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An Inquiry into the Integration of Generative Artificial Intelligence in K-12 Education: Unveiling Educators' Perceptions, Practices, and Professional Development Needs

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Abstract

This study investigated the current perceptions and instructional practices of K-12 educators, in one midwestern state, regarding the use of generative artificial intelligence (AI) in their classrooms. Data were collected using a survey instrument designed to gather information on educators' experiences, practices, and concerns related to generative AI integration. By examining educators' integration of AI technologies, their confidence in utilizing AI tools, and their apprehensions, this study aims to identify the professional development and training needs essential for effective AI adoption within the classroom. Findings indicate that although educators perceive generative AI as a promising tool for enhancing teaching and learning, limited training and concerns about ethics and student dependence prevent confident classroom integration. By identifying the professional development gap, the study informs school districts, teacher education programs, and policymakers about where to invest resources to support teachers.

Key Words:

Artificial Intelligence, Education, Professional Development, Teacher Perceptions, Teaching Practices

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Introduction

Considering more than 20 years of investigations of artificial intelligence (AI) in education, researchers have found that AI can offer educators opportunities to improve efficiency and effectiveness in planning, implementing, and evaluating teaching and learning (Martin et al., 2023). However, research also indicates that educators are unprepared for implementing and refining AI enhanced curriculum for K-12 students (Chiu & Chai, 2020). As AI technologies become more integrated into K-12 education, educators' perceptions and preparedness are pivotal to successful AI implementation. While some educators may see AI as a resource to enrich student engagement, others may feel uncertain about how to incorporate it effectively or may lack the necessary training to do so. Shah (2023) warned that "excessive focus on AI in the classroom may lead to an unhealthy dependence on technology" (p. 7) impacting students' critical thinking and problem-solving skills. Yet, students will soon be "entering a profoundly changed labor market" and need to be well-prepared to do so (Wang & Lester, 2023).

Understanding educators' current engagement with AI and the barriers they face is essential for designing professional development programs that foster confidence and competence in successful AI integration. This study explores educators' perceptions and practices in regards to using generative AI in the classroom and identifies their professional development needs to utilize these technologies effectively. The findings of this study aim to inform educational leaders and university teacher preparation programs so they may better support educators in navigating the evolving landscape of AI-driven education and help shrink the gap in research bridging possibilities with practice.

Literature Review

Historical Context for AI in Education

The integration of artificial intelligence (AI) in K-12 education represents a significant advancement in the pedagogical landscape, with the opportunity to transform traditional teaching and learning methodologies. To understand this evolution, it is essential to examine the historical context of AI, both as a technological innovation and as a tool or resource within the educational setting. The concept of artificial intelligence dates back to the mid-20th century, when the terms "thinking machines" and "artificial intelligence" were coined by Alan Turing and John McCarthy (Zhang & Aslan, 2021; Saha et al., 2024). This period marked the beginning of AI as a field of study, characterized by the development of foundational algorithms and theoretical models. The 1960s and 1970s witnessed the creation of early AI programs, such as ELIZA, a natural language processing program considered to be one of the first chatbots (Simone, 2018), and DENDRAL, "one of the first large-scale programs to embody the strategy of using detailed, task-specific knowledge" for chemical analysis (Lindsay et al., 1993, p. 210). These early developments contributed to the groundwork for more sophisticated AI applications.

In the realm of education, AI's journey began in earnest during the 1980s and 1990s with the advent of intelligent tutoring systems (ITS), although not without controversial issues (Nwana, 1990). ITS, such as the pioneering SCHOLAR program, utilized AI to provide personalized instruction and feedback to students. ITS demonstrated the potential of AI to adapt to individual learning needs, thereby enhancing educational outcomes. Concurrently, the development of cognitive tutors, like those from the Carnegie Learning Initiative, further showcased AI's capability to support and improve student learning in subjects such as mathematics (Corbett et al., 2001). Cognitive tutors can analyze student progress and provide

tailored feedback, allowing the student to focus on areas needing improvement. These systems compare the student's actions to a cognitive model, searching for errors and misconceptions.

