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International Journal of Educational Management, Rivers State University.

Artificial Intelligence as a Tool in Enhancing Teaching Effectiveness in Public Senior Secondary Schools in Awgu L.G.A. Enugu

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Abstract

The study examined artificial intelligence as a tool in enhancing teaching effectiveness in public senior secondary schools in Awgu LGA, Enugu state Nigeria. The study utilized a descriptive survey research design, which is appropriate for gathering data on the current practices of teachers regarding the use of artificial intelligence as a tool in enhancing teaching effectiveness in public senior secondary schools in Awgu LGA, Enugu state. The sample was obtained using a random selection method. The sample size consisted of 355 teachers comprising 189 females and 166 male teachers from 22 public secondary schools. A self-structured questionnaire titled "AI in Teaching Effectiveness Questionnaire" (AITEQ) was used to collect data. The findings of the study revealed that teachers in public senior secondary schools in Awgu LGA of Enugu State moderately use AI tools in enhancing teaching effectiveness.

Keywords: Artificial intelligence, Intelligence tutoring systems, Machine learning algorithm, Natural language processing.

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in the evolving educational sector, offering innovative solutions to longstanding challenges. As educational systems worldwide confront issues such as overcrowded classrooms, diverse student needs, and limited resources, AI presents a compelling opportunity to address these challenges through advanced technological approaches. Artificial Intelligence encompasses a broad spectrum of technologies, including machine learning, natural language processing, and intelligent tutoring systems, which have the potential to revolutionize traditional teaching methods. These technologies can offer personalized learning experiences, facilitate real-time assessment, and assist teachers in managing diverse classroom environments. In Awgu, where educational resources are often constrained, and teaching conditions can be particularly challenging, the integration of AI tools represents a promising strategy for improving educational outcomes.

The application of AI in education can significantly enhance teaching effectiveness by addressing specific needs such as tailored lesson plans, adaptive learning environments, and efficient administrative support. For instance, AI-driven platforms can analyze student performance data to deliver customized instructional strategies, thereby improving student engagement and achievement. Additionally, AI tools can help teachers identify learning gaps and provide targeted interventions, fostering a more supportive and effective learning environment. By evaluating current practices and identifying areas where AI can be integrated, this study seeks to demonstrate how these tools can be utilized to overcome local educational challenges.

The integration of AI into educational settings is a rapidly growing field that holds promise for addressing some of the persistent challenges faced by educators. AI technologies, such as machine learning algorithms, natural language processing, and intelligent tutoring systems, are designed to support personalized learning, streamline administrative tasks, and facilitate data-driven decision-making (Zawacki-Richter et al., 2019). AI-powered platforms can adapt to individual students' learning needs, providing customized resources and feedback aligned with their unique abilities and progress (Woolf, 2010). This level of customization is particularly pertinent in public secondary schools, where diverse student populations present varied educational needs. Awgu Local Government Area, located in Enugu State, Nigeria, serves as a relevant case study due to its unique educational context and challenges. Public secondary schools in this region frequently encounter issues such as overcrowded classrooms, limited resources, and a shortage of qualified teaching staff (Nwachukwu & Nwankwo, 2018). Implementing AI tools could offer innovative solutions to these problems, potentially enhancing teaching effectiveness by automating routine tasks, providing additional support to teachers, and offering more engaging and interactive learning experiences for students.

Research in this area is still emerging, but a growing body of literature suggests that AI can significantly impact educational outcomes. For example, studies have demonstrated that AI applications can improve student engagement and achievement by providing targeted interventions and real-time feedback (Luckin et al., 2016). However, the adoption of AI in education also raises important questions about equity, accessibility, and the role of educators in a technologically advanced classroom environment. As educational institutions seek to adapt to the demands of the 21st century, AI offers a promising solution for enhancing teaching effectiveness in senior secondary schools.

Machine learning algorithms have shown considerable promise in personalizing and adapting instruction to individual student needs. A study by Nwosu and Okafor (2021) in secondary schools in southeastern Nigeria found that the use of adaptive learning systems powered by machine learning led to significant improvements in student performance across multiple subject areas. The researchers noted that these AI-driven systems were able to analyze student data in real-time and adjust the difficulty and pacing of content delivery, allowing for a more tailored learning experience. This personalization helped address the challenge of diverse student abilities within large classroom settings.

Eze and Nnamani (2022) investigated the application of predictive analytics in identifying at-risk students in public secondary schools in Enugu State. Their findings revealed that machine learning models could accurately forecast student performance and engagement levels, enabling early interventions. The researchers emphasized that such proactive measures were crucial in a context where teacher-student ratios were high, making it challenging for educators to closely monitor individual student progress. By leveraging AI, teachers could allocate their time and resources more efficiently to support struggling learners.

