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Principals' Adoption of Artificial Intelligence in Teaching and Learning Processes in Public Secondary Schools in Edo State

[1]Dr (Mrs.) Ezeimwenghian Julian OBANO, [2]Dr (Mrs.) Constance Iyore OSAGIE

Corresponding author: *ezeimwenghian.obano@uniben.edu,* 08027637225

1 Department of Educational Management, Faculty of Education, University of Benin, Edo State, Nigeria

2 Department of Educational Foundations and Management, Faculty of Education, Ambrose Ali University, Ekpoma, Edo State, Nigeria

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Abstract

This study explored school principals' adoption of Artificial Intelligence (AI) in teaching and learning processes in public senior secondary schools in Edo State, Nigeria. Four research questions were raised. Utilizing a descriptive survey design, data were collected from 308 public secondary schools principals via structured questionnaire, titled: "School Principals' Adoption of Artificial Intelligence Questionnaire (SPAAIQ)''. Cronbach alpha method as used toestablish reliability test and coefficient of 0.82 was obtained. 257 copies of the questionnaire were retrieved and found usable, thereby yielding 83.99% response rate. The data were analyzed using Mean and Standard Deviation. Results indicated principals' moderate awareness of AI technologies among others. In response, the study recommended targeted professional development for school leaders and educators, investment in technological infrastructure, and the inclusion of AI-related content in the school curriculum. Furthermore, it advocated for the establishment of clear ethical guidelines for AI use in education, ensuring data privacy, equitable access, and the prevention of unfair outcome.

Keywords: *Principals, Artificial Intelligence (AI), Teaching and Learning Processes, Secondary Schools.*

Introduction

Artificial Intelligence (AI) integration into education system creates a transformative force that reshapes traditional teaching and learning processes across all educational levels. While considerable attention has been directed toward AI adoption in higher education, the implementation of AI technologies in secondary schools presents unique opportunities and challenges that warrant careful examination by secondary school principals, as key decision-makers and educational leaders, play a pivotal role in driving technological innovation and establishing the framework for successful AI adoption within their institutions. Their perspectives and experiences provide crucial insights into the practical realities of implementing AI solutions in secondary education. Holmes et al. (2019) noted in their comprehensive review of AI in education that the potential impact of AI technologies on teaching and learning processes is vast, yet the readiness of educational institutions to embrace these technologies varies significantly across different contexts and levels of education. The rapid evolution of AI technologies has created new possibilities for enhancing educational delivery, assessment methods, and administrative processes in secondary schools. AI-powered tools can facilitate personalized learning experiences, automate routine administrative tasks, and provide data-driven insights for improved decision-making in school management. AI technologies have demonstrated significant potential in supporting adaptive learning environments and providing personalized feedback to students, though the implementation of such systems requires careful consideration of institutional readiness and resource availability. The potential of AI to transform secondary education extends beyond mere technological integration, encompassing fundamental changes in pedagogical approaches, assessment strategies, and the overall learning environment (Roll & Wylie (2016) and Luckin et al. (2016))

The role of school principals in the adoption of AL in teaching and learning processes is significant for strategic leadership and as change agents. Schmitz et al. (2023) asserted in their study of transformational leadership for technology integration in schools, that principals are instrumental in creating the conditions and conducive environment necessary for successful technology integration and innovation which fostering a culture of continuous professional development among staff. Principals understanding of AI technologies, perception of benefits and challenges, and strategic approach to implementation significantly influence the success of AI adoption initiatives within their schools. However, in the Nigerian context, where resource constraints, infrastructure limitations, and

varying levels of technological readiness present additional challenges, the perspectives of principals become even more critical in understanding the practical implications of AI adoption in secondary education. Akinyemi et al. (2022) highlighted these challenges in their analysis of educational technology adoption in Nigerian schools, emphasizing the need for context-specific approaches to technology (AI) integration and adoption of AI would support the various aspects of school operations, from classroom instruction to administrative efficiency, while being mindful of potential challenges such as data privacy concerns, equity issues, and the need for sustainable implementation and evaluation strategies for secondary education. Holstein et al. (2019) emphasized the importance of AI literacy in enabling educators to make informed decisions about AI integration and to address potential ethical concerns effectively.