The turn of the 21st century brought significant technological advancements, including the proliferation of the internet and the advent of machine learning and data analytics. These innovations enabled more dynamic and interactive educational technologies. Key milestones include the development of Massive Open Online Courses (MOOCs), which leveraged AI to manage and personalize learning experiences for large numbers of students globally (Baturay, 2015). Additionally, the introduction of AI-powered adaptive learning platforms, such as Knewton and DreamBox, marked a significant step forward in tailoring educational content to individual learners' needs in real-time (Dutta et al., 2024).

In recent years, AI's role in education expanded with the integration of natural language processing (NLP), computer vision, and advanced data analytics. NLP enables computers to interpret and respond to human language through things like speech recognition. The field of computer vision enables machines to interpret images and videos for tasks like facial recognition. Advanced data analytics allows machines to identify patterns in large data sets, driving data-driven decision-making. Initiatives such as Pearson's partnership with IBM's Watson Education and Google's AI in Education have explored new frontiers in personalized learning, automated assessment, and predictive analytics (Williams & Eynon, 2020).

The historical development of AI in education underscores a trajectory of increasing sophistication and impact. From early expert systems to contemporary adaptive learning technologies, AI has continually evolved, offering new possibilities for enhancing teaching and learning. From ELIZA's rudimentary rule-based programmed responses to ChatGPT's sophisticated neural networks for probabilist reasoning, AI can now significantly enhance educators' ability to personalize instruction, streamline administrative tasks, and support student engagement. As we delve into the current practices, perspectives, and professional development needs of K-12 educators in integrating AI, it is crucial to recognize these historical milestones and their contributions to the ongoing transformation of education.

Evolving State of AI in Education

AI-powered platforms use adaptive algorithms to tailor educational content to the individual learning needs of students. Woolf et al. (2013) share that AI-based instructional software also "connects learners together, provides access to digital materials, supports decentralized learning, and engages students in meaningful ways" (p. 66). These platforms continuously assess student performance and adjust the difficulty and type of content presented to optimize learning outcomes. ITS, such as Carnegie Learning's Mathia, provide one-on-one tutoring by using AI to mimic human tutor behaviors (Fancsali et al., 2023). These systems offer personalized feedback and guidance, helping students understand complex concepts and practice problem-solving skills.

AI-driven automated grading and assessment tools like Gradescope and Turnitin use natural language processing and machine learning to grade assignments, provide feedback, and detect plagiarism (Batane, T., 2010; Singh et al., 2017). These tools can save educators time and provide consistent, objective assessments of student work. Chatbots and virtual assistants like Google's Dialogflow and Microsoft's Azure Bot Service are used in educational settings to answer student queries, provide homework assistance, and offer administrative support. These virtual assistants can be integrated into school websites and learning management systems to improve accessibility and efficiency. AI systems can also analyze large volumes of student data to identify patterns and predict future performance. Tools like BrightBytes and Illuminate

Education help educators make data-informed decisions to improve student outcomes and address potential issues before they become significant problems.

AI-driven language learning apps such as Duolingo use adaptive learning techniques to personalize language learning lessons and provide real-time feedback on pronunciation and grammar (Munday, 2017). Applications like these have the potential to help students practice language skills at their own pace, making language learning more engaging and effective. AI technologies assist in creating inclusive classrooms by offering tools tailored for students with special needs. For example, speech recognition software and communication applications help students with speech and language impairments, while predictive text and reading assistance tools support students with dyslexia or other learning disabilities.

Though these forms of AI have been embedded in educational tools and impacting teaching and learning for many years, it was in 2022 that generative AI became readily available to individual teachers and students as part of the general public. Generative AI is able to create "fresh content spanning images, text, and music, imbued with a semblance of human-like creativity and diversity" (Noroozi et al., 2024). OpenAI released a free version of ChatGPT, a generative AI tool, to the public and by January of 2023 ChatGPT had over a million users (Clark, 2023) including teachers and students of all ages and grade level.

