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Leveraging Artificial Intelligence to Promote Lifelong Learning for Sustainable Educational Development: A Survey of In-Service Teachers in Sokoto State, Nigeria

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Abstract

The integration of artificial intelligence (AI) in education has the potential to transform the way teachers learn and develop their professional skills. This study investigates the role of AI in promoting lifelong learning among in-service teachers, with a focus on sustainable educational development. A survey design was employed; all the in-service teachers in Sokoto state formed the population of the study, and 372 in-service teachers participated in the study. An instrument title, AI for Lifelong Learning, was used for data collection. It was validated, and a pilot test was conducted. A reliability index of 0.94 was obtained using Cronbach's alpha at a 0.05 level of significance. The results revealed that AI is instrumental in promoting lifelong learning, with significant implications for teacher professional development and student learning outcomes. The study concludes that AI can enhance teachers' ability to adapt to changing educational landscapes, improve their pedagogical skills, and increase their confidence in using technology to support student learning. Based on the findings, it is recommended that educators and policymakers prioritize the integration of AI in teacher education programs and professional development initiatives. Additionally, further research is needed to explore the specific ways in which AI can be used to support lifelong learning and to develop strategies for addressing the potential challenges and limitations of AI-based learning.

Keywords: Artificial intelligence; lifelong learning; sustainable educational development.

Introduction The integration of Artificial Intelligence (AI) into education has emerged as a transformative force, offering innovative approaches to facilitate teaching and learning processes.

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In recent years, the emphasis on lifelong learning has attracted significant momentum, particularly in the context of sustainable educational development. This transformation is especially pertinent in regions such as Sokoto State, Nigeria, where educational challenges coexist with opportunities for growth and development.

In-service teachers play a vital role in shaping educational outcomes and fostering a culture of lifelong learning among students. However, the effective utilization of AI technologies in the instructional process is crucial for these educators to meet the evolving demands of the 21st-century classroom. Understanding how frequently in-service teachers in Sokoto State employ AI tools for instructional purposes is essential to gauge the current state of technology integration in the instructional process. Moreover, the variety of AI technologies available provides an opportunity for educators to enhance their instructional strategies and other scholarly activities. By examining the specific AI tools utilized by in-service teachers, this study aims to identify which technologies are most popular and effective in supporting instructional process. This insight will not only highlight trends in AI integration but also reveal prospective areas for improvement or further development.

The potential benefits of AI extend beyond immediate instructional support; these technologies can significantly contribute to teachers' professional development. AI-enabled platforms can facilitate ongoing learning, provide personalized feedback, and connect educators with wider professional networks, thereby promoting a culture of continuous improvement. Understanding how these technologies foster professional growth among teachers is vital for creating a supportive environment that encourages lifelong learning. This study seeks to explore how in-service teachers in Sokoto State leverage AI technologies to enhance their instructional processes. By examining the frequency of AI usage, identifying popular technologies, and assessing their impacts on professional development, the research aims to contribute valuable insights toward sustainable educational practices in the region. This exploration is not only timely but also critical in navigating the intersection of education and technology in the pursuit of an empowered teaching workforce capable of fostering a culture of lifelong learning.

Statement of the Problem

In Nigeria, particularly in regions like Sokoto State, the educational landscape faces numerous challenges, including limited access to quality learning resources, inadequate teacher training, and

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a curriculum that often does not keep pace with global educational standards. As the need for increased educational outcomes becomes paramount, the integration of innovative technologies, particularly Artificial Intelligence (AI), offers a promising avenue for enhancing teaching and learning processes.

Despite the recognized potential of AI to transform education, there remains a significant gap in understanding how in-service teachers in Sokoto State are currently utilizing these technologies for instructional purposes. The frequency of AI adoption in classrooms, alongside the specific AI tools being employed, is not well-documented. This lack of insight impedes the strategic implementation of AI in educational settings, limiting opportunities for teachers to enhance their instructional practices, engage in continuous professional development, and ultimately improve student learning outcomes.

Furthermore, while AI technologies have the capacity to facilitate personalized learning, provide data-driven insights, and foster collaborative professional networks, their actual impact on teachers' professional development in the Nigerian context remains underexplored. This underutilization may result from various factors, including inadequate training, a lack of awareness of available tools, and resistance to new technologies.

