Diversitas Journal
ISSN 2525-5215
Volume 10, Issue 2 (Apr./Jun. 2025) p. 0588 – y
https://diversitasjournal.com.br/diversitas_journal

Improving Educational Outcomes: A Case Study Exploration of AI Applications in the Public School Setting

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ABSTRACT

Artificial intelligence (AI) is recognized globally as the science of making machines that can think deeply and comprehend things like humans. AI contributes a lot in different discipline areas, including education. This case study examines public school teachers' AI tools utilized as part of their pedagogy, perspectives on using AI tools, and how teachers overcome the challenges they face in using AI tools. Eleven (11) public school teachers participated in the study, utilizing a semi-structured interview guide to facilitate the data collection process. Using a thematic analysis, the study generates themes that serve as the answers to the inquiries. The study found that the participants utilized multiple AI tools for personalized learning, administration and instructional support, learning and literacy enhancement, and professional development. Also, participants believed that AI positively and negatively affected teachers and learners. These participants highlighted several difficulties that had negative consequences, even if AI tools had substantially contributed to their line of work. Ultimately, the study concluded that AI can enhance educational outcomes when implemented thoughtfully and strategically. Future research should continue exploring best practices, ethical considerations, and long-term impacts to ensure that AI is a tool for empowerment rather than a source of inequality. The Department of Education can harness AI to create a more dynamic, efficient, student-centered learning environment by embracing innovation while prioritizing student needs.

RESUMO

A inteligência artificial (IA) é reconhecida globalmente como a ciência de fazer máquinas que podem pensar profundamente e compreender coisas como humanos. A IA contribui muito em diferentes áreas disciplinares, incluindo educação. Este estudo de caso examina as ferramentas de IA de professores de escolas públicas utilizadas como parte de sua pedagogia, perspectivas sobre o uso de ferramentas de IA e como os professores superam os desafios que enfrentam no uso de ferramentas de IA. Onze (11) professores de escolas públicas participaram do estudo, utilizando um guia de entrevista semiestruturado para facilitar o processo de coleta de dados. Usando uma análise temática, o estudo gera temas que servem como respostas às perguntas. O estudo descobriu que os participantes utilizaram várias ferramentas de IA para aprendizagem personalizada, administração e suporte instrucional, aprimoramento de aprendizagem e alfabetização e desenvolvimento profissional. Além disso, os participantes acreditavam que a IA afetava positiva e negativamente professores e alunos. Esses participantes destacaram várias dificuldades que tiveram consequências negativas, mesmo que as ferramentas de IA tenham contribuído substancialmente para sua linha de trabalho. Por fim, o estudo concluiu que a IA pode melhorar os resultados educacionais quando implementada de forma cuidadosa e estratégica. Pesquisas futuras devem continuar explorando as melhores práticas, considerações éticas e impactos de longo prazo para garantir que a IA seja uma ferramenta para empoderamento, em vez de uma fonte de desigualdade. O Departamento de Educação pode aproveitar a IA para criar um ambiente de aprendizagem mais dinâmico, eficiente e centrado no aluno, adotando a inovação e priorizando as necessidades dos alunos.

ARTICLE INFORMATION

Article process:
Submitted: 02/27/2025
Approved: 04/15/202x5
Published: 05/10/2025

Keywords:
Artificial Intelligence, Personalized Learning, Professional Development, Department of Education, Philippines

Keywords:
Inteligência Artificial, Aprendizagem Personalizada, Desenvolvimento Profissional, Departamento de Educação, Filipinas

DOI: 10.48017/dj.v10i2.3345

Introduction

Artificial Intelligence (AI) is revolutionizing education by enabling teachers to understand and address each student's unique needs through real-time data analysis. This customization improves student engagement and ensures equitable access to high-quality education. AI tools can also enhance learning experiences by improving academic performance, motivation, engagement, and learning progression. Additionally, AI revolutionizes administrative work by providing predictive analytics, identifying students at risk, and facilitating interventions. For intelligent human decision-making in learning and teaching scenarios, artificial intelligence (AI) can instantly evaluate considerable information, including unstructured data, and find patterns or structures (Ifenthaler & Schumacher, 2023). Tools like data management platforms, virtual assistants, and automated grading systems streamline processes, freeing up teachers to focus on student interaction and instruction quality. Furthermore, AI tools can intensify learning experiences and student outcomes by improving academic performance, motivation, engagement, and learning progression (Xu, 2024). Thus, processes that previously needed much manual labor are streamlined by tools like data management platforms, virtual assistants, and automated grading systems. This frees up teachers from administrative duties so they may concentrate more on student interaction and the quality of instruction.

