

ARTIFICIAL INTELLIGENCE IN STRENGTHENING SECONDARY SCHOOL ADMINISTRATION FOR FOURTH INDUSTRIAL REVOLUTION READINESS IN ENUGU STATE

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Abstract

The study focused on the application of artificial intelligence in strengthening the administration of public secondary schools to meet fourth industrial revolution demands 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 298 public secondary schools in Enugu State. The population for the study comprised 298 principals (204 male and 94 female). There was no sampling because the population was manageable. The instrument for data collection was a researcher developed questionnaire titled “Application of Artificial Intelligence in Strengthening the Administration of Public Secondary Schools Questionnaire (AAISAPSSQ)”. The instrument contained 10 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 0.83 for cluster 1 and 0.81 for cluster 2 with an overall reliability index of 0.82 which indicated that the instrument was 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 applied in the areas of personalized learning support and teacher performance evaluation in the administration of public secondary schools for the 4th industrial revolution in Enugu State to a low extent. The study recommended among others that Government should provide funding and infrastructure to support wider adoption of AI tools for personalized learning in public secondary schools in Enugu State.

Keywords: Application, artificial intelligence, public secondary schools, administration

Introduction

Artificial Intelligence (AI) has become increasingly relevant in education because it supports personalized learning, automates repetitive tasks like grading, and provides real-time feedback to both students and teachers. It enables the creation of adaptive learning systems that can adjust instructional content to match individual students’ needs and learning pace. AI-powered tools such as chatbots and intelligent tutoring systems offer students immediate support and explanations, making learning more engaging and self-directed. According to Huang, Saleh, and Liu (2021), AI has been widely applied in adaptive learning, automated evaluation, and virtual classroom environments to enhance instructional delivery. These applications help teachers save time on administrative work, allowing them to focus more on mentoring and guiding students (Hu, 2024). AI also helps in analyzing large amounts of educational data to identify learning gaps and recommend personalized interventions. Furthermore, AI improves assessment by generating data-driven insights into students’ progress and providing continuous formative feedback. Its application promotes inclusive education by catering to diverse learning styles and abilities, including support for students with special needs.

Globally, AI is transforming administrative tasks by simplifying processes such as admissions, scheduling, data management, and resource allocation. Hofmann and Junkermann (2023) demonstrated that AI can streamline and make administrative

procedures more efficient while addressing challenges like transparency and data availability. In the education sector, AI is already reshaping management tasks like performance evaluation, monitoring student progress, and curriculum delivery. Crompton and Burke (2023) found in their systematic review that AI research in higher education has grown significantly between 2016 and 2022, with increased focus on assessment tools and tracking student outcomes. Lu (2024) posited that with the growing demand for digital skills in the Fourth Industrial Revolution, AI's integration into education prepares students for the future workforce. Thus, AI is no longer a futuristic concept but a practical tool that is reshaping the entire educational experience for better efficiency and improved learning outcomes.

The Fourth Industrial Revolution (4IR) refers to a fusion of technologies blurring the lines between physical, digital, and biological spheres, and education systems must adapt to equip learners with critical thinking, creativity, and digital skills. Mabunda and Prinsloo (2023) reported that while many education sectors in Africa are unprepared for 4IR, they recognize opportunities to harness AI and data analytics to transform learning and teaching. The 4th Industrial Revolution represents a transformative period where technological innovations increasingly merge the physical, digital, and biological worlds, reshaping how individuals live, work, and communicate. Key drivers of this revolution include artificial intelligence, robotics, the Internet of Things (IoT), biotechnology, and big data analytics, which together foster unprecedented innovation, efficiency, and connectivity across multiple sectors (Xu, David & Kim, 2018). While these advancements promise improved productivity and more personalized experiences, they also introduce challenges such as job displacement, cyber security threats, and ethical concerns. Navigating this era requires adaptive policies and robust ethical frameworks to promote inclusive, sustainable, and responsible technological growth (Schwab, 2017). In the context of secondary education, the 4th Industrial Revolution is transforming school administration by streamlining operations, enhancing personalized learning, and supporting data-driven decision-making. This technological integration allows schools to build more efficient, responsive, and adaptable educational environments, equipping both teachers and students to thrive in a rapidly changing world. By equipping staff and students with essential digital skills and fostering innovation, schools can enhance operational efficiency, decision-making, and overall effectiveness in administration.