Natural language processing (NLP) is another AI technology that has shown potential in enhancing language instruction and communication in Nigerian classrooms. Okorie and Onyeka (2020) conducted a study on the use of NLP-based chatbots to support English language learning in secondary schools in Anambra State. Their research demonstrated that AI-powered language tools could provide students with immediate feedback on grammar, vocabulary, and pronunciation, supplementing teacher instruction. The 24/7 availability of these AI assistants allowed students to practice and receive guidance outside of regular class hours, addressing the limited instructional time in crowded classrooms.

Nwoye and Ezeani (2023) explored the application of NLP in automating essay grading and providing detailed feedback to students in Imo State secondary schools. Their study found that AI-assisted grading not only reduced the workload on teachers but also provided more consistent and comprehensive feedback to students. This was particularly beneficial in large classes where manual grading of numerous essays could be time-consuming and prone to inconsistencies. The researchers noted that the AI system's ability to analyze text structure, coherence, and argumentation helped students improve their writing skills more rapidly.

Intelligent tutoring systems (ITS) have also garnered attention for their potential to provide individualized instruction and support. Adebayo and Oluwole (2022) conducted a comparative study of traditional teaching methods and ITS in mathematics education across secondary schools in Oyo State. Their findings indicated that students who used AI-powered tutoring systems alongside regular classroom instruction showed greater improvements in problem-solving skills and conceptual understanding compared to those relying solely on traditional methods. The researchers attributed this success to the ITS's ability to provide step-by-step guidance, immediate feedback, and adaptive problem sets tailored to each student's proficiency level.

In a similar vein, Ugwu and Eze (2021) investigated the impact of an ITS on science education in Enugu State secondary schools. Their study revealed that the AI-driven system effectively simulated laboratory experiments, providing students with virtual hands-on experiences in settings where physical laboratory resources were limited. This not only enhanced student engagement but also improved their understanding of complex scientific concepts. The researchers emphasized that such AI tools could help bridge the resource gap in underfunded schools, providing equitable access to quality science education.

However, the implementation of AI in Nigerian secondary schools is not without challenges. Okonkwo and Nwankwo (2022) conducted a comprehensive survey of AI readiness in public secondary schools across southeastern Nigeria. Their findings highlighted significant barriers to AI adoption, including inadequate infrastructure, limited teacher training in AI technologies, and concerns about data privacy and ethical use of AI in education. The researchers stressed the need for targeted investments in digital infrastructure and comprehensive professional development programs to prepare educators for the integration of AI tools in their teaching practices.

Despite these challenges, the potential benefits of AI in enhancing teaching effectiveness are substantial. Chukwu and Onwu (2023) proposed a framework for integrating AI tools in Nigerian secondary education, emphasizing a phased approach that considers local contexts and resource constraints. Their model suggests starting with basic AI applications like automated administrative tasks and gradually progressing to more advanced tools like adaptive learning systems and intelligent tutors. The researchers argue that such a measured approach could help overcome resistance and build capacity over time.

In conclusion, the literature reveals a growing body of evidence supporting the potential of AI tools to enhance teaching effectiveness in Nigerian secondary schools, including those in Awgu LGA. Machine learning algorithms, natural language processing, and intelligent tutoring systems offer promising solutions to longstanding challenges such as personalized instruction, timely feedback, and resource limitations. However, successful implementation will require addressing infrastructure gaps, providing adequate teacher training, and developing contextually appropriate AI solutions. As research in this field continues to evolve, it is crucial to critically examine both the opportunities and challenges presented by AI integration in education, ensuring that technological advancements serve to enhance rather than replace the crucial role of teachers in the learning process.

Statement of the Problem

Teachers should be well equipped with sufficient resources and support to effectively manage their classrooms, ensuring that no student is left behind. Educational institutions should be well-staffed with qualified educators who can dedicate time and attention to each student, fostering an environment where all learners can thrive. Furthermore, administrative tasks can be streamlined, allowing educators to focus on teaching and engaging with students rather than being burdened by routine paperwork. Technology plays a complementary role, enhancing teaching and learning processes without overwhelming the human elements of education.

