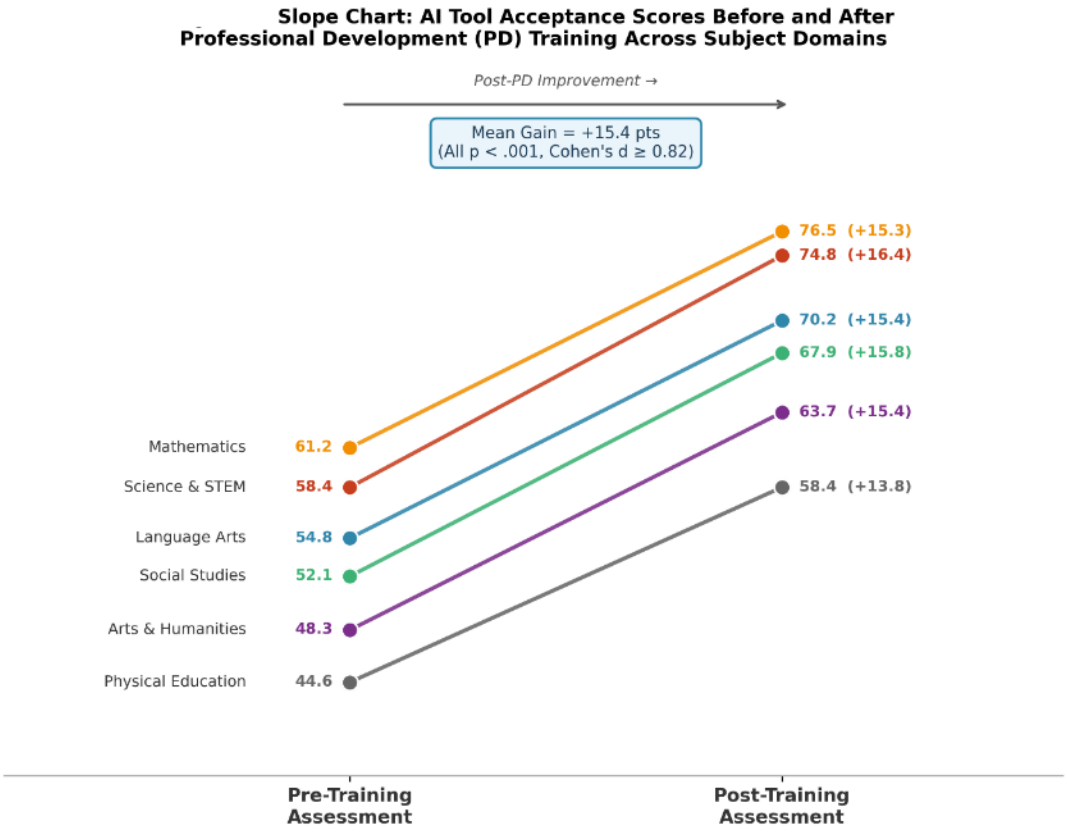

Fig. 5 Slope Chart (Pre–Post PD)

Fig. 5 Explains Tracks AI acceptance score changes before and after Professional Development (PD) training across six subject domains. Science & STEM teachers show the highest gain (+16.4 pts);

Physical Education the lowest (+13.8 pts). All gains are statistically significant ($p < .001$, Cohen's $d \geq 0.82$), supporting PD interventions as a key adoption driver.

The Future of the research on AI acceptance by teachers

The last trend that was found in the literature is the future research directions in terms of AI tools acceptance by teachers working in the K-12 education sector that will be based on new technologies and the changes of educational requirements. The fast development of generative AI, multimodal learning analytics, explainable AI, and human-AI collaboration models will necessitate alternative theoretical frameworks beyond the accepted theories [9,61-63]. The future research will probably focus on the processes of building trust in AI among teachers, the transformation of the professional identity in the conditions of AI assistance, and the ways in which the adoption process can be enhanced by means of training. To comprehend the transformation of the acceptance with time when teachers will become more experienced with AI tools, longitudinal research will be required. An increased need to integrate education, psychology, computer science and policy studies with interdisciplinary research approaches is also observed in order to tackle the multidimensional issues of AI integration. According to the findings of the considered literature, the future of Artificial Intelligence in K-12 education will rely on not only technological advancements but also the possibility of teachers, institutions, and policymakers to collaborate in order to provide responsible, efficient, and sustainable AI-powered teaching and learning spaces.

