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Demystifying Artificial Intelligence (AI) for Early Childhood and Elementary Education: A Case Study of Perceptions of AI of State of Missouri Educators

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Abstract: Artificial intelligence (AI) and its impact on society have received a great deal of attention in the past five years since the first Stanford AI100 report. AI already globally impacts individuals in critical and personal ways, and many industries will continue to experience disruptions as the full algorithmic effects are understood. However, with regard to education, adopting in disciplines remains limited largely to Computer Science and Information Technology in postsecondary education. Recent advances with technology are especially promising for their potential to create and scale personalized learning for students, to optimize strategies for learning outcomes, and to increase access to a more diverse population. Research has confirmed that the current use of AI in education (AIEd) leads to positive outcomes, including improved learning outcomes for students, along with increased access, increased retention, lower cost of education, and decreased time to completion. Future uses of AI will include the following: enabling engaging and interactive education anytime and anywhere; personalized AI mentors that will help students identify and reach their goals; and mass-personalization that will allow AI to be tailored to each student's learning style, level, and needs. Yet with all the potential benefits that AI and machine learning (ML) may provide students, there remains a general reticence to adopt this technology because of misconceptions and perceptions that elementary educators will need expensive equipment, robust support from IT, or to retool and learn programming or coding. As such, this study seeks to identify current perceptions early childhood, and elementary educators in the state of Missouri, USA have towards AI in general; the policies, training and existing resources in districts regarding technology in general and AI in particular; relative comfort with technology and willingness of educators to adopt new technologies for classroom instruction; and perform a needs assessment for necessary infrastructure, including reliable internet access, hardware and software. Results indicate a broad acceptance and willingness to adopt AI in daily activities and classroom instruction, but barriers to entry were identified as lack of resources and training.

Keywords: Artificial Intelligence, AI, Machine Learning, Early Childhood Education, Elementary Education

1. Introduction

The rapid evolution of artificial intelligence (AI) and machine learning (ML) has led to its integration into various aspects of our lives, from image recognition to language understanding (Lu, 2019). In just a few decades, AI systems have progressed from primitive, remote-controlled devices to advanced models capable of generating photorealistic images and interpreting complex language (Spector, 2006; Wang et al., 2019). As AI development accelerates, driven by increasing investments and faster computational training, its potential impact on society grows (Walters & Murcko, 2020; Williams, Park, & Breazeal, 2019). The wide range of applications of AI can have both positive and negative consequences, making it essential for educators, researchers, and the public to understand and engage in discussions about the technology's future. The continuous advancement of AI-related metrics and publicly available resources will facilitate essential discussions and guide decisions regarding the responsible application of AI across different fields (Baum, 2020; Holmes & Porayska-Pomsta, 2022). This includes the integration of AI in early childhood education, which is becoming increasingly important as educators teach about and utilize AI within their classrooms (Uunona & Goosen, 2023).

Indeed, with the swift proliferation of generative AI technologies, such as ChatGPT-3 and ChatGPT-4 from OpenAI, enhancing STEM education before college enrollment has become increasingly vital (Cooper, 2023). For instance, in the United States, less than half of the students who enter science, technology, engineering, and mathematics (STEM) undergraduate curricula as freshmen will graduate with a STEM degree (Louten, 2022). There is even greater disparity in the national STEM graduation rates of students from underrepresented groups with approximately three-fourths of minority students leaving STEM disciplines at the undergraduate level (Lisberg & Woods, 2018; NCES, 2019). Given how central these technologies will be in our life and work in the future, it is imperative that educational administrators and institutions ensure a broad and comprehensive approach be taken starting in early childhood education and scaffolded using an authentic STEM model through to high school graduation to prepare the next generation with the skills and knowledge they will need to thrive (Kilty & Burrows, 2022). Furthermore, given the lack of diversity represented in the current AI community, and how such homogeneity leads to unintended algorithmic bias, ensuring a more concerted effort be made to support underrepresented populations will be necessary to ensure responsible and ethical AI is developed, deployed and evaluated in the future (Blanzeisky & Cunningham, 2022).