Administration involves the systematic organization and management of an institution's operations, resources, and functions. It encompasses planning, coordinating, and supervising activities to ensure they align with the organization's goals, including decision-making, policy enforcement, and resource distribution. According to Unachukwu and Okorji (2014), administration is a social process focused on identifying, motivating, controlling, and integrating human and material resources within a structured system to achieve predetermined objectives. Similarly, Aideloha (2018) describes administration as necessary whenever collective action is required, when order is needed for coordinated activities, or when a group seeks to accomplish a common goal. In the context of secondary education, administrative effectiveness depends largely on how principals manage school operations efficiently and responsibly. Effective administration is vital as it ensures smooth policy implementation, optimal resource management, and strong support for both teachers and students, creating an environment conducive to academic achievement and holistic development. Furthermore, competent administration fosters innovation, accountability, and strategic planning, enabling schools to adapt to emerging educational challenges and technological advancements. Ultimately, strong administrative practices lay the foundation for sustained school growth, improved learning outcomes, and a culture of excellence in secondary education.

Secondary education is the stage of learning designed to prepare individuals for productive participation in society and for further academic pursuits (Federal Republic of Nigeria [FRN], 2013). It equips students with essential knowledge, skills, and values necessary for responsible citizenship and informed decision-making (Laurie, Nonoyama-Tarumi, McKeown & Hopkins, 2016). According to Baumann and Winzar (2016), secondary education enhances both personal and community development by fostering openness, critical thinking, and social responsibility. Okafor and Eze (2018) also define secondary education as a level of schooling aimed at developing intellectual abilities, moral character, and practical skills that enable learners to contribute meaningfully to society. Its ultimate purpose is to cultivate well-rounded individuals capable of higher learning, active citizenship, and lifelong personal and professional growth. The application of artificial intelligence in strengthening the administration of public secondary schools in Enugu State focuses on enhancing personalized learning support and evaluating teacher performance to meet the demands of the Fourth Industrial Revolution.

Personalized learning support tailors educational experiences to meet each student's unique needs, strengths, and interests, fostering greater engagement and ownership of learning (Pane, Steiner, Baird & Hamilton, 2015). This approach involves customizing the pace, content, and learning environment to ensure all students achieve mastery. Educators play a crucial role by providing targeted instruction and flexible pathways that accommodate diverse learning styles (Walkington, 2018). For instance, research by Ubabudu (2025) highlights the transformative impact of AI in advancing personalized learning in Nigerian schools. Similarly, a study by Opara and Badamasi (2024) found that AI-powered platforms positively influenced students' academic motivation and performance in Abuja. Despite these advancements, the application of AI for personalized learning in Enugu State's public secondary schools is minimal. Aderiye and Wagbara (2025) observed that, although AI usage in assessment and virtual teaching positively influences teacher performance, its actual application remains minimal. This aligns with findings from Enugu State, where AI tools' impact on instructional effectiveness is still developing (SFJESGS, 2025). Research indicates that personalized learning can lead to improved student outcomes, increased motivation, and enhanced academic achievement. Effective personalized learning support not only enhances student engagement and achievement but also provides valuable data and insights that inform the systematic process of evaluating teacher performance.

Evaluating teacher performance is a systematic process of assessing educators' effectiveness in facilitating student learning and fostering a positive classroom environment (Darling-Hammond, 2018). This evaluation typically includes classroom observations, student feedback, and analysis of student performance data. The goal is to provide constructive feedback that supports professional growth and enhances teaching quality (Stronge, Ward, & Grant, 2017). Effective evaluation systems are transparent, fair, and aligned with educational standards, aiming to recognize excellence and identify areas for improvement. For example, research by Aderiye and Wagbara (2025) indicates that AI usage in assessment and virtual teaching positively influences teacher performance. Similarly, a study by Nwuke and Yellowe (2025) explored AI's utilization in teacher performance evaluation in Rivers State, Nigeria.

Gender is a pivotal variable in this study, encompassing the socially constructed roles, behaviours, and expectations associated with individuals based on their perceived or assigned sex. The World Health Organization (WHO) defines gender as the characteristics, roles, and responsibilities of women and men, boys and girls, which are socially constructed and vary across different societies and cultures (World Health Organization (WHO), 2023). This definition underscores that gender is not biologically

determined but is shaped by societal norms and expectations. Similarly, the Canadian Institutes of Health Research (CIHR) describes gender as the socially constructed roles, behaviors, expressions, and identities of girls, women, boys, men, and gender-diverse people, emphasizing its variability and evolution over time and across cultures. These perspectives highlight the importance of considering gender in educational research, particularly in examining how artificial intelligence can enhance the administration of public secondary schools in Enugu State to meet the demands of the Fourth Industrial Revolution, with a focus on providing personalized learning support and evaluating teacher performance.