Given these challenges, this research seeks to investigate how in-service teachers in Sokoto State leverage AI technologies to promote lifelong learning and sustainable educational development. Specifically, it will explore the frequency of AI usage, the types of AI technologies employed, and the role these tools play in enhancing teachers' professional development. Understanding these dynamics is vital for developing effective strategies to integrate AI into the educational framework, advancing both teacher effectiveness and student success in Nigeria.

Objectives

This study investigates the role of AI in promoting lifelong learning among in-service teachers, with a focus on sustainable educational development. Specifically, the study indents to:

1. Identify how frequently the in-service teachers use AI technologies for instructional process;
2. Determine the AI technologies being utilized by the in-service teachers for instructional process; and
3. Ascertain how the AI technologies help teachers' professional development.

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Research Questions

1. How frequently do the in-service teachers use AI technologies for instructional process?
2. What are the AI technologies being utilized by the in-service teachers for instructional process?
3. How do the AI technologies help teachers' professional development?

Literature Review

The growing use of AI in education is examined in recent research, which emphasizes how technology may improve student learning, customize learning, and assist instructional strategies. The significance of AI in developing flexible learning environments that cater to the demands of each individual student is emphasized in articles by Luckin et al. (2016). But because of issues like poor training, a lack of infrastructure, and educators' reluctance to adapt, the use of AI technology is still uneven (Brant et al., 2020). According to research by Schmid et al. (2021), in-service teachers' adoption rates of AI vary greatly depending on a number of variables, including institutional support, technological familiarity, and resource availability. Despite obstacles including a lack of training and assistance in efficiently utilizing these technologies, teachers frequently indicate a desire to include AI into their teaching procedures. The requirement for focused professional development is further supported by studies conducted in Nigeria, most notably by Eze et al. (2022), which show that although some teachers use AI tools, many are still ignorant of their potential advantages.

According to a survey of several AI solutions, platforms including adaptive learning technologies, automated grading software, and intelligent tutoring systems are becoming more and more well-liked by educators (Yuan et al., 2021). Ali et al. (2023) describe the usage of particular technologies, such as TeachFX and Knewton Alta, in the Nigerian context, pointing out that these resources support continuous professional development and enhance the quality of instruction. Unequal access to modern technology, however, is still a problem and frequently makes educational gaps worse. According to a survey of several AI solutions, platforms including adaptive learning technologies, automated grading software, and intelligent tutoring systems are becoming more and more well-liked by educators (Yuan et al., 2021). Ali et al. (2023) describe the usage of particular technologies, such as TeachFX and Knewton Alta, in the Nigerian context,

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pointing out that these resources support continuous professional development and enhance the quality of instruction. Unequal access to modern technology, however, is still a problem and frequently makes educational gaps worse.

The successful integration of AI in education is hampered by a number of issues, despite the potential advantages. Among the factors mentioned in the research include a lack of defined policy frameworks to direct the use of AI, inadequate teacher preparation, and limited access to technology (Khan & Hameed, 2023). These obstacles, which are exacerbated by socioeconomic considerations in Nigeria, further restrict in-service teachers' capacity to use AI to enhance education. The research now in publication emphasizes how AI has the ability to revolutionize teaching methods and advance the professional growth of aspiring educators. The efficient application of AI technologies is nevertheless constrained by a lack of infrastructure and training, especially in countries like Nigeria. For sustainable educational progress, future research must concentrate on examining particular approaches to overcoming these obstacles and guaranteeing that teachers have the resources and instruction they need to include AI into their lesson plans.

Methodology

This study adopts descriptive research of a survey type. The study population includes all the in-service teachers in Sokoto State. 372 teachers were selected to participate in the study as suggested by the Research Advisor (2006) model for sample size determination. Simple random sampling was used during the administration of the research instrument. The technique was employed because it gives the respondents equal chances of being selected to participate in the study. The instrument title, AI for Lifelong Learning, was used for data collection. Experts validated it. A pilot study was conducted to ascertain the reliability of the instrument. A reliability index of 0.94 was obtained using Cronbach's alpha at a 0.05 significance level. The data gathered for the study was analyzed using frequency counts, percentages, and pie charts.

Results:

Question 1: How frequently do the in-service teachers use AI technologies for instructional process?