The significance of incorporating artificial intelligence (AI) in K-12 education is highlighted by research, which indicates that successful learning outcomes for students can be achieved through a unified set of requirements that involve all stakeholders in the planning, development, and implementation processes (Barrot et al., 2022; Ramirez, 2023; Trotsko et al., 2019; Wolf 2022). Before contemplating any curriculum revisions, the barriers to entry and adoption from educators' perspectives must be considered. The issue becomes more pressing in light of the current crisis of teacher attrition in educational fields, compounded by the pandemic and characterized by a considerable number of educators leaving the profession (Cooper & Martinez Hickey, 2022; Matthews et al., 2022). Introducing an extra layer of perceived bureaucracy and workload as a result of AI to their existing job requirements might well exacerbate the situation (Li & Yao, 2022).

As such, investigating early childhood and elementary educators' perceptions of AI and potential barriers to adoption can significantly benefit the education domain and scholarly research and avoid further avoidable losses to the profession (Chiu & Chai, 2020). First, by discerning educators' attitudes and perceptions towards AI, researchers can identify potential barriers to adoption and develop interventions to address them as similar studies have confirmed (Midgett, Doumas, & Buller, 2022). This understanding and insight may enhance AI adoption in early childhood and elementary education, potentially leading to improved student outcomes and increased efficiency in the classroom. Second, analyzing educators' perceptions can inform the development of AI tools and systems that cater better to their needs and preferences once those are identified (Li & Wang, 2022). Improving the effectiveness and usability of AI tools may facilitate more substantial adoption, providing greater benefits for students. Third, exploring educators' perceptions can contribute to the broader educational sphere by offering insights into educators' reception and adoption of new technologies (Garcia-Sheridan, 2023; Zou, Li, & Wijaya, 2022). Such insights can inform strategies for supporting the adoption of other innovative technologies in education and contribute to a more comprehensive understanding of how technology can be employed to strengthen teaching and learning (Sanusi et al., 2022).

Therefore, in order to gain insight into how AI is perceived, is currently used and may potentially be deployed in early childhood and elementary education, educators across the state of Missouri, USA were surveyed. The study also examined the policies, training, and existing resources in districts regarding technology in general and AI in particular; the relative comfort with technology and the willingness of educators to adopt new technologies for classroom instruction; and performed a needs assessment for necessary infrastructure, including reliable internet access, hardware, and software. Analysis of the data collected as part of this study suggests that educators are not averse to the idea of using AI in the classroom. On the contrary, they are optimistic and predominantly supportive of its integration and instead feel that adoption would be cost and time prohibitive. Furthermore, the study argues that generative AI tools have the potential to address two issues concurrently, offering an opportunity for meaningful integration of AI. Firstly, responsible usage of generative tools can prepare future generations for conscientious global citizenship and understand the ethical and algorithmic biases possible if the technology is misused (Chan, 2022). Secondly, generative AI can automate numerous time- consuming and laborious tasks that educators must perform beyond interaction with students, such as data entry and report submission, thus alleviating these burdens (Evans et al., 2022). However, before recommendations on how these strategies may be operationalized, the initial step of understanding the present perceived and actual pain points of educators is vital to engage all stakeholders.

2. Methodology

This section outlines the methodology employed in this mixed-methods study, which aimed to identify and evaluate the current perceptions of early childhood and elementary educators in the state of Missouri, USA, towards AI. The study also examined the policies, training, and existing resources in districts regarding technology in general and AI in particular; the relative comfort with technology and the willingness of educators to adopt new technologies for classroom instruction; and performed a needs assessment for necessary infrastructure, including reliable internet access, hardware, and software. The sample consisted of 59 educators from across the state in rural, suburban, and urban districts.

Survey Instrument

The survey instrument employed in this study was designed to gather both qualitative and quantitative data. The questionnaire included questions related to educator demographics, institutional classification, experience with technology, and perceived barriers to the adoption of AI in their districts. Some of the key questions from the survey are outlined below:

- Does your district have policies on the use of artificial intelligence (AI) and its use?
- Does your district have a policy to teach technology in an ethical and responsible way?
- In general, how comfortable are you with technology?
- As part of your teacher-prep program, how much training did you get on technology in general?
- How open would you say you are to learning new technology?
- Have you personally used any of the following generative artificial intelligence (AI) tools?
- What is your current access to technology and technology training?
- What is your general perception of Artificial Intelligence (AI) technology?
- Do you feel as though you would need a great deal of resources to implement AI into your classroom?
- Do the majority of your students have access to the internet in their homes?
- How familiar are you with free tools that may be available to you that would allow you to utilize AI technologies with little to no training required?
- How familiar are you with free tools that may be available to you that would allow you to utilize AI technologies with little to no training required?