4. Discussion

The results of this thorough literature review prove that the multidimensional nature of the phenomenon of acceptance of the use of artificial intelligence tools in the K-12 education of teachers is determined by the technological, psychological, pedagogical, and institutional reasons. In the reviewed studies, the growing use of Artificial Intelligence in Education, generative AI, adaptive learning, learning analytics, and smart tutoring systems has considerably widened the opportunities of digital pedagogy and smart learning environments, and the successful integration of AI into teaching practices is highly dependent on the willingness and confidence of teachers in AI [64-66]. It is always demonstrated that the main mediator of technology adoption in classrooms is a teacher and their attitudes towards usefulness, ease of use, and pedagogical value are the key determinant of the successful use of AI in the classroom. Technology Acceptance Model and UTAUT models remain useful in explaining the adoption behavior, but recent research highlights that it is necessary to include more variables including AI literacy, ethical awareness, institutional support, and human-AI collaboration, which represents the sophistication of the current educational technology ecosystem. Teachers are becoming more eager to admit the advantages of AI in terms of personalization, assessment, and administrative efficiency, although that is not the only aspect as they also raise issues of reliability, transparency, and the effects of automation on the professional autonomy, making both perceived opportunities and perceived risks impact the acceptance.

One more critical theme identified in the results is the increasing variety of AI tools used in K-12 education that encompasses generative AI tools, conversational agents, predictive analytics, automated grading tools, and multimodal learning analytics dashboards. They are used to support personalized learning, real-time feedback, and based on the data to guide the process of decision-making, allowing teachers to operate in more complex classrooms more efficiently. Nevertheless, the literature indicates that educators will be willing to accommodate AI technologies when the tools are perceived as an aid tool instead of a substitute of human instruction. The idea of human-AI partnership has thus come to the centre of the recent research with the focus that AI is not to diminish the role of the teacher but to optimize his or her capabilities. It is also pointed out in the studies that the attitude of the teacher towards AI can be better with the proper training and with the positive results at the initial stage of implementation. The development of new AI creation and large language models has further improved the rate of interest towards AI adoption, but it has also raised questions on academic integrity, content truthfulness and ethical use, particularly in schools where educators should guarantee that learning is carried out responsibly. These results indicate that the future of AI-assisted instruction will rely on the trade-off between innovation and pedagogical control and professional responsibility.

Another strong predictor of teacher acceptance is also found in the review as the professional development and AI literacy. It is found that teachers with greater digital competence, self-confidence in using technology, and knowledge of the concepts involved in AI are more eager to apply AI technologies to their instruction [6,67-69]. On the other hand, inadequate training, inadequate infrastructure and uncertain institutional policies are other significant impediments to implementation within most school systems. One of the studies has shown that well-organized training, participative workshops, and teacher-driven design approaches have a significant effect on the acceptance of AI-based learning technologies. Moreover, the governmental policy and school administration are also instrumental in defining the adoption patterns. Educational systems with explicit guidelines, ethical structures, and technical materials are more likely to be successfully implemented, and this fact proves that the implementation of AI in K-12 education is not merely a technological concern but also an organizational and policy one. The findings also indicate that the engagement of teachers in the development and analysis of AI tools enhances trust and mitigates resistance, which emphasizes the value of participatory strategies in educational change.