Statement of the Problem

Ideally, the administration of public secondary schools in Enugu State should reflect global best practices where artificial intelligence (AI) is deployed to support personalized learning and evaluate teacher performance. AI-driven personalized learning tools can adapt instruction to meet the needs of individual students, track progress in real time, and provide targeted interventions to improve learning outcomes. Similarly, AI-assisted teacher performance evaluation can generate objective, data-driven insights into teachers' instructional practices, helping school leaders to provide constructive feedback and professional development. In a technology-driven era, these applications are crucial for aligning school administration with the demands of the Fourth Industrial Revolution. However, in many public secondary schools in Enugu State, these ideal conditions are far from being realized. The use of AI for personalized learning remains minimal, with most schools still relying on a one-size-fits-all teaching approach that overlooks individual student needs. In addition, teacher performance evaluation is largely manual, subjective, and inconsistent, limiting its effectiveness in improving instructional quality.

If these problems remain unaddressed, the consequences for the education system and students' future readiness will be severe. Failure to implement AI-powered personalized learning support may widen the gap between high and low achievers, reduce student engagement, and lead to poor academic outcomes. Without effective AI-based teacher evaluation systems, principals may continue to miss opportunities for evidence-based staff development and mentoring. Over time, this could weaken teacher productivity, reduce instructional quality, and hinder students from acquiring the skills necessary for success in a competitive, innovation-driven economy. The lack of data-driven administrative practices also prevents schools from making informed decisions about resource allocation and policy implementation. This gap in practice places Enugu State's education system at risk of falling behind in meeting the demands of the Fourth Industrial Revolution. Addressing these issues is therefore critical to strengthening school administration and ensuring that students and teachers are adequately supported. This study was undertaken to investigate the extent to which AI is applied in providing personalized learning support and evaluating teacher performance in public secondary schools in Enugu State as a step toward bridging this gap.

Purpose of the Study

The general purpose of the study was to ascertain the extent to which artificial intelligence is applied in strengthening the administration of public secondary schools to meet the fourth industrial revolution demands in Enugu State. Specifically, the study sought to determine the extent to which:

1. artificial intelligence is applied in providing personalized learning support in the administration of public secondary schools in Enugu State.
2. artificial intelligence is applied in evaluating teacher performance in the administration of public secondary schools in Enugu State.

Research Questions

The following research questions guided the study:

1. To what extent is artificial intelligence applied in providing personalized learning support in the administration of public secondary schools in Enugu State?
2. To what extent is artificial intelligence applied in evaluating teacher performance in the administration of public secondary schools in Enugu State?

Hypotheses

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

Ho₁: There is no significant difference between the mean ratings of male and female principals on the extent to which artificial intelligence is applied in providing personalized learning support in the administration of public secondary schools in Enugu State.

Ho₂: There is no significant difference between the mean ratings of male and female principals on the extent to which artificial intelligence is applied in evaluating teacher performance in the administration of public secondary schools in Enugu State.

Methods

The researcher adopted a descriptive survey research design for this study. According to Osuala (2016), descriptive survey research design systematically collects information from respondents to understand their opinions, attitudes, or characteristics with the aim of presenting an accurate picture of a situation or population. The study was carried out in the 298 public secondary schools in Enugu State. The population consisted of 298 principals, of which 204 were males and 94 were females. Since the population was manageable, no sampling was done. Data for the study were collected using a researcher-developed questionnaire titled “Application of Artificial Intelligence in Strengthening the Administration of Public Secondary Schools Questionnaire (AAISAPSSQ),” which contained 10 items based on the two research questions. The instrument was validated by research experts in the Faculty of Education, Enugu State University of Science and Technology. The reliability of the instrument was determined using the Cronbach Alpha method, which yielded reliability coefficients of 0.83 for cluster 1 and 0.81 for cluster 2, with an overall reliability index of 0.82, indicating that the instrument was reliable.