The use of Artificial Intelligence (AI) can significantly change and improve education around the world. In the Philippine education system, AI can enhance learning outcomes and support informed decision-making with data insights (Estrellado & Miranda, 2023). Despite the potential upside in using AI, the Department of Education (DepEd) Secretary Sonny Angara shared in an interview that the department is scrutinizing the possibility of crafting a policy standard on the responsible usage of AI in schools (Marcelo, 2024). Besides, the news article indicated that the secretary was also aware that this innovation is open to abuse or irresponsible use, such as cheating in an exam. Even the former DepEd secretary under Duterte's Administration, Leonor M. Briones, during the Third National Assembly of Education Leaders (NAEL) last September 24, 2019, said that integrating AI in the education sector posed several challenges, including how to teach 21st-century learners and utilization of advanced technologies (DepEd, 2019). As a result, these considerations highlight the need for a comprehensive framework that addresses both the opportunities and challenges presented by AI integration in education in the Philippines. Developing such a framework requires collaboration among educators, policymakers, and technology experts to ensure AI is utilized ethically and effectively.

The field of education is experiencing significant advancements, with emerging areas leading the way in reshaping the learning landscape. Among these, artificial intelligence (AI) is a transformative force in higher education. Popenici and Kerr (2017) remarked that AI has

brought noteworthy changes to teaching and learning, offering numerous edges. These include the ability to provide instantaneous feedback to learners (Aggarwal et al., 2023), enhanced access to academic resources (Adeshina, 2024), insights driven by data analytics (Widono et al., 2024), and improved accessibility for diverse learners (Eziamaka et al., 2024). Also, artificial intelligence in Education (AIEd) can enhance personalized learning pathways by providing 24/7 training, adapting content to personal needs, providing real-time feedback, and improving the educational process (Tapalova et al., 2022).

Scholars and educators are exploring challenges in integrating AI into education. They aim to make it more accessible, engaging, and effective while ensuring data privacy and avoiding algorithmic bias to create a personalized, efficient future. AI-assisted decision-making faces challenges in understanding complementarity, human mental models, and designing interactions to avoid cognitive overload and ineffective reliance strategies (Steyvers & Kumar, 2023). Furthermore, according to the study of Almethen (2024), secondary school teachers in Saudi Arabia face complex challenges in implementing AI applications in their classrooms, highlighting the need for comprehensive public policies, infrastructure investment, and tailored professional development. Additionally, Moosa (2024) uncovered that AI technologies significantly enhance student engagement and learning outcomes by providing personalized learning experiences and access to advanced educational resources. However, limited infrastructure, funding, and staff training remain significant barriers to widespread adoption. The study concludes that while AI has the potential to bridge educational gaps in low-resourced settings, addressing these challenges is crucial for maximizing its benefits. The findings suggest a need for targeted policies and investments to support the integration of AI in education, particularly in underfunded schools. Thus, AI in education can personalize learning experiences, optimize administrative tasks, and provide data-driven insights, but ethical considerations, equity issues, and technical limitations must be addressed for effective integration (Sytnyk & Podlinyayeva, 2024).

Given the context, this study explores the different AI applications used by public school teachers that can be effectively integrated to magnify educational outcomes, addressing the gaps in technology access, teacher preparedness, and student engagement. By investigating these challenges, the research aims to provide insights into AI's practical and scalable use in improving learning environments in public school settings.

Literature Review

The swift integration of Artificial Intelligence (AI) in education is significantly transforming the entire learning landscape. AI-powered tools and technologies are revolutionizing traditional teaching and learning methods and how educational institutions manage various processes. This in-depth exploration delves into the diverse ways AI is incorporated into education and examines the wide-ranging benefits, potential challenges, and

future implications of this influential integration. It has become an urgent necessity for school students to become AI-ready in the future (Karan & Angadi, 2023). Adiguzel's (2023) and Busu's (2024) studies highlighted that AI-powered classrooms revolutionize education by promoting personalized learning experiences and preparing students for future demands. Moreover, numerous works from different countries have emphasized the importance of AI in education, highlighting its function in intensifying personalized learning, mitigating administrative inefficiency, and honing students for technological advancements.