The survey instrument was designed to provide comprehensive insights into the educators' perspectives and experiences regarding AI and technology in their classrooms. In this study, the validity of the survey was established through previously validated literature from the literature review that noted the difficulties in integrating emerging technologies and AI in particular into K-12 education. The literature review provided a comprehensive overview of the challenges and barriers to integrating AI in K-12 education, including the lack of resources, training, and infrastructure. This information was used to design the survey questions, which were carefully crafted to address these challenges and barriers, providing a comprehensive understanding of the factors that contribute to the adoption and integration of AI technologies in K-12 education. Educators were also contacted directly via their district email addresses. By addressing a wide range of topics, including district policies, personal experiences, access to resources, and familiarity with AI tools, the study aimed to create a holistic understanding of the factors that contribute to the adoption and integration of AI technologies in K-12 education.

3. Result and Discussion

Demographics

The demographics of the participants were between 25 and 44 years of age with 30% being 25- 34, 30% 35-44, 15% 55-64, and 5% 18-24. 96.67% identified as female, 1.67% male, and 1.67% preferred not to say. 95.08% identified as White/Caucasian, 3.28% as Black or African American, and 1.64% as Native Hawaiian or Pacific Islander. The levels at which they taught included mostly early childhood and elementary school with 18.64% First Grade, 16.95%

Kindergarten, 15.25% Fifth Grade, 11.86% Third Grade, 8.47% PreK, 6.78% Second Grade, 6.78% Seventh Grade, 5.08% Eight Grade, 1.69% Sixth Grade, and 1.69% Twelfth Grade. Notably, no participants identified as teaching Ninth-Eleventh Grades.

Institutional Classification

Regarding the institutional information, 96.55% of those represented were public with 3.45% private. 66.67% were rural with 26.67% suburban and only 6.67% being urban. Of these, only 10% had policies on the use of artificial intelligence (AI), 66.67% of respondents were unsure, and 23.33% did not (Figure 2). Additionally, 75.93% of institutions had a policy on the ethical and responsible way to teach technology with 20.37% unsure, and only 3.70% claiming they did not have any policy on this (**Figure 1**).

The survey revealed that only 10% of the institutions had policies on the use of AI. However, 75.93% of institutions had a policy on the ethical and responsible way to teach technology. The discrepancy between these two figures suggests that while institutions recognize the importance of responsible technology use, they may not yet have considered the implications of AI specifically. As AI technologies become more prevalent, it is essential to bridge this gap and develop targeted policies for AI implementation.

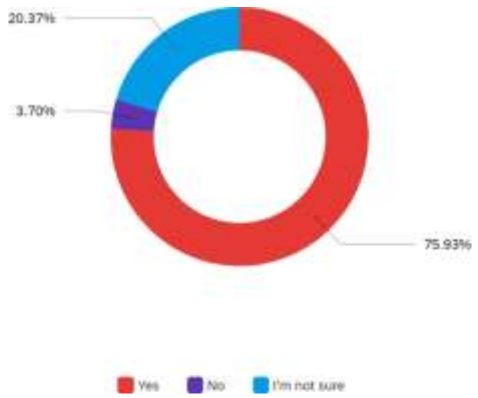

Figure 1. Existing District Policies on Teaching Technology in Ethical and Responsible Way

Technological Proficiency

The next series of questions related to the perceived level of comfort with technology and reported preparation in their education. First, educators were queried on their relative comfort level with technology in general. Overall, most reported being either somewhat or extremely comfortable with 57.41% selecting somewhat comfortable, 25.93% extremely comfortable, 14.81% somewhat uncomfortable, and 1.85% neutral. Significantly, no one reported being extremely uncomfortable (**Figure 2**). Interestingly, while the younger age groups (25 - 34 and 35 - 44) made up the majority of respondents, the overall comfort level with technology was not uniformly high across these age groups. This suggests that comfort with technology may not be exclusively linked to age, and other factors, such as exposure to technology and training, could play a significant role in shaping educators' confidence in using technology.