The potential benefits of AI integration in secondary education are multifaceted and significant, as Du Boulay (2016) demonstrated how AI technologies can enhance students' engagement through interactive learning experiences, provide real-time feedback on student performance, and enable more efficient administrative processes. For teachers, AI tools can assist in lesson planning, automate routine tasks, and provide valuable insights into student learning patterns. From an administrative perspective, AI can support data-driven decision-making, improve resource allocation, and enhance communication between various stakeholders in the educational community. Zawacki-Richter et al. (2019) provided evidence of these benefits in their systematic review of AI applications in higher education, many of which have relevant implications for secondary education contexts. However, the realization of these benefits requires careful consideration of implementation strategies, resource requirements, and potential challenges that may arise during the adoption process. Despite the potential advantages, the integration of AI in secondary education faces numerous challenges such as infrastructure limitations, funding constraints, and varying levels of technological readiness among staff members. In the Nigerian, these challenges may be compounded by broader systemic issues such as inconsistent power supply, limited internet connectivity, and resource disparities between urban and rural schools. Okonjo & Onyije (2022) documented these challenges in their analysis of technology integration in Nigerian secondary schools, highlighting the need for systematic approaches to addressing infrastructure and resource limitations. Additionally, concerns about data privacy, ethical implications of AI use in education, and the potential impact on teacher-student relationships need to be carefully considered and addressed through appropriate policies and

guidelines. Prinsloo & Slade (2016) raised important questions about data privacy and ethical considerations in educational technology adoption, particularly in contexts where regulatory frameworks may be less developed.

The human factor in AI adoption cannot be overlooked, particularly in terms of teacher readiness and professional development needs. Principals must navigate the complex task of building staff capacity while addressing potential resistance to change and ensuring that AI adoption or integration aligned with pedagogical objectives and student needs. Tondeur et al. (2017) emphasized the importance of teacher professional development and support in successful technology integration, highlighting the role of school leadership in facilitating such support. This includes creating opportunities for professional development, fostering a supportive environment for technology adoption, and maintaining a balance between innovation and established educational practices. Furthermore, principals must consider the diverse needs and capabilities of their student population, ensuring that AI integration promotes inclusive education rather than aggravating existing educational disparities. Reich and Ito (2017) discussed that the potential of educational technology to either reduce or amplify existing educational inequalities, emphasizing the importance of intentional and equity-focused implementation strategies. The role of policy frameworks and institutional support in facilitating AI adoption is another critical aspect that requires attention. School principals operate within broader educational systems that may either support or constrain their ability to implement AI solutions effectively. Williamson (2017) examined the policy implications of AI in education, highlighting the need for comprehensive frameworks that addressed both opportunities and challenges. The development of appropriate policies, allocation of resources, and establishment of support systems are essential elements in creating an enabling environment for AI integration. This includes addressing issues related to technology procurement, data management, professional development, and quality assurance in AI-enhanced education. Selwyn (2020) emphasized the importance of developing context-appropriate policies that consider local needs and constraints while promoting sustainable technology integration.

The significance of cultural and contextual factors in AI adoption cannot be understated, particularly in diverse educational settings like Nigeria. Adedoyin & Soykan (2020) explored the cultural dimensions of educational technology adoption in African contexts, highlighting the need to

consider local values, beliefs, and practices in technology integration strategies. Principal leadership in this context requires not only technical and administrative competence but also cultural sensitivity and awareness of community perspectives on technology (AI) adoption. This includes addressing concerns about the cultural appropriateness of AI applications, ensuring that technology integration respects local educational traditions while promoting innovation, and building community support for AI adoption initiatives. The relationship between AI integration and educational quality is another crucial consideration that principals must address. While AI technologies offer potential benefits for teaching and learning, their effective integration requires careful attention to pedagogical quality and educational outcomes. McKenney (2018) established the the importance of maintaining focus on educational objectives while implementing technology solutions, suggesting that principals must ensure that AI adoption serves rather than supersedes pedagogical goals. This includes developing appropriate assessment frameworks for evaluating the impact of AI integration, monitoring student learning outcomes, and ensuring that technology adoption contributes meaningfully to educational quality improvement.

Understanding the perspectives of secondary school principals on AI adoption is crucial for developing effective strategies to promote technology integration in education. Their insights into opportunities, challenges, and implementation strategies provide valuable information for policymakers, educational administrators, and technology developers working to enhance the quality and relevance of secondary education in the digital age.