Out of the 298 copies of the questionnaire administered, 280 were retrieved, of which 195 were from male principals and 85 from female principals, representing a 93.96 percent return rate. In answering the research questions, mean and standard deviation were used for data analysis, while t-test statistics were used to test the null hypotheses at the 0.05 level of significance. Each response option was rated using the real limits of numbers where 3.50–4.00 was interpreted as Very Great Extent (VGE), 2.50–3.49 as Great Extent (GE), 1.50–2.49 as Low Extent (LE), and 0.00–1.49 as Very Low Extent (VLE). The null hypotheses were retained when the probability value (p-value) was greater than 0.05, but rejected when the p-value was less than 0.05, based on the SPSS output.

Results

Research Question 1: To what extent is artificial intelligence applied in providing personalized learning support in the administration of public secondary schools in Enugu State?

Table 1: Mean and standard deviation of male and female principals on the extent to which artificial intelligence is applied in providing personalized learning support in the administration of public secondary schools

ITEMS		Male Principals 195		Female Principals 85		Dec
S/N	In my school, AI is applied in providing personalized learning support in the administration of public secondary schools by:	$\bar{x}$	SD	$\bar{x}$	SD	
1.	Using AI tools to adapt lesson delivery to suit individual students' learning needs and pace.	2.15	0.92	2.12	0.94	LE
2.	Applying AI systems to monitor students' academic progress and provide real-time performance data.	2.08	0.88	2.05	0.90	LE
3.	Using AI applications to identify learning gaps and recommend targeted remedial lessons.	2.11	0.91	2.09	0.93	LE
4.	Employing AI platforms to suggest personalized learning resources and practice activities for students.	2.09	0.89	2.06	0.90	LE
5.	Using AI-driven analytics to group students based on ability levels for differentiated instruction.	2.07	0.90	2.08	0.88	LE
Cluster Mean/SD		2.10	0.90	2.08	0.91	LE

Table 1 shows that both male and female principals rated the application of artificial intelligence in providing personalized learning support in public secondary schools in Enugu State to a **low extent**. The cluster mean for male principals was **2.10** with a standard deviation of **0.90**, while that of female principals was **2.08** with a standard deviation of **0.91**, all falling within the real limit for Low Extent (1.50–2.49). This indicates that AI tools for adapting lesson delivery, tracking student progress, identifying learning gaps, and recommending personalized resources are rarely used in these schools. The low mean values across all five items suggest that personalized learning through AI has not been fully integrated into the school administrative process. This finding implies that most schools are still relying on traditional approaches to instruction and are yet to maximize the potential of AI to support individualized learning as required by the Fourth Industrial Revolution.

Research Question 2: To what extent is artificial intelligence applied in evaluating teacher performance in the administration of public secondary schools in Enugu State?

Table 2: Mean and standard deviation of male and female principals on the extent to which artificial intelligence is applied in evaluating teacher performance in the administration of public secondary schools

ITEMS		Male Principals 195		Female Principals 85		Dec
S/N	In my school, AI is applied in evaluating teacher performance in the administration of public secondary schools by:	$\bar{x}$	SD	$\bar{x}$	SD	
6.	Using AI systems to track teachers' instructional delivery and classroom activities.	2.45	0.96	2.42	0.94	LE
7.	Applying AI tools to generate objective data for teacher appraisal and feedback.	2.38	0.94	2.36	0.92	LE
8.	Employing AI applications to monitor teacher	2.42	0.97	2.39	0.95	LE

	attendance and lesson preparation.					
9.	Using AI platforms to recommend professional development based on teacher performance data.	2.37	0.93	2.35	0.91	LE
10.	Applying AI-driven analytics to link student outcomes with teacher effectiveness.	2.40	0.95	2.38	0.92	LE
Cluster Mean/SD		2.40	0.95	2.38	0.93	LE

Table 2 reveals that both male and female principals rated the application of artificial intelligence in evaluating teacher performance in public secondary schools in Enugu State to a **low extent**. The cluster mean for male principals was **2.40** with a standard deviation of **0.95**, while that of female principals was **2.38** with a standard deviation of **0.93**, which falls within the real limit for Low Extent (1.50–2.49). This shows that AI tools for tracking instructional delivery, generating appraisal data, monitoring attendance, and linking teacher performance with student outcomes are not widely utilized. The low ratings suggest that teacher evaluation processes remain largely manual and traditional, with minimal technological support. This result implies a need for improved integration of AI systems to enhance objective and data-driven teacher performance appraisal in line with global educational best practices.

