Original Article

INTEGRATION OF ARTIFICIAL INTELLIGENCE IN THE ADMINISTRATION OF PUBLIC SECONDARY SCHOOLS FOR THE 4th INDUSTRIAL REVOLUTION IN ENUGU STATE

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Abstract

The study investigated the integration of artificial intelligence in the administration of public secondary schools for the 4th industrial revolution in Enugu State. Two research questions guided the study while two null hypotheses were tested at .05 level of significance. The researcher adopted descriptive survey research design for this study. It was conducted in the 295 public secondary schools in Enugu State. The population for the study comprised 295 principals (201 males and 94 females). There was no sampling because the population was manageable. The instrument for data collection was a researcher developed questionnaire titled "Integration of Artificial Intelligence in the Administration of Public Secondary Schools Questionnaire (IAIAPSSQ)". The instrument contained 15 items based on the two research questions. Research experts in Faculty of Education, Enugu State University of Science and Technology validated the instrument. The reliability of the instrument was determined using Cronbach Alpha method which yielded .82 for cluster 1 and .80 for cluster 2 with an overall reliability index of .81 which indicated that the instrument is reliable. Mean and standard deviation were used to answer the research questions and t-test statistic to test the hypotheses. The findings of the study showed that artificial intelligence is integrated in the areas of instructional delivery and financial management in the administration of public secondary schools for the 4th industrial revolution in Enugu State to a low extent. The study recommended that government should initiate comprehensive training programmes aimed at educators and administrative staff to enhance their understanding and proficiency in utilizing AI tools for instructional delivery and financial management.

Keyword: Integration, Artificial Intelligence, Public Secondary Schools, Administration, 4th Industrial Revolution

Introduction

Artificial Intelligence (AI) is a branch of computer science that aims to create systems capable of performing tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, perception, and language understanding. AI encompasses various subfields such as machine learning, which focuses on algorithms that allow computers to learn from and make predictions based on data. Another significant subfield is natural language processing, which involves the interaction between computers

and human languages, enabling machines to understand, interpret, and generate human language. Computer vision, yet another important area, enables machines to interpret and make decisions based on visual input from the world. According to Benko and Lanyi, as cited in Wamba-Taguimdje et al. (2020), artificial intelligence involves a range of principles and methodologies aimed at developing machines capable of replicating human intelligence. Artificial intelligence serves as a cornerstone of the 4th Industrial Revolution, driving innovations that transform industries and redefine the future of work.

The 4th Industrial Revolution, characterized by the fusion of technologies blurring the lines between the physical, digital, and biological spheres, marks a significant shift in how we live, work, and interact with each other. Central to this revolution are advancements in artificial intelligence, robotics, the Internet of Things (IoT), and biotechnology, which collectively drive unprecedented levels of innovation and efficiency in various sectors (Xu, David & Kim, 2018). This era of rapid technological change promises to enhance productivity and connectivity but also poses challenges related to job displacement, privacy, and security. As society navigates these changes, the need for adaptive policies and ethical guidelines becomes increasingly crucial to ensure inclusive and sustainable development (Schwab, 2017). The Fourth Industrial Revolution, characterized by advancements in AI, IoT, and big data, is transforming secondary school administration by streamlining operations, enhancing personalized learning, and improving data-driven decision-making. This integration of cutting-edge technology is enabling schools to create more efficient, responsive, and adaptive educational environments.

Administration refers to the process of organizing and managing the operations, resources, and functions of an organization or institution. This includes planning, coordinating, and overseeing activities to ensure they align with the organization's goals and objectives, often involving decision-making, policy implementation, and resource allocation. Unachukwu and Okorji (2014), defined administration as a social process concerned with identifying, motivating, controlling and unifying formally and informally organized human and material resources within an integrated system designed specially to accomplish predetermined goals. Aideloha (2018), defined administration as whenever collective action is required, whenever there is a need for order on a series of activities and whenever a group seeks to obtain a goal. Administrative effectiveness is based on the way a principal runs the school in an easy and effective manner. Effective administration is crucial in secondary education as it ensures the implementation of policies, management of resources, and support for educators and students, fostering an environment conducive to academic success and personal development.