Objectives

The objectives were to:

1. Evaluate the current level of AI awareness school principals in public senior secondary schools in Edo state.
2. Assess the current level of AI utilization in school management and educational practices in public senior secondary schools in Edo state
3. Identify secondary school principals' perceived benefits of integrating AI tools in public senior secondary schools in Edo state.

4. Ascertain secondary school principals' perceived challenges of integrating AI tools in public senior secondary schools in Edo state

Research Questions

1. What is the current level of AI awareness among school principals in public se senior secondary schools in Edo State?
2. What is the current level of AI utilization in school management and educational practices in public senior secondary schools in Edo state?
3. What are school principals' perceived benefits of integrating AI tools in public senior secondary schools in Edo state?
4. What are school principals' perceived challenges of integrating AI tools in public senior secondary schools in Edo state?

Methodology

This study employed a descriptive survey design. The population for this study comprised 308 public senior secondary school principals in Edo State. Census approach was adopted, and 308 principals were included in the study. This ensured that the sample was representative of the entire population of public senior secondary school principals in the state, providing a robust data set for analysis. Data were collected using a structured questionnaire developed by the researchers titled: "School Principal Adoption of Artificial Intelligence Questionnaire (SPAAIQ)". The questionnaire had four clusters which capture: the principals' awareness of AI, the extent to which AI is utilized in school management and education, the perceived benefits of AI integration, and the challenges faced in adopting AI. The questionnaire was validated by three experts in the Department of Educational Management, Faculty of Education, University of Benin, Nigeria and its reliability was established using Cronbach Coefficient Alpha Method which yielded a coefficient of 0.82 The questionnaire was administered in two formats: face-to-face and via Google Forms, to accommodate varying preferences and technological accessibility among the principals. A total of 308 questionnaires were

distributed to the principals, and 257 completed questionnaires were successfully retrieved, resulting in a response rate of approximately 83.99%. The data collected from the questionnaires were analyzed using descriptive statistics, specifically mean and standard deviation. The mean scores provided an overall indication of the principals' level of agreement with the statements on the questionnaire, while the standard deviation helped to assess the extent of variation in their responses.

Presentation of Results

Research Question 1: What is the current level of AI awareness among school principals in public senior secondary schools in Edo State?

Table 1: Level of AI Awareness among Secondary School Principals in Edo State

S/N	Item Statement	N	Mean	St.D	Remark
1	I am familiar with the concept of Artificial Intelligence (AI).	257	2.92	.88	Somewhat Aware
2	I am aware of various AI tools available for educational use.	257	2.86	.91	Somewhat Aware
3	I have attended workshops or training sessions on AI in education	257	3.01	.84	Somewhat Aware
4	My school has initiated discussions on the potential of AI.	257	2.98	.81	Somewhat Aware
5	I regularly seek information on advancements in AI and education	257	3.01	.83	Somewhat Aware
6	I understand the role of AI in automating administrative tasks.	257	2.92	.91	Somewhat Aware
	Cluster Mean		**2.95**	**.86**	Somewhat Aware

As indicated in Table 1, that secondary school principals in Edo State are generally "Somewhat Aware" of AI concepts and tools, with a cluster mean of 2.95 and standard deviation of .86, reflecting moderate awareness across the six items measured. The highest awareness levels were observed for attending workshops on AI and seeking information on AI advancements (Mean = 3.01), while the lowest was for awareness of specific AI tools for educational use (Mean = 2.86). The moderate standard deviation values (ranging from .81 to .91) suggest some variability among respondents. Overall, while principals demonstrate a foundational awareness of AI.

Research Question 2: What is the current level of AI utilization in school management and educational practices in public senior secondary schools in Edo State?

Table 2: Level of AI utilization in school management and educational practices in secondary schools in Edo State

S/N	Item Statement	N	Mean	St.D	Remark
1	AI is used in my school for scheduling or timetabling	257	1.08	.74	Very Low
2	AI tools assist in monitoring student performance and attendance.	257	1.10	.61	Very Low
3	AI applications are integrated into teaching practices in my school.	257	1.12	.54	Very Low
4	My school uses AI tools for communication with parents and stakeholders	257	1.06	.73	Very Low
5	Decision-making processes in my school are supported by AI analytics.	257	1.10	.71	Very Low
6	Training on using AI tools is provided to staff in my school.	257	1.17	.51	Very Low
	Cluster Mean		**1.11**	**.64**	Very Low

The results in Table 2 shows very low level of AI utilization in school management and educational practices among secondary school principals in Edo State, with a cluster mean of 1.11 and a standard deviation of .64. All six items measured fall within the "Very Low" category, with the highest mean score for training on AI tools provided to staff (1.17) and the lowest for using AI tools for communication with parents and stakeholders (1.06). The standard deviation values, ranging from .51 to .74, suggest limited variability, indicating consistent minimal use of AI across schools.