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
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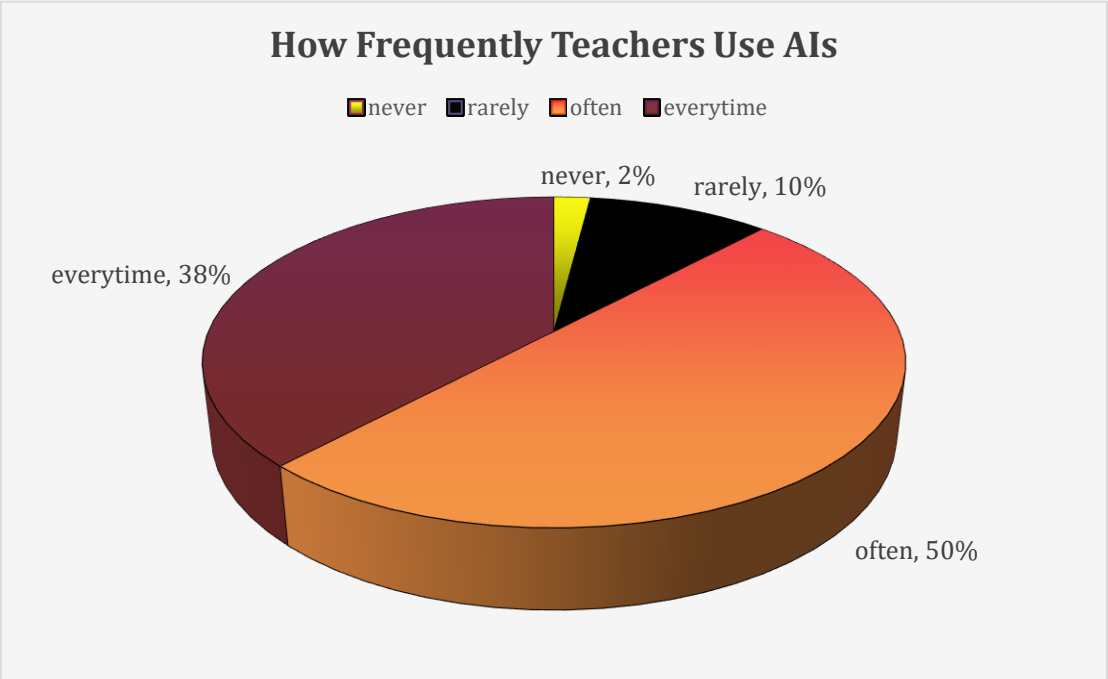
Figure 1: Frequency at which the in-service teachers use AI technologies for instructional process