Pedagogical Implications

Constructivist theories, such as those proposed by Jean Piaget and Lev Vygotsky, emphasize that learning is an active process of constructing meaning through interaction with the environment (Waite-Stupiansky, 2022). AI technologies can support constructivist learning by providing interactive and adaptive learning environments where students can explore concepts, receive feedback, and engage in authentic problem-solving activities. AI-powered personalized learning platforms align with constructivist principles by allowing students to build their own understanding and knowledge through experiences tailored to their individual needs and learning pace. These platforms have the potential to support active learning and engagement, key tenets of constructivist theory.

Behaviorism, a learning theory associated with the work of B. F. Skinner, emphasizes the connections between stimuli and rewards which can be found within AI educational tools. ITS and automated grading tools reflect behaviorist approaches by providing immediate feedback and reinforcement, helping students to form correct associations and improve their skills through practice and repetition (Krishna et al., 2024). Connectivism, introduced by George Siemens, posits that learning is distributed across networks of people, resources, and technologies. AI tools can facilitate connectivist learning by connecting learners to vast amounts of digital resources, providing personalized recommendations based on learners' interests and preferences, and enabling collaboration and knowledge sharing in online learning communities. AI tools also support Universal Design for Learning (UDL) principles by offering multiple means of representation, engagement, and expression. AI tools provide personalized support that accommodates diverse learning styles and needs, ensuring that all students have equal access to the curriculum.

As the potential for AI to support multiple learning theories and principles becomes more evident, the focus shifts to the critical role of professional development in equipping educators to leverage these tools effectively. Current professional development practices must evolve to align with the dynamic nature of generative AI technology, addressing not only technical skills but also pedagogical strategies that foster active, student-centered learning environments supported by generative AI. The next section examines the

state of professional development for generative AI integration, identifying gaps and opportunities to empower educators in transforming their instructional practices.

Professional Development for AI Integration

High-quality professional learning is essential for educators as they grow in their understanding and use of generative AI tools. However, support for teachers and school leaders varies greatly depending on the district and school. While some districts have dedicated personnel to support generative AI implementation, others offer minimal or no structured support systems. As districts plan to support teachers, several key areas must be considered to ensure professional learning is intentional, ongoing, relevant, and addresses critical concerns around security.

Professional learning plans must be purposeful and start small (Bouffard, 2024a). Teachers are often overwhelmed by the sheer volume of new technological tools, including the newest AI tools available, so it is more effective to focus on two or three tools at a time, during professional development sessions. Educators need to receive deep, hands-on training where facilitators model tool usage and educators experiment with incorporating at least one tool into their classrooms. It is critical to support professional development efforts by encouraging educators to share successes, challenges, and lingering questions. Additionally, allocating time for educators to develop specific AI-enhanced lessons tailored to their own classrooms allows educators to personal lessons for their students. Recognizing that not every teacher will be ready to use AI daily or across all subjects is also an important aspect of designing professional development events. Implementation takes time, but once educators begin to see the benefits of integrating AI for themselves and their students, they may be motivated to learn more (Bouffard, 2024a).

Effective professional learning is not a one-time event. Given the rapid pace of AI advancements, professional learning must be ongoing and intentionally sustained (Bouffard, 2024a). Districts should pair professional learning sessions with job-embedded opportunities for application, such as through PLCs, department teams, or grade-level planning. These collaborative spaces allow teachers to adapt whole-group learning about AI tools to the specific needs of their content and students. As Bouffard (2024b) highlighted, the best professional learning occurs when educators come together, identify shared goals, and collaboratively discuss their learning. This collective approach ensures AI tools are implemented thoughtfully and purposefully.

For professional learning to be effective it must be content focused (Darling-Hammond et. al., 2017). For educators, this means professional learning must be focused on enhancing their instructional strategies to improve their students' learning. Generative AI tools can be used to enhance teaching by enabling teachers to create meaningful, relevant lessons that improve student learning outcomes (Bouffard, 2024a). Training should, therefore, focus on helping teachers identify when AI tools enhance learning and when they should be restricted. When considering students' use of AI, strategies like the traffic light protocol, red (no AI use), yellow (teacher permission required), and green (encouraged AI use), can help teachers establish boundaries for AI use in their classrooms (Bouffard, 2024a). Educators must also be reminded that AI is a tool to enhance not replace the human element of teaching (Smokoroski & Dickson, 2024). Thoughtfully guiding teachers to determine when AI supports or detracts from learning will lead to more relevant and impactful use of these tools.