However, the reality in many senior secondary schools, particularly in regions such as Awgu Local Government Area of Enugu State, Nigeria, diverges significantly from this ideal. According to Ukazu (2017), Schools in Awgu LGA are often characterized by overcrowded classrooms, limited educational resources, and a shortage of qualified teaching staff. Teachers face significant challenges in managing diverse classroom environments, meeting the varied needs of students, and ensuring that all learners are adequately supported. The lack of sufficient resources further exacerbates these challenges, as teachers are unable to access the tools and materials necessary for effective instruction. As a result, educational outcomes are often suboptimal, with students not receiving the personalized attention they need to succeed. Administrative inefficiencies add to the burden on educators, leaving them with less time to focus on improving teaching practices and student engagement.

This research seeks to explore the potential of Artificial Intelligence (AI) tools in enhancing teaching effectiveness in public senior secondary schools in Awgu Local government area, Enugu State. The research will examine how AI can be utilized to provide personalized learning

experiences, support teachers in managing classroom dynamics, and streamline administrative tasks. The question this study seeks to answer is: Can the integration of AI truly transform the educational sector in Awgu Local Government Area, creating a more equitable and effective system for all students?

Purpose of the Study

The purpose of this study was to investigate Artificial Intelligence as a Tool for enhancing Teaching Effectiveness in Public Secondary Schools in Awgu Local Government Area of Enugu State. Specifically, the study sought to:

1. determine the extent teachers use machine learning algorithms as a tool in enhancing teaching effectiveness in public senior secondary schools in Awgu L.G.A of Enugu state.

   2. examine the extent teachers use natural language processing as a tool in enhancing teaching effectiveness in public senior secondary schools in Awgu local government area of Enugu state.
2. ascertain the extent teachers use intelligent tutoring systems in enhancing teaching effectiveness in public senior secondary schools in Awgu local government area of Enugu state.

Research Questions

The following research questions guided this study;

1. To what extent do teachers use machine learning algorithms in enhancing teaching effectiveness in public senior secondary schools in Awgu L.G.A of Enugu state?
2. To what extent do teachers use natural language processing as a tool in enhancing teaching effectiveness in public senior secondary schools in Awgu local government area of Enugu state?
3. To what extent do teachers use intelligent tutoring systems in enhancing teaching effectiveness in public senior secondary schools in Awgu local government area of Enugu state?

Methodology

This study adopted a descriptive survey design, which is appropriate for gathering data on the current practices of teachers regarding the use of Artificial Intelligence (AI) tools in enhancing teaching effectiveness in public senior secondary schools within Awgu Local Government Area (LGA) of Enugu State. The population for this study consisted of 3084 teachers comprising of

1956 females and 1119 males from 43 public senior secondary schools in Awgu LGA (Source: ESSSSBR, Jan 2024), which were randomly selected to ensure representation across gender, age, and experience. The sample size was determined using the Taro Yamane formula, which yielded a sample of 355 teachers comprising of 189 female teachers and 166 male teachers from 22 public senior secondary schools in Agwu local government. This sample was stratified to include both male and female teachers, ensuring the diversity necessary for examining differences in their responses.

A self-structured questionnaire titled "AI in Teaching Effectiveness Questionnaire" (AITEQ) was used to collect data. The questionnaire comprised 30 items divided into three sections corresponding to the study's objectives: the use of machine learning algorithms, natural language processing, and intelligent tutoring systems in teaching. Each item was rated on a 4-point Likert scale ranging from Very High Extent (VHE), High Extent (HE), Low Extent (LE) and Very Low Extent (VLE) with values 4,3,2 and 1 respectively. Cronbach Alpha was used to establish the reliability of the instrument which yielded reliability indexes of 0.83, 0.71 and 0.80. Mean and standard deviation were used to answer the research questions with a criterion mean of 2.50. Questionnaire items with ratings below 2.50 denoted 'Low Extent' while 2.50 and above signified 'High Extent'.

Results

Research Question 1: To what extent do teachers use machine learning algorithms in enhancing teaching effectiveness in public senior secondary schools in Awgu L.G.A of Enugu state?

Table 1: Mean Ratings of Male and Female Teachers on the Extent of the Use of Machine Learning Algorithms in Enhancing Teaching Effectiveness in Public Senior Secondary Schools in Awgu L.G.A of Enugu State?