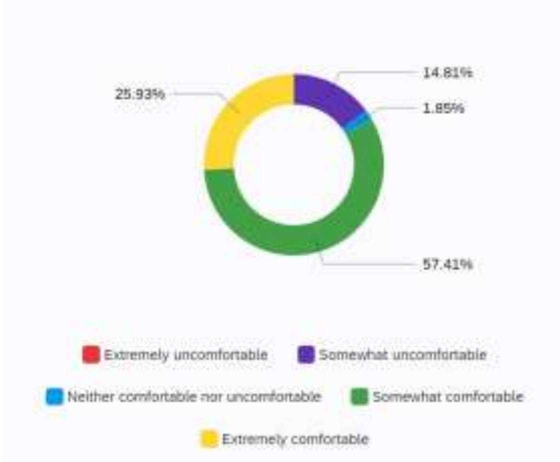

Figure 2. Level of Comfort with Technology in General

Preparation and Use

Next, training and preparation prior to their role in the classroom was considered with regards to technology. When asked how much training participants received as part of their teacher-prep programs, unfortunately, 41.51% stated only “a little,” 22.64% “none at all,” 24.53% a moderate amount,” while only 7.55% stated “a lot” and 3.77% “a great deal” **(Figure 3)**.

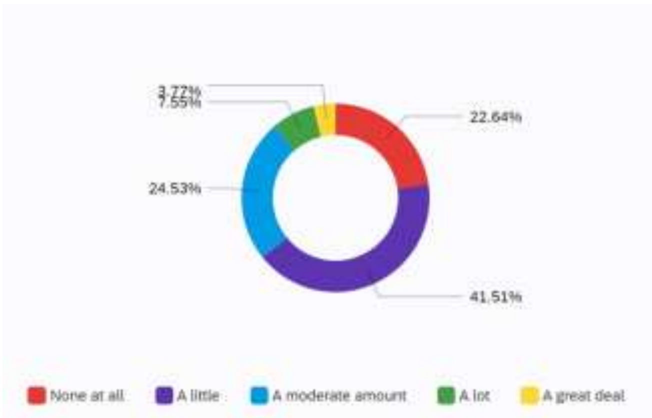

Figure 3. Amount of Training on Technology Received as Part of Teacher-Prep Programs

On the other hand, when asked how open participants were to learning new technology, an overwhelming majority responded positively. 55.56% indicated a high level of openneness, 35.19% a very high level, and only 7.41% slightly not open and 1.85% not open at all **(Figure 4)**. The next set of questions sought to determine the actual level of use teachers have had with AI tools in general. 81.48% stated they had not personally used any of the examples provided, including ChatGPT-3, Bard, DALLE-2, Midjourney, Crayion, even though an “other” category was also offered. Of the tools, the only clear standout was ChatGPT-3 at 11.11% use **(Figure 5)**. In order to address upskilling, participants were asked what current access to technology and technology training were available to them. 46.30% responded an average level of access was available with 24.07% responding good and 3.70% excellent. A minority reported poor or terrible levels of access at 22.22% and 3.70%, respectively **(Figure 6)**. The overwhelming majority of respondents (90.75%) indicated a high or very high level of openness to learning new technology. However, 81.48% of respondents had not used any of the AI tools mentioned in the survey. This apparent disconnect between openness to learning and actual experience with AI tools highlights the need to provide educators with opportunities to explore and experiment with AI technologies in a supportive environment.