Aside from the Philippines, AI is also widely used in other countries to transform and enhance their education systems. In India, a new National Education Policy (NEP) has been implemented that incorporates AI-based teaching techniques to prioritize digital literacy, foster creative thinking, and create new research and innovation projects in response to the emergence of automated systems (Shetty & Mishra, 2020). In an article, Dr. Krishnaswamy Kasturirangan, the chairman of the NEP drafting committee, said that by incorporating necessary components into education, these programs seek to foster the development of 21st-century abilities. This gives young people the technology tools they need to communicate, be creative, and solve problems in the modern world (TOI-online, 2022). In countries like China, India, and the US, AI in education involves using AI technologies in online teaching and learning processes, recognizing, identifying, and predicting students' behaviors, and enabling adaptive and personalized learning (Dogan et al., 2023). From one particular point of view, China adopted AI technology in its education, which has significantly enhanced both efficiency and equity (Li, 2023). AI in China is being utilized through Massive Open Online Courses (MOOCs), online classes, and the flipped classroom model, yielding remarkable results. (Peng & Si, 2018). Nevertheless, institutions face challenges adapting to these technologies and ensuring student learning and support.

Although AI has great potential to transform and revolutionize education, its integration into the system has notable difficulties and challenges. Issues surrounding AI in education involve job loss, its effect on students' critical thinking, challenges for teachers in assessing AI-supported student work, and the risk of incorrect data outputs (Jose & Jose, 2024). Data confidentiality, possible plagiarism and fraud, and socioeconomic inequality brought on by unequal access to technology are also concerning (Nykonenko, 2023).

Additionally, AI applications play a significant role in education, addressing current challenges and promoting contemporary teaching methods (Ahmad, 2021). In a study, the author indicated that AI-driven personalized learning enhances the effectiveness of tailored educational experiences by recognizing individual student characteristics, personalizing content delivery instructional methods, and improving engagement and accessibility (Castro, 2024). Even in flipped classrooms, AI integration can improve learning outcomes and scalability but faces challenges like technology infrastructure, teacher preparation, privacy, and equity (Ray & Sikdar, 2024). The flipped classroom model integrating an AI-based

language learning platform improves students' learning interest, study autonomy, and class involvement while not significantly increasing English listening scores compared to traditional classes (Li, 2022). Additionally, AI-powered adaptive content delivery systems in flipped classrooms can enhance student engagement and personalized learning experiences, revolutionizing pedagogical innovation (Zharmukhanbetov, 2023).

In conclusion, the literature review demonstrates AI as a contributor to transforming education, highlighting improving educational outcomes, specifically in personalized learning, administrative efficiency, and preparing 21st-century students to be prepared for future technological demands. On the one hand, the above studies stress that integration of AI into their educational system can leverage its potential to intensify teaching methods and engagement toward students. On the other hand, the existence of AI poses challenges, including ongoing concerns about critical thinking, academic integrity, data privacy, and digital inequality. Therefore, a balanced approach is needed to fully maximize the benefits of AI tools while putting high consideration into mitigating risks for a more effective and inclusive education system.

Methods

Design

The researchers used a qualitative method to address the study's inquiries, specifically engaging a case study route since it involves studying a specific phenomenon in its natural context to gain a deep understanding. In fact, Baxter and Jack (2008) stress that qualitative case study methodology is a method for studying complex phenomena within contexts, developing theory, evaluating programs, and developing interventions.

This methodology not only aids in developing theoretical insights but is also instrumental in evaluating existing programs. Additionally, it plays a crucial role in designing and implementing targeted interventions. By focusing on real-world settings and experiences, qualitative case studies capture the richness and complexity of the subject matter, allowing researchers to gain a deeper understanding that can inform theory and practice.

Environment

The study was conducted in Cebu City, a bustling urban center in the Philippines known for its historical significance and diverse culture. The research focused on various public schools throughout the city, each serving a unique student population and contributing to the local education landscape. These schools, set against Cebu's lively streets and rich heritage, provided a fascinating context for exploring educational practices and challenges in the region.