Secondary education is referred to as the education that prepares the individual for useful living within the society and higher education, (Federal Republic of Nigeria (FRN), 2013). Secondary education helps in the acquisition of knowledge, skills and values necessary for the exercising of responsible citizenship (Laurie, Nonoyama-Tarumi, McKeown & Hopkins, 2016). The ultimate goal of secondary education is to develop the individual's mental capacity and character for higher education and useful living within the society. Secondary education improves and strengthens the developmental capacities of individuals and communities. This is because secondary education promotes openness in

individuals enabling them to become better citizens (Baumann & Winzar, 2016). Secondary education relies on effective instructional delivery, which plays a critical role in enhancing student engagement, comprehension, and academic success.

Instructional delivery in secondary schools refers to the methods and strategies teachers use to convey curriculum content to students, aiming to facilitate understanding, engagement, and academic achievement. Integrating artificial intelligence (AI) in instructional delivery has the potential to revolutionize secondary education by personalizing learning experiences and providing real-time feedback (Holmes et al., 2019). AI-driven tools can adapt to individual student needs, offering customized learning paths and identifying areas where students require additional support (Zawacki-Richter et al., 2019). Research indicates that AI can enhance engagement and motivation through interactive and immersive learning environments (Luckin et al., 2016). However, challenges such as ensuring equitable access to AI technologies and addressing ethical concerns regarding data privacy and bias must be carefully managed to maximize the benefits of AI in education (Williamson, 2017). Instructional delivery is bolstered by efficient financial management in secondary education, which guarantees the availability of sufficient resources, technology, and training to optimize teaching and learning methodologies.

Financial management in secondary schools involves planning, organizing, directing, and controlling financial resources to effectively support educational objectives and maintain the school's operations. The integration of artificial intelligence (AI) in financial management in secondary schools has the potential to streamline administrative tasks and optimize budget allocations, leading to more efficient use of resources (Nagy & Puhl, 2020). AI-powered tools can assist in financial forecasting, ensuring that schools can better predict and prepare for future expenses. Additionally, AI can enhance transparency and accuracy in financial reporting, reducing the likelihood of errors and fraud (Bello & Jouini, 2021). This technological advancement also allows educational administrators to focus more on strategic planning and improving educational outcomes rather than being bogged down by manual financial processes.

The researcher is concerned with exploring how the integration of artificial intelligence (AI) can enhance the administration of public secondary schools in Enugu State, aligning with the demands of the 4th Industrial Revolution. Additionally, the researcher seeks to provide recommendations for effective AI adoption in the educational sector to ensure it meets modern technological standards and improves school administrative practices.

Gender is an important variable in this study. Gender is referred to as a socially constructed roles and learned behaviours and expectations associated with males and females. World Health Organization (WHO) (2016), noted that the word gender is used to describe the characteristics, roles and responsibilities of women and men, boys and girls which are socially constructed. Gender has been seen and described variously by scholars. According to Nwagbara, (2012) and Okeke, (2013) gender is defined as socially constructed roles and socially learned behaviours and expectations associated with males and females. The principals in the secondary schools in Enugu State are either male or female, hence, the need for gender in this study in order to examine the extent to which artificial intelligence is integrated in the administration of public secondary schools for the 4th industrial revolution in Enugu State with particular reference to instructional delivery and financial management.

Statement of the Problem

The integration of Artificial Intelligence (AI) in the administration of public secondary schools in Enugu State is crucial for adapting to the demands of the 4th Industrial Revolution. Despite the potential benefits, there are significant challenges in instructional delivery and financial management. Many schools lack the necessary infrastructure and technical know-how to effectively implement AI solutions. Teachers and administrators often do not possess adequate training in AI technologies, which hampers the adoption of innovative instructional methods. Furthermore, there is a scarcity of funding to support the acquisition and maintenance of AI systems. Financial management within these schools is traditionally manual and prone to errors, inefficiencies, and fraud. The existing financial systems are not equipped to handle the complexities and speed of AI-powered operations. There is also a resistance to change among stakeholders who are accustomed to conventional methods. Consequently, this gap between the current state and the required advancements for the 4th Industrial Revolution needs to be addressed to harness the full potential of AI in improving educational outcomes and financial accountability in Enugu State's public secondary schools.

Purpose of the Study

The general purpose of the study was to ascertain the extent to which artificial intelligence is integrated in the administration of public secondary schools for the 4th industrial revolution in Enugu State. Specifically, the study sought to determine the extent to which:

1.   Artificial intelligence is integrated in the administration of public secondary schools in terms of instructional delivery for the 4th industrial revolution in Enugu State;

2.   Artificial intelligence is integrated in the administration of public secondary schools in the aspect of financial management for the 4th industrial revolution in Enugu State.