Research Question 3: What are school principals' perceived benefits of integrating AI tools in public senior secondary in Edo State?

Table 3: School principals' perceived benefits of integrating AI tools in public senior secondary schools in Edo State

S/N	Item Statement	N	Mean	St.D	Remark
1	AI can improve the efficiency of administrative processes in schools	257	3.42	.91	Agree
2	AI tools can enhance personalized learning for students	257	3.36	.88	Agree
3	AI integration can help reduce the workload for teachers	257	3.31	.87	Agree
4	AI applications can improve communication with parents and the community.	257	3.38	.85	Agree
5	AI can assist in identifying students at risk of poor academic performance	257	3.21	.88	Agree
6	AI can promote innovation in teaching methods and curriculum design.	257	3.42	.90	Agree

The analysis in Table 3 reveals that secondary school principals in Edo State generally agree on the perceived benefits of integrating AI tools in secondary education, with a cluster mean of 3.35 and a standard deviation of .88. Among the items, the highest-rated benefits were AI's ability to improve the efficiency of administrative processes and to promote innovation in teaching methods and curriculum design (3.42 each). The lowest-rated benefit was AI assisting in identifying students at risk of poor academic performance (3.21). The standard deviation values, ranging from .85 to .91, show consistent agreement among respondents. These findings reflect a positive outlook among principals toward AI's potential to enhance efficiency, personalization, and innovation in secondary education, suggesting readiness for AI integration when the necessary resources and training are made available.

Research Question 4: What are secondary school principals' perceived challenges of integrating AI tools in secondary education?

Table 4: School principals' perceived challenges of integrating AI tools in public senior secondary schools in Edo State

S/N	Item Statement	N	Mean	St.D	Remark
1	There is limited technical expertise among staff to use AI tools effectively	257	3.11	.83	Agree
2	Lack of sufficient funding is a major barrier to AI adoption	257	3.82	.80	Agree
3	AI tools may not align well with existing educational systems	257	3.28	.93	Agree
4	Concerns about data privacy and security hinder the adoption of AI.	257	3.51	.86	Agree
5	Resistance to change among staff and stakeholders limits AI integration	257	3.00	.80	Agree
6	The reliability and accuracy of AI systems in education are questionable.	257	2.96	.86	Agree

The analysis in Table 4 deduces that secondary school principals in Edo State generally agree on the challenges of integrating AI tools in secondary education, with a cluster mean of 3.28 and a standard deviation of .85. The most significant challenge identified is the lack of sufficient funding for AI adoption (Mean = 3.82), followed by concerns about data privacy and security (Mean = 3.51). Other notable challenges include limited technical expertise among staff (Mean = 3.11) and the misalignment of AI tools with existing educational systems (Mean = 3.28). The least concern, though still agreed upon, is the reliability and accuracy of AI systems (Mean = 2.96). The standard deviation values, ranging from .80 to .93, indicate moderate variability in responses.

Discussion of Findings

The findings of the study revealed a moderate AI awareness among secondary school principals in Edo State. This finding aligns with the work of Long & Magerko (2020) who identified that AI literacy among educators often remains at medium level and foundational rather than advanced. In the same vain, Adedoyin & Soykan (2020) and Okonjo & Onyije (2022) studies, highlighted that awareness alone does not translate to effective integration, rather leads to cutting-edge in the use of AI which can hinder educators' ability to fully grasp and leverage of AI's transformative potential. Successful integration requires moving beyond awareness to actionable knowledge, which

necessitates targeted interventions to enhance AI literacy among school principals (Luckin et al, 2016). The findings from this study contrast the studies of Al- Darayseh (2023), Omobolanle (2024) and Guneyli et al (2024) that established a high level of awareness and acceptance of the use of AI in teaching and learning processes.