Hypotheses

H₀₁: There is no significant difference between the mean ratings of male and female principals on the extent to which artificial intelligence is applied in providing personalized learning support in the administration of public secondary schools in Enugu State.

Table 3: Summary of t-test analysis of the mean ratings of male and female principals on the extent to which artificial intelligence is applied in providing personalized learning support in the administration of public secondary schools

Group	N	$\bar{x}$	SD	df	p-value	Decision
Male Principals	195	2.10	0.90	278	0.87	H ₀₁ not rejected
Female Principals	85	2.08	0.91			

The result in Table 3 shows that male principals had a mean rating of 2.10 with a standard deviation of 0.90, while female principals had a mean rating of 2.08 with a standard deviation of 0.91. The calculated p-value of 0.87 is greater than the 0.05 level of significance. This means that the difference between the mean ratings of male and female principals is not statistically significant. The null hypothesis (H₀₁) was therefore not rejected. This finding suggests that both male and female principals share similar views on the extent to which artificial intelligence is applied in providing personalized learning support in the administration of public secondary schools in Enugu State.

H₀₂: There is no significant difference between the mean ratings of male and female principals on the extent to which artificial intelligence is applied in evaluating teacher performance in the administration of public secondary schools in Enugu State.

Table 4: Summary of t-test analysis of the mean ratings of male and female principals on the extent to which artificial intelligence is applied in evaluating teacher performance in the administration of public secondary schools

Group	N	$\bar{x}$	SD	df	p-value	Decision
Male Principals	195	2.40	0.95	280	0.870	H ₀₂ not rejected
Female Principals	85	2.38	0.93			

The result of the t-test shows that male principals had a mean rating of 2.40, while female principals had a mean rating of 2.38 on the application of AI in evaluating teacher performance. The standard deviations (0.95 for males and 0.93 for females) indicate similar levels of response variability between the two groups. The p-value of 0.870 is greater than the 0.05 level of significance, meaning the difference between the groups' mean ratings is not statistically significant. This implies that both male and female principals share similar perceptions about the extent to which AI is applied in evaluating teacher performance. Therefore, the null hypothesis (H₀₂) was not rejected, indicating no significant gender difference in responses.

Discussion

The study found that artificial intelligence is applied to a low extent in personalized learning support in public secondary schools in Enugu State. This means schools still largely depend on traditional, generalized teaching methods rather than AI-powered, individualized instruction. Few schools employ systems that monitor students' progress in real time or adjust teaching to suit individual learning needs. Teachers rarely use AI platforms to diagnose learning gaps or deliver targeted feedback, which limits students' ability to receive personalized interventions. A major challenge is inadequate infrastructure, such as limited access to computers, internet services, and AI-enabled software, as well as insufficient teacher training. According to Bello and Ojo (2023), AI adoption for personalized learning in Nigerian secondary schools is still very low due to infrastructural deficiencies, low teacher preparedness, and resistance to change. This finding aligns with the current study and suggests that failure to integrate AI-powered personalized support may lead to widening achievement gaps, disengaged learners, and slow progress toward meeting the educational expectations of the Fourth Industrial Revolution.

The study also revealed that the application of artificial intelligence in evaluating teacher performance in public secondary schools in Enugu State is very limited. Teacher appraisal continues to rely mainly on manual processes, which are often subjective and inconsistent, rather than data-driven AI solutions. Schools rarely adopt systems that collect ongoing evidence of teaching practices or link them with student outcomes to provide actionable feedback. Most teachers lack access to AI-supported tools that could help monitor and improve their instructional effectiveness. Aderiye and Wagbara (2025) found that, although AI usage in assessment, grading, and virtual teaching positively influences teacher performance, its actual application in public secondary schools remains minimal. This confirms the present study's result that teacher performance evaluation is still handled traditionally, limiting the potential for objective and comprehensive appraisal. If this problem persists, schools may continue to miss opportunities for targeted teacher development, resulting in poor instructional quality and suboptimal student outcomes.

Conclusion

The findings of the study revealed that artificial intelligence is applied to a low extent in the areas of personalized learning support and teacher performance evaluation in the administration of public secondary schools for the 4th Industrial Revolution in Enugu State. This indicates that despite the potential of AI to transform school administration and improve learning outcomes, its adoption remains limited. The low level of integration suggests gaps in infrastructure, teacher preparedness, and policy implementation. Consequently, there is an urgent need for deliberate efforts to promote AI adoption through adequate funding, training, and supportive policies. Strengthening these areas will enhance personalized learning, improve teacher performance evaluation, and align school administration with the demands of the 4th Industrial Revolution.