The integration of generative AI tools in classrooms brings both opportunities and risks therefore professional learning must address the ethical and safety concerns surrounding AI as well. Teachers and

students alike must understand the importance of protecting privacy and avoiding the use of personal data when utilizing AI tools (Ruiz & Tsai, 2024). For instance, when creating lessons or materials, teachers should never input student names or identifying information into AI systems. As Ruiz and Tsai (2024) emphasize, districts must establish clear guidelines and policies to mitigate risks while supporting educators' use of AI. Explicit training on these issues ensures that both teachers and students use AI responsibly and safely. Finally, addressing the digital divide is about more than internet access or software, it is about educators' capacity and opportunity to apply AI effectively (Chase, 2024). Supporting every educator with targeted, grade-level and content-appropriate AI tools ensures that both teachers and students benefit from this technology (Balderas, 2024).

Though research identifies the value in high-quality professional learning opportunities and the benefits of integrating AI in education, there remains a gap in this understanding and current practice. Zhang and Aslan (2020) suggest that there is a "critical gap" between what educational AI tools can do and how they are actually being implemented in the classroom (p. 1). As previously mentioned, prior research in AI education is lacking the importance of the classroom educators' perspectives. Classroom educators' perspectives "undergirds their sense-making of the emerging AI technology" which impacts curriculum development and delivery (Chiu & Char, 2020, p. 1).

Methodology

Research Design

Surveys are an appropriate tool when researchers wish to "assess trends or characteristics of a population; learn about individual attitudes, opinions, beliefs and practices" and when we hope to "identify the needs of a community" (Creswell & Guetterman, 2019, p. 413). This study employed the use of a cross-sectional survey to investigate current K-12 educators' use of generative AI in their classrooms and to explore their perspectives on generative AI integration, specifically what they believe to be the benefits or drawbacks. To guide this investigation, the following research questions were developed:

1. What are the primary concerns of educators regarding the implementation of generative AI in their teaching practices?
2. What do educators perceive as the benefits of using generative AI in their teaching practice?
3. What types of professional development do teachers identify as necessary for effective integration of AI in their classrooms?

The survey instrument was created by the researchers with a holistic approach (Dillman et al., 2009) to gather data on AI-related classroom activities and educators' perceptions on the impacts on teaching and learning as well as challenges. Survey questions were developed with attention to clarity, unambiguous wording, and respect for participants, with the goal of eliciting meaningful responses. The survey received approval from an Institutional Review Board and included a consent form. Participants were only able to proceed to the questionnaire after providing their consent to voluntarily participate. Survey responses were anonymous and data collected were securely stored as password-protected files requiring multi-factor authentication for access.

The survey instrument included a combination of multiple choice, Likert-scale, and open-ended questions, allowing for both quantitative and qualitative insights. The survey was delivered electronically to current K-12 educators, representing the sampling frame, across one mid-western state. Educators' school email