From the findings, very low utilization of AI in school management and educational practices was revealed among the principals in Edo state, due to inequities in resource allocation, infrastructure and access to technology. The finding is in line with Thomas & Gambari (2021) and Ukeh & Anih (2024) findings that showed a very low level of utilization of AI in Nigerian universities This finding is consistent with the challenges documented by Akinyemi et al. (2022), where they noted that infrastructural deficiencies among others, significantly constrain the implementation of educational technologies (AI) in Nigerian schools. In support of this, Williamson (2017) and Zawacki-Richter et al. (2019) emphasized that while AI holds great promise for automating administrative processes and improving instructional delivery, the realization of these benefits requires an enabling environment characterized by adequate infrastructure, funding, and technical support. Additionally, the low levels of AI utilization may also reflect the absence of supportive policies and strategic frameworks for technology integration in Nigerian secondary schools. The study disagreed with the findings of Guneyli et al (2024) that obtained high degree of utilization of AI in all sector of education in Cyprus.

The findings established that principals expressed strong positive potential benefits of AI in enhancing secondary education. This findings is in line with Du Boulay (2016), Thippanna et al (2023) and Karakose (2024) that highlighted how AI technologies can support adaptive learning environments, through the provision of real-time feedback, and optimize resource allocation. Principals' recognition of these benefits indicates a readiness to embrace AI if the necessary conditions are met, such as access to resources and professional development opportunities. It also corroborated the studies of Roll & Wylie (2016), McKenney (2018) and Hartono et al (2023) demonstrated that AI-driven adaptive learning systems can cater to individual learning styles and paces, thereby improving student engagement and outcomes. However, the realization of these benefits depends on the effective alignment of AI tools with a robust pedagogical framework and goals that center on students learning outcomes and quality education..

Lastly, the study identified several challenges to AI adoption, including limited technical expertise, insufficient funding, data privacy concerns, and resistance to change. The study findings resonated with Prinsloo & Slade's (2016) Jankakun et al (2021), Badawi (2022) and Tkhayneh et al (2023) who analyzed that ethical and practical barriers to educational technology adoption, include: Al illiteracy, lack of training and technical expertise among staff underscores the critical need for professional development and capacity-building initiatives. Tondeur et al. (2017) argued that teacher readiness is a key determinant of successful technology integration, suggesting that school leaders must prioritize training and support to overcome this barrier. Funding constraints emerged as the most significant challenge, reflecting broader systemic issues in the Nigerian education sector. Okonjo & Onyije (2022) highlight the pervasive underfunding of schools, which limits their ability to invest in innovative technologies like AI. The principals' concerns about data privacy and security further underscore the need for robust regulatory frameworks to address ethical considerations in AI adoption. Prinsloo & Slade (2016) emphasize the importance of establishing clear guidelines for data governance and ethical AI use, particularly in contexts where regulatory oversight may be limited. Resistance to change among staff and stakeholders represents another critical barrier, pointing to the need for a change management approach that fosters buy-in and collaboration. Schmitz et al. (2023) highlight the role of transformational leadership in creating a culture of innovation and openness to new technologies. Principals must therefore navigate the complex dynamics of organizational change, addressing both technical and human factors to ensure the successful adoption of AI.

Conclusion

Principals demonstrated a moderate awareness, identified positive benefits of AI for teaching and learning processes and coupled with the challenges of AI. Embracing AI is not merely an option but a necessity for ensuring the relevance and quality of secondary education in a rapidly evolving global society for teaching and learning processes.

Recommendations

Based on the findings of this study, the following recommendations are proposed to enhance the integration of AI in Nigerian secondary schools:

1. School Administrators and Management should establish targeted training and professional development initiatives for school principals and teachers to build AI literacy and practical skills in using AI tools for teaching, learning, and administrative purposes.

2. School administrators and management should prioritize the provision of reliable internet connectivity, adequate power supply, and AI-enabled devices in secondary schools, particularly in underserved regions, to create an enabling environment for AI integration.

3. Education ministries should integrate AI-related topics and skills into the secondary school curriculum across various subjects to ensure students are equipped with knowledge relevant to the future workforce and technological advancements.

4. Policy makers and regulators should develop clear policies and ethical guidelines on AI use in education, addressing issues such as data privacy, equitable access, and the prevention of unfair outcome, while promoting collaboration between government, schools, and private sector partners.

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