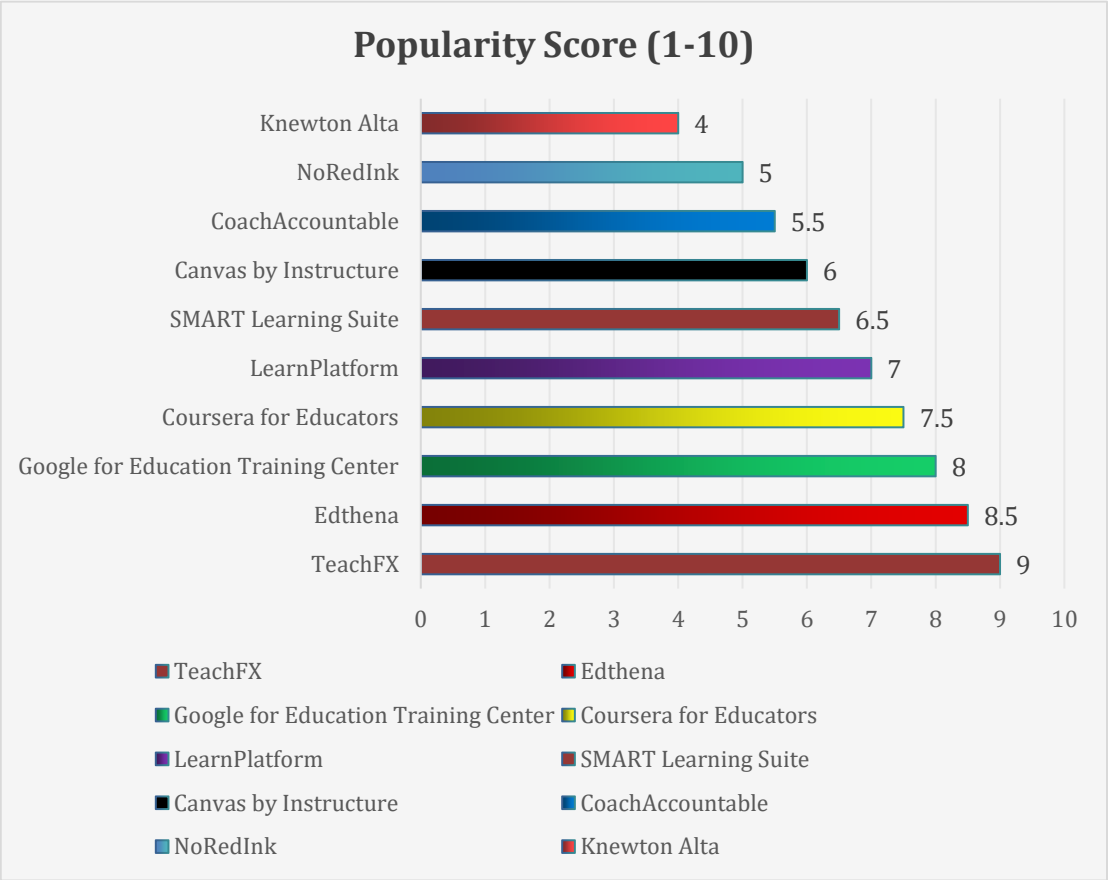


The pie chart illustrates how frequently in-service teachers utilize AI technologies in their instructional processes, categorized into four response options: never, rarely, often, and every time. A substantial portion of teachers (38%) report using AI tools every time they engage in instructional activities. This signifies a strong integration of AI into their teaching practices, suggesting that these teachers view AI as an essential resource for their daily instructional processes. The largest segment of respondents (50%) indicate that they use AI often. This indicates a positive trend toward habitual use of AI technologies, reflecting the increasing reliance on these tools to support instructional strategies and enhance learning experiences. A smaller group of teachers (10%) report using AI rarely. This could suggest that while they recognize the potential benefits of AI, they may not have fully integrated it into their teaching practices for various reasons such as familiarity, accessibility, or confidence in using the technology. Only 2% of the teachers claim to never use AI technologies at all. This demonstrates that a minimal number of educators are completely disengaged from AI tools, which may highlight areas for training or awareness.

Question 2: What are the AI technologies being utilized by the in-service teachers for instructional process?

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
ISSN: 2960-0006 DOI: https: https://doi.org/10.59231/edumania/9120

Figure 2: The AI technologies being utilized by the in-service teachers for instructional process



The figure displays the popularity scores of various AI technologies used by in-service teachers for instructional processes, rated on a scale from 1 to 10.

TeachFX stands out as the most popular AI technology among teachers, with a high score of 9. This suggests that it is highly valued for its usability and effectiveness in enhancing instructional practices. Its strong ranking indicates widespread acceptance and reliance on this tool in the teaching community. Knewton Alta follows closely with a score of 8.5, reflecting its significant adoption as a preferred AI tool. This level of popularity suggests that teachers find it beneficial for instructional purposes and likely perceive it as enhancing student learning. With a score of 7.5, CoachAccountable is also well-received among educators, indicating a robust level of trust and regular use in the classroom. Its functionality likely resonates well with teachers' needs for managing student progress and facilitating accountability.

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
ISSN: 2960-0006 DOI: https: https://doi.org/10.59231/edumania/9120

The SMART Learning Suite earns a score of 6.5. This mid-range rating implies that while it is utilized, its popularity is not as high as the top three technologies. Factors for this could include varying degrees of effectiveness or familiarity among teachers. With a score of 5.5, LearnPlatform shows moderate usage but indicates potential for growth. Teachers may use it sporadically or may not yet fully realize its benefits, suggesting opportunities for further professional development. Google for Education Training Center scoring 5 suggests a balanced but lower adoption compared to higher-ranked technologies. While it is recognized, that the training tools may not be integral to all teachers' practices, highlighting a potential area for increased engagement or promotion. With a score of 4, Coursera for Educators indicates limited use among teachers. This could suggest barriers in access, relevance, or familiarity that prevent more widespread adoption.

NoRedInk shares the same score as Coursera (4), demonstrating that it is similarly less popular. This signals room for improvement in how this tool is promoted or integrated into teaching practices. Scoring 6, Canvas by Instructure occupies a mid-level position. It denotes some regular use, likely attributed to its functionality as a learning management system that supports resource management. Edthena has the lowest popularity score of 3, indicating minimal usage among in-service teachers. This points to possible challenges in its adoption, which could include a lack of awareness or perceived effectiveness. The ranking showcases that TeachFX and Knewton Alta are leading AI technologies embraced by teachers, emphasizing their effectiveness in enhancing instructional processes. In contrast, tools like Edthena and the two previously mentioned options (Coursera and NoRedInk) reflect lower popularity, indicating potential barriers to their use. This information can inform future professional development initiatives, targeting lower-rated technologies to enhance their visibility and integration into teaching. The findings highlight the need for schools and educators to consider the variety of AI technologies available and to prioritize those that best meet their instructional needs while exploring ways to improve the adoption of less popular tools.