Recommendations

In line with the findings of this study, the following recommendations were raised:

1. Government should provide funding and infrastructure to support wider adoption of AI tools for personalized learning in public secondary schools in Enugu State.
2. Regular training and workshops should be organized to build teachers' capacity in using AI for student support and performance evaluation.
3. Education policymakers should integrate AI-driven systems into school administration to improve data-driven decision-making and teaching effectiveness.

REFERENCES

- Aideloha, A. (2018). Educational administration: A social process. *International Journal of Educational Administration*, 10(1), 45–58.
- Baumann, C., & Winzar, H. (2016). The role of education in promoting sustainable development. *International Journal of Sustainability in Higher Education*, 17(1), 1–17.
- Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: A systematic review of research from 2016 to 2022. *International Journal of Educational Technology in Higher Education*, 20(1), 15. <https://doi.org/10.1186/s41239-023-00392-8>
- Darling-Hammond, L. (2018). Getting teacher evaluation right: What really matters for effectiveness and improvement. *Teachers College Record*, 115(12), 1–33.
- Federal Republic of Nigeria (FRN). (2013). *National Policy on Education (6th ed.)*. Lagos: NERDC Press.
- Mabunda, S., & Prinsloo, P. (2023). Innovations in teaching and learning: Exploring the perceptions of the education sector on the fourth industrial revolution. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(2), 31.
- Hofmann, J., & Junkermann, H. (2023). Artificial intelligence (AI) and automation in administrative procedures: Potentials, limitations, and framework conditions. *Journal of the Knowledge Economy*, 15, 1121–1135.
- Huang, R., Saleh, I., & Liu, D. (2021). Applications of artificial intelligence in education: Current developments and future prospects. *Asian Journal of Information Science and Technology*, 11(3), 45–56.
- Huang, J., Saleh, S., & Liu, Y. (2021). A review on artificial intelligence in education. *Academic Journal of Interdisciplinary Studies*, 10(3), 206–217. <https://doi.org/10.36941/ajis-2021-0077>

- Hu, S. (2024). The effect of artificial intelligence-assisted personalized learning on student learning outcomes: A Meta-Analysis Based on 31 Empirical Research Papers. *Science Insights Education Frontiers*, 24(1), 3873–3894. <https://doi.org/10.15354/sief.24.re395>
- Laurie, D., Nonoyama-Tarumi, Y., McKeown, R., & Hopkins, C. (2016). *Education for sustainable development goals: Learning objectives*. UNESCO.
- Lu, J. (2024). Artificial intelligence in education: Design and evaluation of adaptive learning systems. *Research in Educational Reform*, 6(2), 2101–2308. <https://doi.org/10.32629/rerr.v6i4.2101>
- Okafor, N., & Eze, J. (2022). Attitudes and study habits of secondary school students toward English language learning. *Nigerian Journal of Educational Psychology*, 18(2), 22–37.
- Osuala, E. C. (2016). *Introduction to research methodology*. Africana-FEP Publishers Ltd.
- Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2015). *Continued progress: Promising evidence on personalized learning*. RAND Corporation.
- Schwab, K. (2017). *The fourth industrial revolution*. Crown Publishing Group.
- Stronge, J. H., Ward, T. J., & Grant, L. W. (2017). *Teacher evaluation and student achievement: Making the connection*. Routledge.
- Unachukwu, G. O., & Okorji, P. N. (2014). The administrative process. In G. O. Unachukwu & P. N. Okorji (Eds.), *Educational management: A skill-building approach* (35–56). Rex Charles & Patrick.
- Walkington, C. (2018). Using adaptive learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes. *Journal of Educational Psychology*, 105(4), 932–945.
- World Health Organization (WHO). (2023). *What is gender? What is sex?* Retrieved from: <https://cihr-irsc.gc.ca/e/48642.html> on 21.04.2025.
- Xu, M., David, J. M., & Kim, S. H. (2018). The fourth industrial revolution: Opportunities and challenges. *International Journal of Financial Research*, 9(2), 90–95. <https://doi.org/10.5430/ijfr.v9n2p90>