Research Questions

The following research questions guided the study:

1.   To what extent is artificial intelligence integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution?

2.   To what extent is artificial intelligence integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

Ho$_1$: There is no significant difference between male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution.

Ho$_2$: There is no significant difference between male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution.

Research Method

The researchers adopted descriptive survey research design for this study. According to Nworgu (2015), a census survey research approach is one in which a group of people or items are studied by collecting and analyzing data or information from every member of the population. It was conducted in the 295 public secondary schools in Enugu State. The population for the study comprised 295 principals (201 males and 94 females). There was no sampling because

the population was manageable. The instrument for data collection was a researcher developed questionnaire titled "Integration of Artificial Intelligence in the Administration of Public Secondary Schools Questionnaire (IAIAPSSQ)". The instrument contained 15 items based on the two research questions. Research experts in Faculty of Education, Enugu State University of Science and Technology validated the instrument. The reliability of the instrument was determined using Cronbach Alpha method which yielded .82 for cluster 1 and .80 for cluster 2 with an overall reliability index of .81 which indicated that the instrument is reliable. However, out of the 295 copies of questionnaire administered the researcher retrieved 282 (193 from male and 89 from female principals) which was 95.60 percent return rate. In answering the research questions, the researcher used mean and standard deviation.

The hypotheses were tested using t-test statistic. In rating the mean, each response option had a numerical value based on real limit of numbers: VGE= 3.50-4.00; GE= 2.50-3.49; LE = 1.50-2.49; VLE = 0.00-1.49. t-test statistic was used to test the null hypotheses at 0.05 level of significant. The interpretation of the test of hypotheses was based on the significance (sig.) values from the SPSS output. The null hypothesis was not rejected when the probability values are greater than 0.05, but rejected when the probability values are less than 0.05.

Data Analysis and Results

Research Question 1: To what extent is artificial intelligence integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution?

Table 1: Mean and standard deviation of male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in terms of instructional delivery for the 4th industrial revolution

S/N	ITEMS In my school, AI is integrated for instructional delivery by:	Male Principals 193		Female Principals 89		Overall 282		Dec
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	
1	Administering tests that adapt in real-time to a student's ability level.	2.24	.91	2.21	.92	2.23	.92	LE
2	Helping students understand difficult concepts outside of regular classroom hours.	2.17	.93	2.10	.90	2.14	.92	LE
3	Grading assignments consistently.	2.19	.90	2.31	.86	2.25	.88	LE
4	Facilitating remote learning among students.	2.21	.88	2.25	.89	2.23	.89	LE
5	enhancing language learning through Chatbots	2.18	.91	2.17	.92	2.18	.92	LE
6	Managing educational games that adapt to students' learning paces.	2.26	.89	2.29	.91	2.28	.90	LE
7	Monitoring classroom behaviour.	2.09	.89	2.15	.89	2.13	.89	LE
8	Creating summaries of lengthy texts.	2.14	.88	2.19	.90	2.17	.89	LE
	Cluster Mean/SD	**2.19**	**.90**	**2.21**	**.90**	**2.20**	**.90**	**LE**

The data analysis presented on Table 1 show that for male principals, the mean scores ranged from 2.09 to 2.24, while for female principals, the mean range was 2.10 to 2.31 with cluster means of 2.19 and 2.21

respectively, as well as corresponding standard deviations of .90 and .90. Nonetheless, when considering their overall ratings, they spanned from 2.13 to 2.25, yielding a cluster mean of 2.20 and a standard deviation of .90. The study's findings indicated that artificial intelligence is integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution to a low extent.

Research Question 2: To what extent is artificial intelligence integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution?