Table 2. Challenges, Opportunities, and Future Directions

Sr. No.	Issue / Challenge	Opportunity	Future Direction
1	Low AI literacy	Training programs	AI certification
2	Lack of trust	Explainable AI	Transparent systems
3	Data privacy	Secure AI	Privacy-aware AI
4	Bias in AI	Ethical design	Responsible AI
5	Technical barriers	Infrastructure	Smart schools
6	Resistance to change	Teacher support	Change management
7	Workload concerns	Automation	AI assistants
8	Policy gaps	Regulations	AI governance
9	Skill gaps	Professional development	Continuous training
10	Cost issues	Open AI tools	Scalable AI
11	Curriculum mismatch	AI curriculum	AI integration
12	Lack of guidance	Frameworks	Standards
13	Reliability issues	Testing	Robust AI
14	Over-dependence	Balanced use	Human-AI model
15	Ethical risks	Guidelines	AI ethics
16	Student misuse	Monitoring	Safe AI
17	Teacher fear	Collaboration	Co-teaching AI
18	Complexity	User-friendly AI	Simplified tools
19	Inequality	Inclusive AI	Universal access
20	Limited research	More studies	Longitudinal research
21	Training gaps	Workshops	AI PD
22	Lack of data	Analytics	Big data AI
23	Cultural factors	Localization	Context AI
24	Evaluation issues	Metrics	AI evaluation
25	Future uncertainty	Innovation	Hybrid education

Ethical and social concerns also emerge as a topical theme of recent works, especially with the emergence of responsible AI, explainable AI, and AI ethics in education. One of the most important factors that influence the readiness of teachers to implement these technologies is the issue of data privacy, the possibility of algorithmic bias, and the misuse of AI-generated pieces of content [70-73]. These issues are particularly relevant in K-12 education since teachers are expected to provide integrity, equal treatment and respect of education norms among students. Empirical research indicates that acceptance is higher in case AI systems are transparent, controllable and goal-oriented in pedagogy. The creation of explainable AI-interfaces and teacher-focused algorithms is thus seen to be key to gaining confidence in AI-based teaching systems. Meanwhile, the literature mentions the necessity of the policies that will ensure the safety of student data and permit the innovation, since overprotecting AI integration can lead to the restriction of the latter. The results of this study suggest that the next step of research should be to create an AI tool that is not only technically well-elaborated but also ethically acceptable and meaningful in terms of the pedagogy.

The other important outcome is the change in teacher roles in AI-powered learning settings, as the educators become more of facilitators, mentors, and decision-makers and less instructors. Learning analytics, adaptive learning, and automated assessment systems can help teachers to track student progress in a more efficient way, but new competencies connected with the interpretation of data and AI management are also required. According to research, educators inclining towards regarding AI as a collaborative partner are more likely to embrace it and teachers fearing replacement or lack of control are more prone to resist AI adoption. Such a change of professional identity shows the value of lifelong learning, interdisciplinary teams, and curriculum redesign to train teachers in AI enhanced education. The findings also show that generative AI will also transform the way of teaching as it allows the automatic creation of content and interactive learning, which means that an educator needs to acquire critical evaluation as a skill to control the quality and reliability of AI-generated materials.

The identified direction of the future studies in the literature highlights the necessity of longitudinal studies, cross-cultural comparisons, and interdisciplinary strategies that can help to better understand how AI tools are accepted by teachers in K-12 education. Such emerging technologies as multimodal learning analytics, reinforcement learning tutors, and AI-driven curriculum design will necessitate new theoretical models that go beyond traditional acceptance models [19,25]. The researchers also emphasize that it is necessary to conduct research regarding the role of AI in the quality of teaching, the results of student learning, and the well-being of teachers in the long run. Besides that, an increasing need to investigate the impacts of national policies, school leadership and socio-economic factors on adoption within various educational contexts. The findings indicate that the future of AI in Education will be based on how the educators, policymakers, and developers can collaborate to develop transparent, ethical, and teacher-focused AI systems that can enhance innovation without compromising the human values of education.