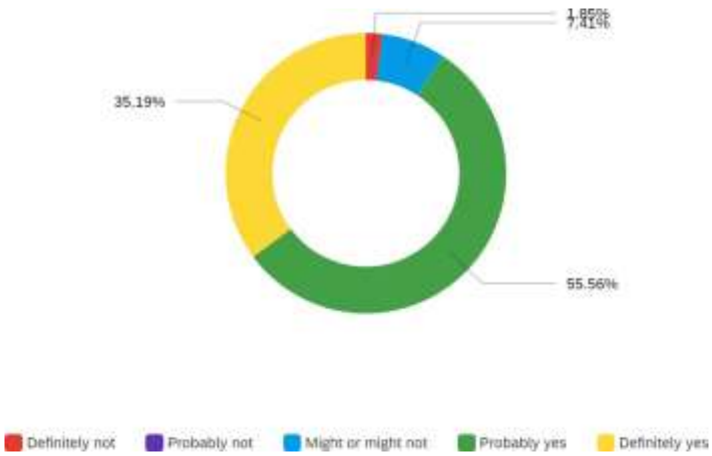

Figure 4. Educator Openness to Learning New Technologies

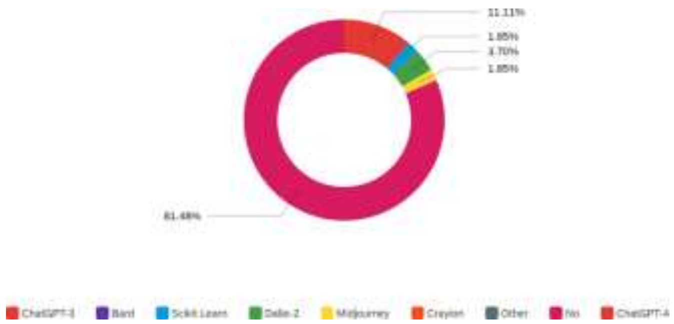

Figure 5. Educator Experience with Types of AI Tools

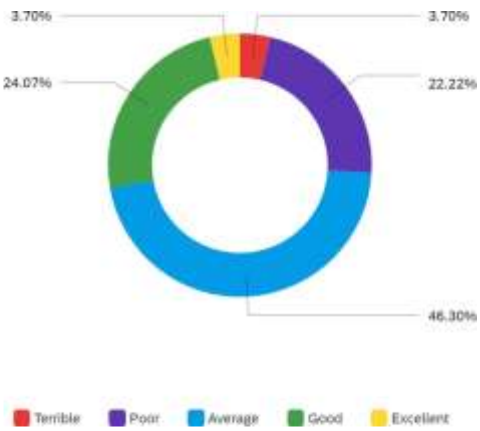

Figure 6. Educator Current Access to Technology and Training

Perceptions of AI

Next, the perceptions of AI and its use in the classroom was broached. When asked what their perception of AI technology in general was, 54.72% were neutral, 26.42% somewhat positive, 16.98% somewhat negative and 1.89% extremely so **(Figure 7)**. Therefore, while participants were more positive in general in their views of AI, none selected extremely positive. When asked what kinds of resources were believed to be needed to implement into their classrooms, 53.70% believed a great deal would be required with 25.93% unsure, and 20.37% believing only a few resources would be needed **(Figure 8)**. While the majority of respondents had a neutral to somewhat positive perception of AI, more than half (53.70%) believed that a great deal of resources would be needed to implement AI in their classrooms. This perception could act as a barrier to AI adoption, as educators may be discouraged from attempting to integrate AI technologies due to concerns about resource requirements. Addressing these concerns through awareness campaigns, training, and support can help alleviate these apprehensions and facilitate AI adoption.

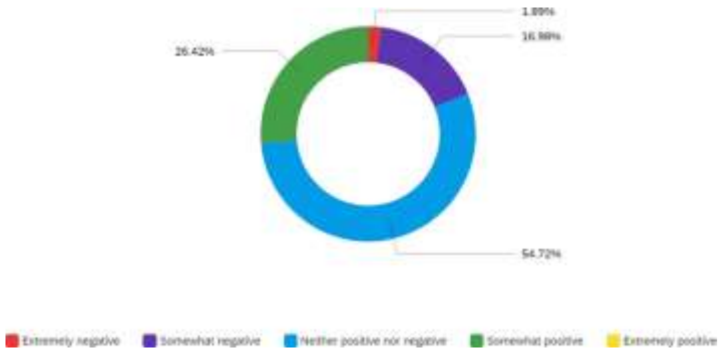

Figure 7. Educator General Perception of Artificial Intelligence (AI) Technology

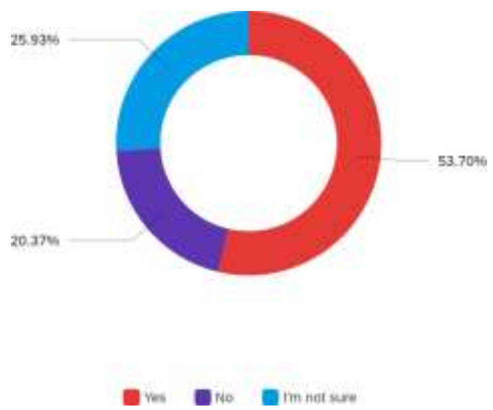

Figure 8. Educator Perception of Resources Required to Implement Artificial Intelligence (AI) in Classrooms

Infrastructure and Integration

Considering the logistics of integration, the next set of questions dealt with access and infrastructure. First, participants were asked if their students had access to reliable internet at their homes. 53.85% responded yes, but that it was not always reliable, 34.62% said they did not and 11.54%, yes, they did **(Figure 9)**. Next, teachers were asked if they were familiar with the free tools that could be used with little or no training. 35.19% were unsure, with 29.63% claiming they did not and 22.22% probably not familiar. Only 12.95% said they were probably familiar and none responded in the definitive **(Figure 10)**. Finally, a free response asked for elaboration on their previous response and almost unanimously, respondents indicated they were not familiar with any of the tools.