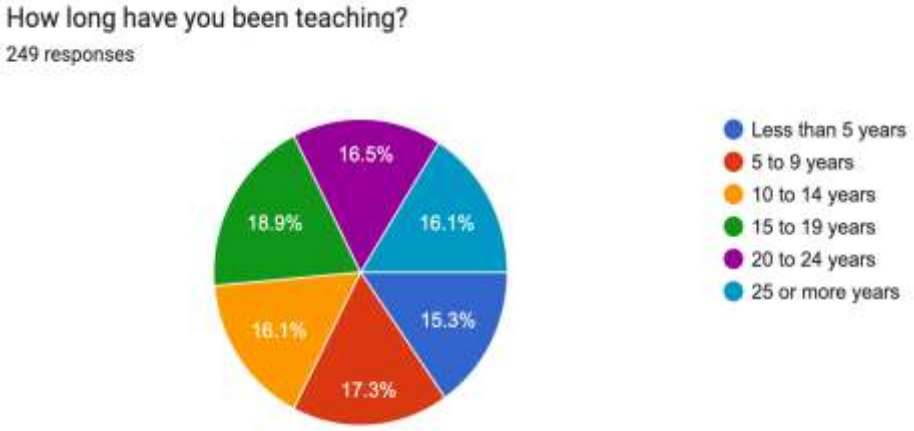
addresses were gathered from the state Department of Elementary and Secondary Education. Emails were used to conduct a probabilistic sampling of educators representative of the population (Creswell & Clark, 2011) and were placed into a random selection generator. Many school email addresses were found to be invalid or inactive, resulting in 249 valid responses. This sample is sufficient to support reliable interpretation, using guidelines cited by the Gallup Organization and Qualtrics survey platform, as it corresponds to a 95% confidence level with an approximate margin of error of ±6%. Recipients of the survey represented various grade levels, subject areas, and school contexts (i.e., rural, urban). There was no participation incentive provided to participants. The survey response rate was lower than anticipated, which may introduce a nonresponse bias, potentially limiting the extent to which findings can be generalized (Dillman et. al., 2009). Transferability of the findings may also be limited as participants in this study may not fully represent all educators across all contexts and geographical locations. Descriptive quantitative analyses were conducted to summarize data. Qualitative responses were analyzed using established coding procedures, beginning with a preliminary exploratory analysis, followed by the coding process and aggregating similar codes into themes (Creswell & Guetterman, 2019).

Findings

The survey was fully completed by 249 educators representing rural (46.8%), suburban (37.1%) and urban (16.1%) school districts across the state. Educators responding to the survey were representative of various experience levels with the greatest representation from 15 to 19 years and the least representation of less than 5 years. Figure 1 displays the distribution of teaching experience by percent of total responses.

Figure 1

Distribution of Respondents' Teaching Experience



Responses representing multiple grade levels, including those who teach sixth grade through twelfth grade and those who teach grades kindergarten through twelfth grade, were received. The greatest number of responses were received from secondary educators. Table 1 displays the frequency distribution of grade level responses. The 249 participants represented multiple disciplines including English and foreign languages (50), mathematics (45), general education (30), science (27), social studies (21), special education (16), career and technical education (13), agriculture (6), art (6), speech (5), reading (5), music

(4), counseling (4), library sciences (3), physical education (2), and computer science (1). Eleven respondents did not provide information regarding their primary discipline.

Table 1

Distribution of Respondents Teaching Assignments

Grade Levels Taught	Count	Percent
Secondary	127	51.0%
Elementary	70	28.1%
Middle School	34	13.7%
K-12	8	3.2%
6-12	7	2.8%
No Response	3	1.2%

To gain a better understanding of current classroom practices, participants were asked to respond to selected-response questions related to formal training and implementation. Of the 249 respondents, 75.8% indicated that they had not received any formal training in utilizing AI tools for educational purposes. Those indicating they had received formal training were also asked to provide additional information about that training. Of the 24.2% who indicated that they had received formal training, only 2.2% believed the training was effective in preparing them to integrate AI into their teaching methods. Sample responses related to professional development experiences included:

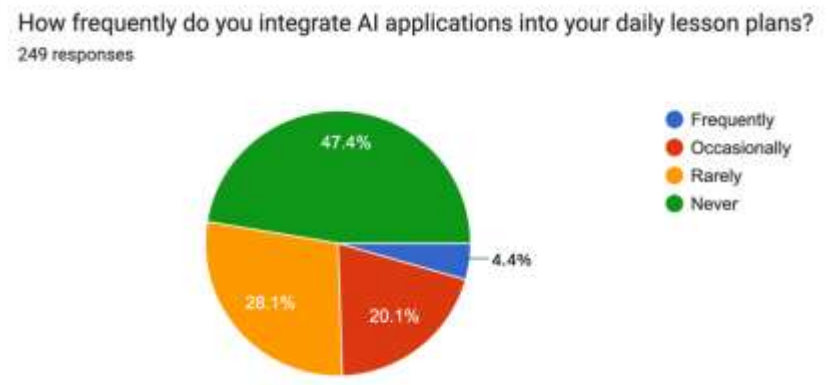
- "I have only received a brief overview offered by our Librarians."
- "District introduced different AI programs but that was all. Zero time for us to practice and apply any information."
- "I have not received any training nor have I heard anything about using AI tools for educational purposes, however I am extremely curious about this."
- "District [provided training] but it was a choice to participate in the session-it was not mandatory."
- "We had a PD on this a couple of times. No in-depth training."