The study involved eleven (11) public school teachers currently employed in Cebu City in gathering data. These participants were selected using a purposive sampling technique, which aims to select participants based on the researchers' set inclusion criteria. Furthermore,

the selection of this number of participants was guided by the principle of data saturation, a widely recognized criterion in qualitative research.

Instrument

The researchers utilized a semi-structured interview guide during the data gathering, which is the best approach, according to the study of Peters and Halcomb (2015), for a qualitative study since it can obtain valuable insights from the participant's standpoints, experiences, and opinions. The interview guide has three (3) parts: the first part centers on exploring the AI applications that public school teachers who participated were using in their teaching profession, the second part focuses on discovering the teachers' perspective on AI tools, and finally, the third's objective is to unearth the different challenges that the participants encountered in using AI applications.

Additionally, the researchers went to three (3) experts and asked them to validate the instrument and conduct pilot testing to ensure that the instrument was valid and reliable.

Procedures

A letter was authored to qualified public school teachers who participated in the study. The researchers checked these participants based on the set inclusion criteria, which include (1) being a public school teacher under Cebu City Division, (2) having already rendered at least three (3) years of teaching experience, (3) having used AI tools in their teaching endeavor, and (4) being willing to take part in the interview.

Then, the eleven (11) participants were all informed about the objective of the interview, and they agreed to participate in a focus group discussion (FGD), which was recorded. Furthermore, these face-to-face interviews took place, and the recordings were made using a cell phone that belonged to one of the authors.

In addition, when the interview was audio recorded, questions were asked following the guide to understand the participants' experiences in utilizing AI tools in their teaching profession and the challenges they encountered. The audio-recorded interview was converted to text, and the transcripts were dissected to uncover themes and generate central themes that aligned with the participants' standpoints.

After agreeing in writing to participate, participants received written and verbal instructions about the process before the interview. They were informed about their privacy and the terms of their voluntary participation, as outlined in the consent form they had approved. They also got an overview of the interview guide and data collection method. To protect their privacy, each participant was assigned a unique identification number.

Data Analysis

The researchers analyzed the gathered data using a thematic analysis. This approach centers on analyzing qualitative data, identifying patterns, and reporting them as researcher-

generated themes (Lochmiller, 2021). This approach facilitated their comprehension of the accounts provided by the primary sources and enabled them to identify patterns of variance and convergence, leading to the development of thematic categories. Subsequently, they structured these categories to represent the qualitative data visually.

As indicated in the study by Maguire and Delahunt (2017), there are six steps to follow to perform thematic analysis (Braun & Clarke, 2006). The first step is to become familiar with the data. Researchers achieve this by reading and re-reading the transcripts while noting key points shared by the participants. The second step involves generating initial codes, which help arrange the data systematically and meaningfully. In the third step, researchers explore themes by grouping the codes under overarching ideas that reflect the core message of the data. The fourth step focuses on revisiting the themes to ensure they align with the study's objectives and research questions. The fifth step finishes the themes for inclusion in the manuscript. Finally, the sixth step is the write-up, where researchers present the themes and interpret the results.

Ethical Considerations

The researchers adhered strictly to ethical protocols throughout the research process, particularly during data gathering. They emphasized fairness by treating all participants equally and keeping a neutral outlook to ensure unbiased outcomes. Respect was a cornerstone of their approach, guiding interactions and decision-making at every stage. The researchers conscientiously avoided allowing subjective beliefs or feelings to influence the study, seeking to uphold impartiality and consistency when engaging with key informants.

Moreover, they prioritized thoroughly, ultimately informing participants about the nature and intent of the research. Participants were mindful of their rights, including the chance to decline participation without repercussions. This open communication fostered trust and ensured that the study was conducted in a manner that kept the dignity and independence of all involved. The researchers underscored their dedication to conducting a fair and responsible investigation by following these ethical procedures.

Result and Discussion

Detailed description of the AI resources used by public school teachers participating in the study are in Table 1. This frame categorizes the AI tools used based on their theme, application, and significant responses from the participants. These categories are the following: AI for personalized learning, AI in administration and instructional support, language learning and literacy enhancement, and AI for professional development. Moreover, Table 1 emphasizes the growing integration of AI in education and showcases the mixture of tools teachers are leveraging to enhance teaching effectiveness and student engagement.