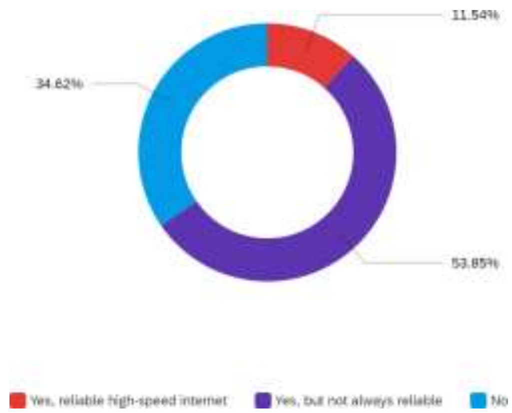

Figure 9. Student Access to Reliable Internet at Home

The results show that a significant portion of respondents (25.92%) reported either poor or terrible access to technology and technology training. Moreover, 34.62% of educators indicated that their students did not have reliable internet access at home. These findings underscore the importance of improving access to technology and infrastructure to ensure that all students can benefit from AI-driven learning experiences.

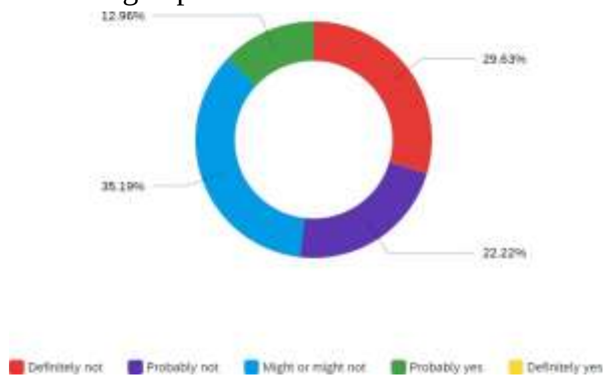

Figure 10. Educator Familiarity with Free Tools Requiring Little to No Training

4. Conclusions

Teachers occupy a central position in the success of teaching and learning processes; their active involvement is crucial to maintain effectiveness (Trotsko et al., 2019). While there have been few studies to determine the perceptions of integrating AI into early childhood and elementary classrooms, the results of this study support initiatives that prepare teachers for AI learning, ultimately aiming for its effective implementation in schools, and demonstrate the openness and willingness of educators to do so. AI is seen as a crucial concept for all students, irrespective of their grade levels. The results highlighted gaps in AI policies, technology training, and awareness of AI tools among educators. To address these issues, several recommendations are proposed. In order to successfully integrate these emerging technologies, enhanced technology and AI training in teacher-prep programs need be provided along with continuous professional development opportunities for current educators. These measures will ensure that teachers are well-equipped to integrate AI technologies into their classrooms effectively. Next, increasing awareness of AI tools and resources through workshops, seminars, and hands-on demonstrations is crucial. As the study noted, most respondents were unaware of the potential applications of AI, availability, and ease of adoption. Therefore, the continued fostering of positive perceptions of AI among educators is necessary where the benefits of AI in improving teaching and learning outcomes are emphasized and any misconceptions or concerns that educators might have addressed. Of course, improving access to technology and infrastructure is vital, which includes providing reliable internet access, hardware, and software to ensure that educators can effectively integrate AI technologies into their teaching practices and offer students the necessary resources to benefit from AI-driven learning experiences. Lastly, it is recommended that schools and districts develop comprehensive AI policies that outline ethical and responsible practices for AI implementation in the classroom. These policies should address issues such as data privacy, algorithmic bias, and digital equity to ensure that AI technologies are employed in a manner that benefits all students.

By addressing these recommendations, schools and districts can create a supportive environment for the successful integration of AI technologies in K-12 education. This, in turn, will enhance teaching and learning outcomes and prepare students for a future increasingly shaped by artificial intelligence. For future steps, identifying resources and training programs is necessary to provide teachers with the skills to effectively incorporate AI into the classroom. This encompasses determining the most successful instructional methods and understanding the unique needs of diverse student groups. Furthermore, addressing potential data privacy concerns is essential when storing student information on proprietary servers like those used by OpenAI. Adherence to district policies, state-level Individual Education Acts, and HIPAA regulations is vital to protect student privacy and ensure ethical AI usage in the classroom. Collaboratively, stakeholders must establish clear guidelines and best practices for data storage and management, enabling seamless AI integration in education while protecting student privacy.

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