Although 25.4% of respondents believe AI enhances student engagement in the learning process and 16.9% indicated that they actively encourage their students to use AI, 75.5% indicated that they rarely or never integrate AI applications into their daily lessons. Figure 2 displays additional frequencies of integration by percent of responses. Additionally, 69.7% do not feel confident in addressing potential ethical or privacy issues associated with the use of AI in education. Furthermore, 70.4% of respondents indicated that they believe formal AI training is needed in teacher education programs. Sample responses regarding participants' current hesitation to integrate AI applications included:

- "Children [are] not learning critical thinking or problem solving through their own abilities."
- "Students can become dependent on their "robot friend" to meet the challenges of academic work."
- "I don't know enough about privacy concerns."
- "Other than search engines, I am not sure how to use AI successfully in my English class."
- "Time involved in learning and teaching new methodology."
- "Ethics, plagiarism, & students abusing AI generators to the extent that they are unable to complete assignments without them."
- "I don't really see it as necessary. It may be useful in some classes or assignments but does not seem to be something [that] is needed."
- "Being able to get enough professional development and support to the teachers."
- "I get nervous about the unknown. I don't feel confident with it, so it is tricky to feel comfortable with it in my classroom."
- "I think it will make teachers reliant on the AI to develop lessons and ideas and will become less skilled at creating lessons on their own."
- "Lack of training, I want to make sure I can effectively show benefits and explain what is unacceptable."
- "At this point, they [educators] get together and try to piece-meal a solution to the students overwhelmingly using the technology for every single assignment--with reckless abandon."

Figure 2

Frequency of Integrating AI Applications



Participants were also invited to respond to open-ended questions related to their perceptions of generative AI integration in education. Responses were systematically analyzed, using the Atlas software program, to organize and inductively code responses by recurring concepts then reducing codes to greater themes (Creswell, 2013). A frequency count was also used to interpret the results.

When asked what educators perceive to be academic performance improvements associated with the use of AI in K-12 education, 30.7% identified instructional efficiency and resource management, 17.8% identified student engagement and personalized learning, 16.8% identified writing and other academic skills

improvement, 8.9% believe AI can support accessibility and inclusivity, 7.9% believe that AI could hinder the development of critical thinking skills, 6.9% recognized AI for reducing teacher workload by automating tasks, and 5% were unsure of AI's impact or expressed mixed feelings based on limited exposure to or experience with AI tools. Finally, 14.9% of responses focused on concerns, rather than performance improvements, about students becoming overly reliant on AI and ethical issues related to plagiarism.

Respondents were also asked what they considered to be primary concerns for educators regarding the implementation of AI in their teaching practices. Academic dishonesty was identified as a primary concern by 62.3% of respondents. A loss in ability to think critically, solve problems independently, learn essential skills, and be creative was identified by 21.8% of respondents. Another 10.9% of respondents identified ethical concerns related to AI-generated content quality, accuracy and potential misuse of information as a primary concern. Additional responses (5%) specifically referred to concerns regarding educators' own readiness to integrate AI into teaching practices and potential resistance to change among colleagues.

Participants were invited to identify professional development needs for effective integration of AI in their classrooms. From the responses, three major themes emerged: general awareness; specific skills, techniques and advanced applications; policy planning. Respondents indicated that a basic introduction to AI and its potential applications in education would help lay the foundation for identifying responsible ways to begin integration efforts. Learning about the basic benefits, purpose, relevance and risks related to classroom use would help educators better understand their role in modeling appropriate use. Respondents indicated a need for opportunities to explore how AI can be used effectively, what the recent advancements in AI bring to the classroom, and how AI can help in specific subject areas (i.e., mathematics).