Table 1.

Artificial Intelligence (AI) Tools Utilized by Public School Teachers

Theme	AI Tool	Application	Significant Responses
AI for Personalized Learning	DreamBox	Adaptive learning for personalized math instruction.	*I use DreamBox, which has been a game-changer for teaching math. It personalized learning for each student, making them more active. - Informant 7*
	Quizlet	Interactive flashcards and adaptive study tools.	*I use Quizlet to create interactive quizzes and flashcards for my students. It keeps them engaged, as my students continue to participate in every activity I give them that involves this application. - Informant 6*
	Photomath	Step-by-step math problem solutions.	*Using Photomath in my class, I discovered that this app enables my students to see step-by-step solutions to math problems, reinforcing learning. However, I've noticed some students overuse it without trying to solve problems independently. - Informant 3*
AI in Administration and Instructional Support	ChatGPT	Assists with lesson planning, drafting materials, and automating responses.	*Sometimes, I use ChatGPT to help me make lesson plans and draft classroom activities. It saves me much time by generating ideas tailored to my students' needs. However, occasionally, the information is not entirely accurate, so I must confirm it from time to time. - Informant 4*
	Magic School AI	Automate tasks like grading and writing reports.	*This application helps me automate repetitive tasks like writing report cards and generating feedback. It's a huge time-saver, but I wish more custom options were tailored to public school settings. - Informant 9*
	Google Drive	Cloud-based storage and resource sharing.	*Personally, I use Google Drive to store and share classroom resources, including PowerPoint presentations of my lessons, video materials, and other relevant documents. So far, it is reliable and accessible, but storage limits can become an issue with big files. - Informant 5*
	Messenger	Facilitates teacher-parent and teacher-student communication.	*It is common for us teachers to have group chats, which allow us to communicate easily with our students and their parents. It is convenient, but I worry about maintaining professional boundaries on this informal platform. - Informant 6*
Language Learning and Literacy Enhancement	Grammarly	Grammar, punctuation, and style suggestions to enhance your writing.	*As a teacher who is not well-versed in English, Grammarly is my go-to tool for lesson materials and student outputs regarding grammar. It ensures the writing is error-free or at least improves sentence construction. - Informant 1*
	Quillbot	Paraphrases and summarizes text for enhanced writing clarity.	*As a research teacher, I find Quillbot helpful for rewriting instructions or simplifying text for learners' research output. However, I also need to be cautious because it can sometimes alter the meaning when paraphrasing complex sentences. - Informant 2*
	Jenni AI	Suggest improvements for student writing.	*As a classroom teacher, Jenni AI helps me frame classroom materials, such as lesson notes or summaries, in just minutes. It's very convenient, but I often need to edit the*

			content for more reasonable accuracy. - Informant 9
	Perplexity AI	Assists in research and content exploration.	*For me, Perplexity AI is impressive for collecting information on unfamiliar topics. It's quick and valuable but sometimes provides vague answers that require further research. - Informant 8*
AI for Professional Development of Teachers	Atlas.Org	Provides resources for curriculum development and professional learning.	*As a teacher, Atlas.org has been incredibly helpful in guiding me through curriculum planning. It provides numerous resources for professional development, but I wish there were more training opportunities to help teachers maximize its features. - Informant 3*
	ChatGPT	Offers real-time feedback and suggestions for professional growth.	*This application is handy to me from a professional growth perspective, as it has consistently provided suggestions that help me refine the way I articulate my thoughts. However, I need to put in the effort to verify all the information provided by this app. - Informant 4*
	Google Workspace	Enhances teacher collaboration and resource sharing.	*Google Workspace has simplified my workflow, as I use Google Docs for lesson plans, Google Slides for presentations, and Google Sheets for managing student records, including written and performance tasks. - Informant 10*

In line with the above finding, Taufikin et al. (2024) stated in their study that supporting educators and creating a flexible learning environment can enhance student engagement and teaching efficacy through the integration of AI in education. Jantanukul (2024) added that integrating AI into traditional teaching methods improves educational effectiveness by providing real-time analytics and personalized feedback. AI tools significantly increase student engagement through interactive learning experiences. According to Kehoe (2023), generative AI tools like ChatGPT and Google Bard can generate tailored educational content, alleviating time constraints and enhancing the quality of teaching in initial teacher education. By producing customized instructional materials, these tools can simultaneously reduce time constraints and improve teaching quality. Although these tools transform the teaching profession, they cannot replace actual human teachers.