Question 3: How do the AI technologies help teachers' professional development?

Table 1: How the AI technologies help teachers' professional development

S/N	**Items**	**SA**	**A** F(%)	**D** F(%)	**SD** F(%)

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
ISSN: 2960-0006 DOI: https: https://doi.org/10.59231/edumania/9120

		F(%)			
1	AI technologies provide personalized learning opportunities that enhance my professional skills.	204(55)	123(33)	19(5)	26(7)
2	AI tools help me access relevant teaching resources that contribute to my professional growth.	260(70)	74(20)	26(7)	11(3)
3	Using AI technology has improved my skills in utilizing data for instructional planning and assessment.	297(80)	56(15)	19(5)	0(0)
4	AI-enabled platforms facilitate collaboration with other educators, enhancing my professional development.	372(100)	0(0)	0(0)	0(0)
5	AI technologies help streamline administrative tasks, allowing me more time for professional growth activities	297(80)	74(20)	0(0)	0(0)
6	AI tools provide timely feedback on my teaching practices, contributing positively to my professional development.	186(50)	167(45)	19(5)	0(0)
7	Exposure to AI technologies encourages me to try innovative teaching methods in my classroom.	372(100)	0(0)	0(0)	0(0)
8	AI tools enable me to connect with a wider network of educators, fostering my professional learning.	279(75)	56(15)	19(5)	19(5)
9	AI technologies encourage continuous professional learning and development by providing ongoing training resources.	260(70)	74(20)	37(10)	0(0)
10	AI tools assist me in improving my	335(90)	37(10)	0(0)	0(0)

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
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	classroom management skills, enhancing my overall effectiveness as a teacher.				

On personalized learning opportunities, a significant majority (327 out of 372) of respondents agree or strongly agree that AI technologies enhance their professional skills through personalized learning opportunities. Only a small percentage (45) expressed disagreement or strong disagreement. This suggests that teachers see considerable value in personalized learning facilitated by AI. On access to relevant resources, this item received a high level of agreement, with 334 respondents affirming that AI tools help them access relevant teaching resources. The low disagreement numbers indicate that teachers rely on these tools for enhancing their professional growth effectively. On skills in data utilization, with 353 respondents agreeing that AI technology improves their skills in data utilization for instructional planning, this item highlights the positive impact AI has on teacher competency in data-driven decision-making. Based on collaboration with other educators, all respondents strongly agree that AI platforms facilitate collaboration among educators. This unanimous support indicates that teachers view AI as a powerful tool for professional networking and collaboration.

On streamlining administrative tasks, the positive responses (371 total) show that teachers believe that AI technologies significantly relieve their administrative burdens, allowing more focus on professional growth. No negative feedback suggests general satisfaction with AI's role in this area. On timely feedback on teaching practices, while 353 participants agree, a notable 19 expressed doubt about the effectiveness of AI tools for providing timely feedback. This could signal that although many find value in AI, there are concerns regarding the adequacy or quality of the feedback received. On encouragement for innovative teaching methods, similar to item 4, this item received unanimous support. All respondents express that exposure to AI technologies encourages innovation in teaching, suggesting that AI fosters a progressive teaching environment. On connection with wider network of educators, this item shows strong agreement from the majority (335 participants) that AI tools help build professional networks. However, a small number of respondents (38) feel less positively, pointing to potential areas for improvement in AI networking capabilities. On continuous professional learning, most respondents (334) affirm that AI supports continuous professional learning, though 37 disagree. These responses suggest that while many appreciate AI's contributions, there are some who may not find it sufficiently beneficial for their

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ongoing professional development. On improving classroom management skills, with 372 respondents indicating positive feelings toward AI's role in classroom management skills, this underscores AI's significant impact on enhancing teachers' effectiveness in managing their classrooms.

The frequency distribution indicates a strong overall support for the integration of AI technologies in teachers' professional development. Teachers overwhelmingly perceive these tools as beneficial across various dimensions, including personal skills enhancement, resource access, collaboration, and innovation. However, there are some areas, such as timely feedback and continuous learning, that could benefit from further exploration to address the concerns of the minority expressing doubt. This data provides valuable insight for educators and administrators about the perceived effectiveness of AI in their professional practices, which can guide future training and resource allocation.