The next level of professional development requested is supportive of practical sessions on specific tools and platforms. Respondents would like hands-on training so that they can practice integrating AI for curriculum enhancement in specific subjects. They would also like to practice techniques for identifying AI-generated work and to understand best practices in preventing misuse (i.e., cheating, plagiarism). Respondents indicated a desire to learn to utilize AI for complex tasks, to challenge students, improve instructional strategies, and teach students to use AI responsibly. Respondents would also like professional development specifically dedicated to understanding ethical considerations, developing school policies, privacy and protection for minors, and planning for future advancements in education.

Finally, participants were asked how they would prefer AI-related training to be incorporated into existing professional development programs. Responses were again analyzed for recurring concepts and then sorted into five themes. One of these themes exposed an uncertainty or lack of knowledge regarding professional development components and was therefore removed from the categories. Another theme focused again on the educators' specific concerns for ethical use of AI by students rather than on professional development models and was removed. The three remaining concepts and sample quotes are identified in Table 2.

Table 2

Incorporating AI-related Professional Development

Question: How do you suggest incorporating AI-related training into existing professional development programs?	
Recurring Concepts	Sample Responses
Attitudes and Readiness	"Offer it as one of multiple optional PD hours. Not everyone wants to use it or thinks it's beneficial."
	"Not initially, older teachers will try to buck the trend, while newer teachers will become over reliant upon it."
	"I don't know because I'm so against it."
	"I would offer it to teachers who are interested but do not require everyone to attend."
	"Target groups of interested teachers. If a teacher is resistant then they will likely ignore the training. Once it begins to be adopted by colleagues more teachers will want to wade in."
	"Note that students aren't waiting for us. And, teachers cannot be prevented from using AI. The greatest mistake we can make at this juncture is to do nothing; if you don't want to deal with AI, your best option is to retire!"
	"Just dive in and be ready for some folks to resist and be prepared with relevant info and examples to show the benefits."
	"Something else must be dropped from the PD program before adding new AI training."
Implementation Strategies	"DO NOT FRONT LOAD with a DISCUSSION ABOUT AI!!"
	"Having the district do more than just telling us about programs and giving us zero professional development time to actually work out solutions."
	"I think first of all language is important so we have to make this technological language accessible to teachers who are often short on time and high on tasks."
	"Follow protocols related to andragogy and make sure that it is relevant and outcome oriented with a focus on implementing and piloting it gradually for a few lessons first."
	"At conferences, give teachers the opportunity to explore and see how AI could be used in their subject/grade-specific classroom. Teachers would need opportunities to become familiar and comfortable with new technologies."
	"I think incorporating AI into what you're already doing makes sense. For example, my district has a big emphasis on equity. So, examining AI with an equity lens is INTERESTING and fits into what we're already doing."
	"Even with the introduction of new technologies, teachers still need to see how it can be incorporated into a lesson, or replace old pedagogies to create or enhance new ones."
	"Free in-district courses to teachers on PD days so they do not have to give up anymore of their personal time or planning time."
	"Teachers (and library-media specialists) telling others what has worked (or could work) for

	them."
	"Training should be broken down for each subject. I imagine AI training should look very different for science class than English class."
	"Examples of its use and how it undergirds the learning during carousels."
	"PLC-specific work then cross-departmental collaboration."
	"Let teachers share what they're doing with each other."
	"Providing workshops to allow teachers to explore AI tools."
	"We need specific sites and uses, time to develop them with someone helping and watching and assisting."
	"It should be addressed along with curriculum and how to supplement current standards and practices."
Practical Approach and Tools	"Giving teachers time and space to play with tools and use their creativity."
	"Need hands on approaches to see what AI can do and guidance in how to integrate with students."
	"Schools should choose 3-4 [AI applications] and teach us to use them. Then make sure we have those resources in the school system."
	"Focus on identifying the tools students might use to cheat on assignments."
	"Having an expert come in and teach some handy tools."
	"Discuss how to use AI to teach my specific subject."