The results above highlight the beneficial effects of AI tools on teaching and learning by discussing the various tools that public school teachers use. Some literature, however, disputes these conclusions. For instance, Basha (2024) argues that while AI tools can enhance learning efficiency, they may also hinder the development of foundational skills, critical thinking, and problem-solving abilities in students. Similarly, according to a 2024 Pew Research Center survey, a sizable percentage of K -12 educators believe that ChatGPT and other AI tools cause more harm than good, potentially impacting students' academic achievement and life skills. According to these viewpoints, although AI tools have advantages, excessive dependence on them may harm crucial educational results.

Table 2 illustrates teachers' perspectives on using AI tools in educational settings and explores several positive and negative aspects of AI in the context of education. Positively, by automating monotonous tasks, AI enhances instructors' work-life balance, fosters peer collaboration, creates a dynamic and responsive learning environment, and strengthens critical thinking skills. However, concerns exist about the digital divide, which restricts access to AI tools for some students, and an over-reliance on AI, which could hinder autonomous critical thinking. Concerns about data protection and ethics surround the use of AI in education, making it challenging for teachers to keep up with its rapid developments. All things considered, even if AI has many advantages, some drawbacks must be resolved.

Table 2.

The Teachers' Perspective on Using Artificial Intelligence (AI) Tools

Aspect	Themes	Description	Significant Responses
Learners	Enhanced Critical Thinking Skills	AI helps teachers develop high-order thinking skills, such as problem-solving and analytical reasoning, through applications like Photomath.	*As a math teacher in a public school, I know that AI tools encourage learners to think critically by guiding them through solving math problems rather than giving direct answers. - Informant 3* *My students use applications like Photomath, as suggested by our Math Coordinator, to comprehend math concepts better, but I ensure they demonstrate their thought processes after using it. - Informant 9*
	Dynamic and Responsive Educational Environment	AI platforms adapt to performance, offering personalized learning and instant feedback.	*AI platforms provide real-time feedback so students can quickly correct their mistakes and improve. This helps me to make my tasks easier to fulfill. - Informant 1* *DreamBox is a handy tool as it adapts lessons to my students' performance, keeping them involved and motivated. I also see it as a tutor for my students. - Informant 7*
	Facilitated Peer Collaboration	AI tools such as Canva and Google Workspace can improve creativity and teamwork in group projects.	*With AI tools like Canva, my students unite to create visually attractive presentations since this is my output in their performance task, which expands their collaboration skills. - Informant 5*
	Over-reliance on AI Tools (Negative)	Dependence on AI may negatively affect the development of learners' independent critical thinking.	*From what I observed in my own and other classes, some students rely too heavily on tools like Quillbot and other applications to complete their assignments, which hinders their ability to develop unique concepts. - Informant 2*
	Digital Divide and Accessibility Challenges (Negative)	Unequal access to AI tools can lead to disparities in learning outcomes.	*The sad reality in public schools is that not all students have access to gadgets or a stable internet connection, which creates an obstacle to using AI tools. - Informant 11* *Our school's lack of ICT resources makes it hard for all my students to benefit equally from AI technology. - Informant 9*

Teachers	Focus on Teaching and Instruction	AI automates repetitive tasks, enabling teachers to spend more time developing effective lessons.	*Using tools like Grammarly and Turnitin, I can review student work more quickly and devote more time to lesson planning. - Informant 1*
	Improved Work-Life Balance	AI lessens workloads, giving teachers adequate time to rest and engage in professional growth.	*Since these AI tools were introduced to us, we, teachers, have been faster in performing our administrative tasks, and I've been able to spend more time with my family and rest appropriately after work. - Informant 4* *AI has significantly reduced my workload as a teacher and coordinator, especially with tools that handle routine tasks. This gives me more time with my family and sideline business. - Informant 2*
	Convenience and Efficiency in Classroom Management	AI tools simplify lesson planning for teachers.	*AI applications such as Google Drive and Workspace, based on my experience so far, make my tasks easy to manage and communicate with my students. Everything is in one place. - Informant 6*
	Potential for Skill Gap and Over-reliance (Negative)	Teachers might encounter challenges keeping pace with AI advancements, leading to potential dependency.	*Sometimes, I feel like I'm left behind because new AI tools keep coming out, and it's tough to keep up with them. It is very hard for us teachers who are not so tech-savvy. -Informant 8* *I think there's a risk of becoming too dependent on AI. I feel uncomfortable that I might fail some of my writing skills over time. - Informant 3*
	Ethical and Data Privacy Concerns (Negative)	Data security and ethical principles might be at risk if too reliant on AI.	*When utilizing AI tools, I am concerned about the privacy of my data and my students' data. It is challenging to determine where their data is kept. - Informant 7*