5. Conclusion

This systematic review of the existing literature, which has been conducted in accordance with the PRISMA 2020 systematic review framework, offers a synthesized view of the current situation in the research on the acceptance of artificial intelligence tools in K-12 education, showing both the dynamism of the field and the multiplicity of factors that have an impact on its implementation. The integration process of recent researches proves that the implementation of Artificial Intelligence in Education, generative AI, adaptive learning systems, intelligent tutoring systems, and learning analytics is gaining momentum across the world, although its successful deployment is predominantly hinged upon the perception of teachers, their readiness, and the institutional support. The review establishes that the classic theoretical models, including Technology Acceptance Model (TAM) or Unified Theory of Acceptance and Use of Technology (UTAUT) are still prevalent at explaining the choice of teachers, and perceived usefulness, perceived ease of use, social influence, and facilitating conditions have persistently been found as the most powerful predictors of AI adoption. Nevertheless, modern studies continue to expand these models by adding new constructs like AI literacy, algorithmic trust, ethical awareness, data privacy issues, and explainable AI as evidence of the changing nature of educational technologies and the growing role of responsible AI integration in the school setting.

The other critical conclusion of this review is the fact that the determining factor of acceptance of AI-based educational tools is teacher readiness and professional development. The research also indicates repeatedly that educators with increased digital competence, AI self-efficacy, and pedagogical confidence are more open to using AI-assisted teaching, personalized learning space and smart classroom technologies. On the other hand, a training deficit, the inadequacy of technical infrastructure and the hesitation to embrace AI as pedagogical value are the primary impediments to adoption in numerous K-12 settings. The literature also discloses that institutional and policy level support also plays a significant role in influencing acceptance because schools that have well established AI policies, ethical codes and well-organized training programs have greater rates of successful integration. Besides that, recent studies highlight the increased importance of the human-AI collaboration in education, in which teachers are not substituted by intelligent systems but collaborate with intelligent systems to facilitate the quality of instructional services, the accuracy of assessment, and the engagement of

students. The review also reveals that the adoption of AI tools is never dependent on technology factors only but psychological, social, and ethical factors as well. The issues of student data privacy, AI algorithm bias, academic integrity, and excessive dependence on automation largely influence the readiness of teachers to use AI in classroom practice. These issues are especially relevant to the K-12 school setting where teachers need to weigh innovations, responsibility, student safety, and pedagogical integrity. Consequently, in recent literature, there is a growing need to develop ethical AI models, explainable AI, and transparent decision-making tools that would enable teachers to have the upper hand on the learning process but receive support by AI.

In the future research, the results show that more empirical research should be conducted on teachers within K-12 setting since much of the current research continues to be situated within the context of higher education. Longitudinal studies on the development of AI acceptance over time, particularly with generative AI and large language models increasingly becoming a part of daily teaching practice, are also needed [6,8]. Further research needs to examine the correlation between AI literacy, teacher identity, pedagogical innovation, the influence of national education policies, cultural factors, and school leadership on the adoption of AI needs to be studied. Moreover, a research integrating educational technology, psychology, data science, and policy studies will be crucial to find out what AI means in the long term in the school education. Finally, based on the literature, it is evident that the future of Artificial Intelligence in K-12 Education is not only based on technological advancement but also on how much the teachers achieve trust, competence, and pedagogical confidence in the utilization of AI tools. Enhancing teacher training, codes of ethics, institutionalization, and research implementation plans will be significant in making sure that AI serves as a constructive influence in the area of educational innovation, personalized learning, and sustainable digital transformation in schools. The further investigation of the teacher acceptance, AI literacy and responsible AI implementation will thus be a primary research focus in the years to come.

Author Contributions

SS: Conceptualization, study design, analysis, data collection. SK: Methodology, software, resources, visualization, writing original draft. MK: Conceptualization, writing original draft, writing review and editing, and supervision.

Conflict of interest

The authors declare no conflicts of interest.

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