Discussion

Although some educators recognize the potential benefits of using generative AI tools, such as enhancing lesson plans to elicit student engagement and supporting personalized learning, a substantial proportion report rarely or never integrating AI tools into their daily instruction. The lack of confidence in addressing ethical and privacy concerns underscores the need for training that equips educators to navigate these challenges responsibly. Concerns about academic dishonesty, loss of critical thinking skills, and ethical considerations further illustrate the hesitance among educators to fully embrace AI without proper guidance.

The open-ended responses provided additional perspectives on the perceived benefits and risks of AI in K-12 education. Educators highlighted AI's potential to improve instructional efficiency and foster personalized learning, while continuing to express apprehensions about its impact on critical thinking skills and student reliance on AI. These findings suggest that while educators see value in AI, they also recognize the importance of balancing its use to mitigate unintended consequences.

The findings of this study reveal key insights into K-12 educators' perceptions, experiences, and professional development needs regarding AI integration in education. With survey responses from a diverse group of educators across rural, suburban, and urban settings, this research highlights both the challenges and opportunities associated with leveraging AI tools in any classroom. The respondents, representing a wide range of disciplines, revealed a significant lack in formal AI training. A majority

reported no formal training in AI applications for education, and among those who had training, only a small fraction considered the training effective.

These findings point to a critical need for comprehensive and meaningful professional development tailored to the practical needs of educators. Participant responses emphasize a strong desire for structured, multi-level professional development addressing general awareness, specific skills, and ethical considerations. Educators expressed preferences for professional development that is practical, hands-on, and tailored to their unique teaching contexts. They also emphasized the need for ongoing support, collaborative opportunities, and resources to stay updated on advancements in AI. In alignment with Darling-Hammond et al.'s (2017) research, participants' responses emphasize the importance of professional development that is contextually relevant, active, collaborative, and sustainable. Notably, many respondents expressed interest in exploring how AI could address specific disciplinary challenges, such as its applications in mathematics and other subjects. Participant responses indicate not only a desire to understand AI but also to be able to use it effectively and responsibility to enhance teaching and learning, suggesting that AI training should be integrated into pre-service teacher education as well as in-service teacher training.

Conclusion

The integration of AI in K-12 classrooms in the United States (U.S.) is diverse and multifaceted, reflecting potential advancements in educational technology and a paradigm shift in pedagogical practices. In 2023, the U.S. Department of Education Office of Educational Technology published a report identifying three reasons to address AI in education: achieving educational priorities, concerns about trust and transparency, and the scaling of unintended or unexpected consequences. This report also included recommendations for preparing and supporting teachers, identifying potential challenges teachers might face.

By aligning with established educational goals, theories and frameworks, AI technologies have the potential to enhance both teaching and learning by providing targeted support and enabling data-driven decision-making, ultimately contributing to more effective and inclusive educational experiences (Chiu, 2023) and addressing educational gaps. Classroom educators and teacher educators carry the responsibility of aligning AI with research-based pedagogical practices to effectively implement AI tools and prepare K-12 students for careers requiring AI skills. For classroom educators and teacher educators to successfully meet this tremendous challenge, they must have access to high-quality professional development. Just as successful physicians, attorneys, chemists, engineers, and other professionals continue to grow in knowledge and skills, so do educators.

The growing demand for AI education is evident and without clear guidance misunderstandings can arise, as highlighted by a recent lawsuit in Massachusetts. A Hingham High School student faced significant academic and reputational consequences for using AI in a history project, sparking debates about the need for consistent and transparent policies regarding AI in classrooms (Langreo, 2024). This case underscores the urgency of providing educators with the resources and high-quality training needed to integrate AI effectively and equitably into their teaching practices. Classroom educators are seeking more opportunities to learn about artificial intelligence in education and this request for support should not be ignored.

Future research should build on these findings by examining how educators' perceptions and practices evolve as generative AI technologies become more embedded in classroom education. Longitudinal studies could explore how sustained professional development influences teachers' confidence and instructional use of AI tools over time. Comparative studies across rural, suburban, and urban contexts would also

provide valuable insights into equity of access and implementation. Finally, research exploring the integration of AI literacy into teacher preparation programs would help identify effective strategies for preparing both pre-service and in-service educators to navigate the ethical, pedagogical, and practical challenges of AI-enhanced teaching.

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