Discussion of Findings

This portion discusses the findings in line with the objectives of the study.

On integration and frequency of AI use, a substantial portion of teachers (38%) use AI tools every time they engage in instructional activities, with 50% using these tools often. This supports the work by Schmid et al. (2021), which noted significant variance in AI adoption among teachers based on factors like technological familiarity and institutional support. The high frequency of AI use among certain teachers reflects the growing acceptance of AI tools in instructional practices, as also suggested by Yuan *et al*. (2021), who noted the increasing popularity of such technologies. It was found by the study that some teachers (10%) use AI rarely, citing barriers such as lack of training and support. This finding corresponds with Brant et al. (2020) and Eze *et al*. (2022), who highlighted the challenges educators face, including inadequate training and resistance to change. The results imply that while there is significant enthusiasm for AI, practical constraints are still prevalent, reinforcing the need for targeted professional development as emphasized in the literature. On the perceptions of AI in professional development, a considerable majority of respondents believe AI enhances their professional skills, facilitates collaboration, and streamlines administrative tasks. This aligns well with Santo *et al*. (2022) and Suleiman *et al*. (2023), which recognized AI's role in fostering continuous professional learning and improving teacher

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
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confidence. The findings strengthen this assertion by demonstrating widespread support among teachers for AI's role in improving professional development and collaboration. On the specific AI tools and their impacts, TeachFX and Knewton Alta emerged as the most popular tools among educators, reflecting high usability and effectiveness. This resonates with Ali *et al*. (2023), who noted these technologies' effectiveness in improving instructional quality. The prominence of these specific tools in your survey highlights their practical impact and suggests areas for further professional development focusing on their features, as noted by the literature.

Regarding some of the challenges related to infrastructure and access to AI technologies, while many respondents are on board with AI technologies, there are stark contrasts in adoption due to varying levels of access and familiarity. This disparity is particularly relevant in the Nigerian context discussed by Khan and Hameed (2023), which points out insufficient access to technology and socioeconomic barriers. Your findings echo these challenges, underscoring the need for equitable access to AI tools to avoid exacerbating educational disparities. While most participants appreciate the timely feedback from AI, a notable minority expressed doubts about its quality. This reflects findings by Schmid *et al*. (2021), where teachers showed a desire for effective integration of AI but expressed concerns about operational efficacy. The results highlight the need for ongoing evaluation of AI tools to ensure they meet educators' needs and expectations.

Conclusion

The study reveals a strong acceptance and integration of AI tools among educators, particularly with highly valued technologies like TeachFX and Knewton Alta. While many teachers actively engage with AI to enhance their instructional practices and professional development, substantial barriers remain, including inadequate training, inconsistent access to technologies, and concerns over the quality of feedback provided by AI systems. These findings echo existing literature, highlighting the transformative potential of AI in education alongside the need for targeted support and resources. To leverage the benefits of AI technology effectively, it is essential to address existing challenges, particularly in under-resourced contexts such as Nigeria, where socioeconomic factors significantly impact access to technology and training.

Recommendations

In line with the findings of the study, the following are recommended:

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 106-119
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1. To enhance professional development programs, comprehensive training programs tailored to educators' varying levels of familiarity with AI technologies should be developed. These should include hands-on workshops, online courses, and ongoing support to ensure teachers can effectively integrate AI into their teaching practices.
2. To increase accessibility to AI tools, equitable access to AI technologies by collaborating with educational stakeholders, policymakers, and community organizations should be advocated for. This could involve government grants or partnerships to provide schools, particularly in under-resourced areas, with necessary technological infrastructure.
3. To foster a culture of innovation, a culture that embraces innovative teaching methods through AI by providing recognition and support for educators who actively engage in experimenting with AI tools should be encouraged. This could help mitigate resistance to change and inspire broader adoption.
4. To create collaborative networks, networking opportunities for educators to share best practices and experiences with AI technologies should be facilitated. This could include online forums, workshops, and conferences that connect teachers across different regions and backgrounds.

Suggestion for Further Study

Encourage further research into effective strategies for AI integration, particularly in varied contexts. Studies should focus on understanding the specific barriers educators face and exploring innovative solutions to overcome these challenges.

Implication for Policy Development

Clear policies that support the implementation of AI technologies in education should be advocated for. These policies should address training, resource allocation, and guidelines for technology integration within curricula to streamline the process and clarify expectations for educators.

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