Artificial intelligence (AI) technology has revolutionized various aspects of life, including education. It simplifies tasks, improves productivity, and streamlines processes. Students utilize AI tools to enhance their learning, access vast amounts of information, and meet academic deadlines, thereby transforming the teaching and learning process. In classrooms, AI tools such as Clickup, Lessonplans.ai, OpenAI ChatGPT, Gradescope, Chatbots, and Botsify are utilized to create personalized learning environments.

These tools facilitate lesson planning, grading, and targeted tests, enhancing students' academic performance. The primary objective is to enhance student outcomes. Even so, Basha (2024) discusses the negative impacts of AI tools on students' academic and real-life performance, emphasizing that over-reliance on AI can hinder the development of foundational skills and critical thinking. In addition, Seo et al. (2021) highlight that AI's effects on online learning can negatively impact learner-instructor interaction, potentially reducing the quality of education. In the same way, Holmes et al. (2019) argue that AI in education can perpetuate biases present in the data it is trained on, leading to unfair outcomes and

reinforcing existing inequalities. Furthermore, Khoso (2023) emphasizes that excessive use of AI tools, such as Chat-GPT, can distract students and lead to poor academic performance, making them more complacent and reckless.

Table 3.

Challenges Encountered by Public School Teachers in Using Artificial Intelligence (AI) Tools

Theme	Description	Significant Responses
Poor Internet Connection	Teachers often encounter internet disconnections, limiting their ability to access and utilize AI tools effectively.	*As far as I have experienced using AI tools in my class, one of the main challenges is a very slow internet connection in our school. Sometimes, lessons that rely on AI tools like Photomath, Dreambox, or Magic School AI can get delayed because the connection is interrupted. - Informant 3* *Our internet connection is very slow, mainly when many teachers use the WiFi that has been installed in our faculty office. If that will always happen, it becomes impossible to work efficiently with AI tools. - Informant 10*
Reliability of AI Tools	AI tools sometimes provide inaccurate data, leading teachers to distrust their use.	*I have noticed that some AI tools don't function consistently, especially when the software updates aren't compatible with our old cell phones or laptops. - Informant 9* *AI tools like Quillbot help teach research in my class, but sometimes the suggested words do not align with the context, which is why I always remind my students to use them properly. - Informant 11*
Lack of ICT Devices	Inadequate ICT devices, including computers and other gadgets, hinder the integration of AI.	*It's frustrating that we have access to these excellent AI tools, but we can't use them effectively without the proper devices and latest technologies. - Informant 2* *Our school lacks the necessary equipment, such as laptops or tablets, for teachers and students to fully utilize AI tools. - Informant 8*
Insufficient Knowledge of AI	Poor understanding of navigating AI tools causes a massive problem for teachers.	*As a teacher who is not so tech-savvy, I find these tools hard to use, and I admit that due to minimal knowledge and exposure to these tools. - Informant 6* *I've heard about many AI tools through seminars and workshops provided by our school and our division office, but I don't know which ones are easy for me to use and how to integrate them into my lessons. - Informant 1*
Data Privacy and Security Concerns	Teachers are concerned about their privacy and security when using AI tools.	*I'm worried about my private information since AI tools require us to input our data. I am afraid that it might also be used for some scams since that is very rampant right now. -Informant 3*

The main challenges faced by public school teachers who participated in the study are described in Table 3. In addition, the frame presents the description of each challenge and the

significant responses mentioned by a specific informant. This suggests that teachers, despite the positive effects of using AI applications, often face poor internet connections, inaccurate information provided by AI, inadequate ICT devices, insufficient knowledge in using AI, and concerns about data security.