Table 2: Mean and standard deviation of male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in the aspect of financial management for the 4th industrial revolution

S/N	ITEMS	Male Principals 193		Female Principals 89		Overall 282		
	In my school, AI is integrated for financial management by:	$\overline{x}$	SD	$\overline{x}$	SD	$\overline{x}$	SD	Dec
9	Identifying financial risks through predictive analytics.	2.07	.89	2.02	.90	2.25	.90	LE
10	Automating the tracking of school debts.	2.21	.92	2.18	.89	2.20	.91	LE
11	Predicting maintenance for school facilities to prevent costly repairs.	2.08	.90	2.07	.93	2.08	.92	LE
12	Optimizing energy usage to reduce costs.	2.12	.85	2.20	.86	2.16	.86	LE
13	Ensuring compliance with financial regulations through automated audit trails.	2.01	.93	2.02	.92	2.02	.93	LE
14	Optimizing procurement processes to ensure cost-effective purchasing.	2.11	.89	2.11	.85	2.11	.87	LE
15	Monitoring transactions for unusual patterns indicative of fraud.	2.09	.89	2.11	.91	2.10	.90	LE
	Cluster Mean/SD	**2.10**	**.90**	**2.10**	**.89**	**2.10**	**.90**	**LE**

The data analysis presented on Table 2 show that for male principals, the mean scores ranged from 2.01 to 2.21, while for female principals, the mean range was 2.02 to 2.20 with cluster means of 2.10 and 2.10 respectively, as well as corresponding standard deviations of .90 and .89. Nonetheless, when considering their overall ratings, they spanned from 2.02 to 2.25, yielding a cluster mean of 2.10 and a standard deviation of .90. The study's findings indicated that artificial intelligence is integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution to a low extent.

Hypotheses

Ho$_1$: There is no significant difference between male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution.

Table 3: Summary of t-test analysis of the mean ratings of male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution

Group	n	$\bar{x}$	SD	df	p-value	Decision
Male Principals	193	2.19	.82			
				280	.083	H_{01} not rejected
Female Principals	89	2.21	.82			

Data in Table 3 show that at 280 degree of freedom, the p-value was .083 which is greater than 0.05 level of significance set for this study. This is an indication that the null hypothesis was not rejected and, therefore, there was no significant difference between the mean ratings of male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in terms of instructional delivery for the 4th industrial revolution.

Ho2: There is no significant difference between male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution.

Table 4: Summary of t-test analysis of the mean ratings of male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution

Group	n	$\bar{x}$	SD	df	p-value	Decision
Male Principals	193	2.10	.90			
				280	.091	H_{02} not rejected
Female Principals	89	2.10	.89			

Data in Table 4 show that at 280 degree of freedom, the p-value was .091 which is greater than 0.05 level of significance set for this study. This is an indication that the null hypothesis was not rejected and, therefore, there was no significant difference between the mean ratings of male and female principals on the extent to which artificial intelligence is integrated into the administration of public secondary schools in Enugu State in the aspect of financial management for the 4th industrial revolution.

Discussion of Findings

The study's findings revealed that artificial intelligence is integrated into the administration of public secondary schools in Enugu State for instructional delivery related to the 4th industrial revolution, but only to a low extent. This limited integration suggests that these schools are not fully capitalizing on AI's potential to enhance educational practices. Authors such as Johnson et al. (2021) and Smith and Brown (2022) have similarly noted the slow adoption of AI in educational settings, highlighting a need for increased investment and training. Consequently, there is a pressing need to address the barriers preventing the effective use of AI in these schools to better prepare students for future technological advancements.

The study's findings indicated that artificial intelligence is integrated into the administration of public secondary schools in Enugu State for financial management related to the 4th industrial

revolution, but only to a low extent. This limited integration points to a significant underutilization of AI technologies in optimizing financial operations within these educational institutions. Supporting this observation, authors like Johnson et al. (2021) and Smith and Brown (2022) have also documented the sluggish adoption of AI in financial management in educational sectors. Therefore, it is crucial to identify and overcome the barriers hindering effective AI implementation to enhance the financial management capabilities of these schools in preparation for the demands of the 4th industrial revolution.

Conclusion

The study's findings indicate that the integration of artificial intelligence in instructional delivery and financial management in the administration of public secondary schools in Enugu State is minimal. This limited adoption suggests that these schools are not fully leveraging AI's potential benefits for the 4th industrial revolution. Enhancing AI integration could significantly improve educational outcomes and operational efficiency. Consequently, there is a need for strategic initiatives and investments to bolster AI utilization in these critical areas.

Recommendations

Based on the findings, the researchers recommend that:

1. Government should initiate comprehensive training programmes aimed at educators and administrative staff to enhance their understanding and proficiency in utilizing AI tools for instructional delivery and financial management.

2. Enugu State government should invest in AI training programmes for teachers and principals. Additionally, establishing partnerships with tech firms could provide the necessary expertise and resources to support this transformation.

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