AI applications serve as a foundation for teachers to enhance their teaching strategies, as they provide benefits that can make their jobs easier and help them prioritize the needs of diverse learners. However, challenges just like those mentioned above directly or indirectly affect them. Multiple studies confirm the aforementioned challenges in utilizing AI applications in educational settings. Both studies emphasize that a poor internet connection has a detrimental impact on students and teachers in online classes, significantly hindering their effectiveness (Baburajan et al., 2022; Bhuana & Apriliyanti, 2021). Other studies found that lack of technology knowledge and skills of both teachers and students (Chounta et al., 2021; Crompton et al., 2022), less reliability of AI tools (Pokorni, 2024), inadequate ICT devices (Almethem, 2024; Arvin et al., 2023), and privacy concerns that affect data security (Abimbola et al., 2024; Akgun & Greenhow, 2021).

Conclusion

This study revealed that AI applications play a transformative role in improving educational outcomes in public schools. Teachers utilize these tools for personalized learning, instructional support, language learning, and professional development, making their roles more effective and efficient. However, challenges such as poor internet connectivity, limited ICT resources, lack of AI knowledge, and data privacy concerns hinder seamless implementation. While AI enhances students' critical thinking and facilitates collaboration, excessive reliance may lead to complacency.

By integrating AI into public schools, students gain access to personalized learning, which helps reduce educational disparities and fosters the development of well-equipped 21st-century professionals. This, in turn, enhances employment opportunities, driving economic growth and innovation. Moreover, AI-driven efficiency in schools can serve as a model for other public services, improving governance, healthcare, and business operations. This study also highlights the importance of ethical AI use, ensuring that technological advancements prioritize inclusivity, accessibility, and well-being. Ultimately, by aligning AI with education, this study contributes to a more equitable and future-ready society where individuals are better equipped to navigate and succeed in a rapidly evolving digital landscape.

Despite these challenges, AI has the potential to improve teaching methodologies, streamline administrative tasks, and foster an inclusive learning environment. Successful integration requires addressing barriers and ensuring equitable access to resources. By aligning AI advancements with educational goals, public schools can create a more dynamic

and student-centered learning ecosystem, preparing learners for the demands of an increasingly digital world.

Therefore, strategic interventions and well-structured policies must be implemented to maximize the benefits of AI while mitigating its challenges. Addressing these concerns will enable educators and students to harness AI fully as a powerful tool for learning and development, ensuring that no one is left behind in the transition toward a more technologically advanced education system.

Recommendation

The Department of Education (DepEd) must develop and implement clear ethical guidelines for the use of AI tools in public schools in the Philippines. This must address key concerns such as data privacy, reliability, and over-reliance on AI tools. This implies more meaningful learning and the appropriate use of AI tools, promoting ethical practices in basic education. This is in connection with Senator Sonny Angara's (DepEd Secretary) vision regarding the possibility of developing policy standards for the responsible use of AI in schools. Hands-on workshops and continuous professional development sessions should be conducted to help educators navigate AI tools effectively and address challenges related to the adoption of AI tools. The Department of Education (DepEd), in collaboration with the Department of Information and Communications Technology (DICT), should establish mentorship programs to support the use of AI tools among educators in public schools. This will guide them to provide digital literacy, personalized instruction, and improved student engagement.

The DepEd must invest substantial financial resources in Information and Communication Technology (ICT) devices and establish a strong partnership with an internet provider that can provide a reliable internet connection within the locality, ensuring consistent internet connectivity. This initiative will enhance educational outcomes to create a future-ready education system that leverages the full potential of AI while promoting the reliability and accessibility of AI tools for students.

Ultimately, future researchers may conduct a systematic literature review on ethical and data privacy concerns in various Asian countries. This will shed light on the growing concern among scholars and educators regarding various aspects of data privacy issues related to the proper use of AI tools in educational settings. Aside from that, future researchers can pursue scientific inquiry about the degree of competency of educators in navigating AI tools in drafting lesson plans, preparing interactive classroom activities, crafting personalized instruction, and automating tasks. This implication calls for investigating educators' competency in utilizing AI tools, explicitly examining how well teachers are prepared and equipped to integrate these tools into lesson planning, interactive learning activities, and personalized instruction.

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