S/N	Item	Male Teachers N=166		Decision	Female Teachers N=189		Decision	Mean set ($\bar{X}1+\bar{X}2$ /2)
		$\bar{X}$	SD		$\bar{X}$	SD		
1	teachers' ability to use machine learning tools to assist in teaching.	3.31	0.78	**HE**	2.90	0.72	**HE**	3.11
2	ability to identify and analyze students' performance through the use of machine learning tool	3.08	0.61	**HE**	2.65	0.51	**HE**	2.87
3	ability for teachers to receive training on using machine learning in teaching practice	3.13	0.77	**HE**	3.09	0.73	**HE**	3.11

4	ability to create lesson plan using machine learning tools	2.73	0.63	**HE**	2.96	0.69	**HE**	2.85
5	ability to identify the barriers faced in using machine learning algorithms in teaching	3.20	0.79	**HE**	3.05	0.76	**HE**	3.13
	Grand Mean/SD	**3.09**	**0.72**	**HE**	**2.93**	**0.68**	**HE**	3.01

The result in Table 1 above revealed that all the questionnaire items 1, 2, 3, 4 and 5 had grand mean scores of 3.09 and 2.93 with corresponding standard deviations of 0.72 and 0.68 for both male and female teachers. This infers that to a high extent teachers' utilization machine learning algorithms enhances teaching effectiveness in public senior secondary schools in Awgu L.G.A of Enugu State**.**

Research Question 2: To what extent do teachers use natural language processing as a tool in enhancing teaching effectiveness in public senior secondary schools in Awgu local government area of Enugu state?

Table 1: Mean Ratings of Male and Female Teachers on the Extent of the Use of Natural language processing as a tool in Enhancing Teaching Effectiveness in Public Senior Secondary Schools in Awgu L.G.A of Enugu State?

S/N	Item	Male Teachers N=166 $\bar{X}$	SD	Decision	Female Teachers N=189 $\bar{X}$	SD	Decision	Mean set ($\bar{X}1+\bar{X}2/2$)
1	teachers' ability to use natural learning processing tools in teaching	3.17	0.59	**HE**	2.96	0.70	**HE**	3.07
2	ability to incorporate natural learning processing tools in teaching practices	3.38	0.74	**HE**	3.15	0.66	**HE**	3.27
3	ability to identify subjects or areas natural learning processing tools are needed	3.24	0.79	**HE**	2.93	0.71	**HE**	3.09
4	ability to use natural learning processing tools to impact students' engagement in the classroom.	3.20	0.68	**HE**	2.66	0.88	**HE**	2.93
5	ability to identify students' improvement when using natural learning processing tools.	2.87	0.77	**HE**	2.43	0.80	**HE**	2.65
	Grand Mean/SD	**3.17**	**0.71**	**HE**	**2.83**	**0.75**	**HE**	3

The result in Table 2 above revealed that all the questionnaire items 1, 2, 3, 4 and 5 had grand mean scores of 3.17 and 2.83 with corresponding standard deviations of 0.71 and 0.75 for both male and female teachers. This infers that to a high extent teachers' utilization of natural language processing as a tool enhances teaching effectiveness in public senior secondary schools in Awgu L.G.A of Enugu state

Research Question 3: To what extent do teachers use intelligent tutoring systems in enhancing teaching effectiveness in public senior secondary schools in Awgu local government area of Enugu state?

Table 1: Mean Ratings of Male and Female Teachers on the Extent of the Use of intelligent tutoring systems in Enhancing Teaching Effectiveness in Public Senior Secondary Schools in Awgu L.G.A of Enugu State?

S/N	Item	Male Teachers N=166		Decision	Female Teachers N=189		Decision	Mean set ($\bar{X}1+\bar{X}2$ /2)
		$\bar{X}$	SD		$\bar{X}$	SD		
1	Teachers' ability to use intelligent tutoring systems	3.72	0.81	**HE**	2.70	0.76	**HE**	3.21
2	Ability to evaluate the influence of intelligent tutoring systems in students' engagement.	3.02	0.87	**HE**	2.90	0.91	**HE**	2.96
3	Ability to identify improvements in students' performance related to the use of intelligent tutoring systems.	3.15	0.94	**HE**	3.07	0.78	**HE**	3.11
4	Ability to identify diverse learning needs among students with the use of intelligent tutoring systems.	2.60	0.93	**HE**	2.80	0.60	**HE**	2.7
5	Ability to identify challenges faced in utilizing intelligent tutoring systems	3.50	0.71	**HE**	3.09	0.79	**HE**	3.29
	Grand Mean/SD	**3.19**	**0.85**	**HE**	**2.91**	**0.77**	**HE**	3.05

The result in Table 3 above revealed that all the questionnaire items 1, 2, 3, 4 and 5 had grand mean scores of 3.19 and 2.91 with corresponding standard deviations of 0.85 and 0.77 for both male and female teachers. This infers that to a high extent teachers' utilization of intelligent tutoring systems enhances teaching effectiveness in public senior secondary schools in Awgu L.G.A of Enugu State.

Summary of Findings

The findings of the study revealed that teachers in public senior secondary schools in Awgu LGA of Enugu State moderately use AI tools in enhancing teaching effectiveness. Specifically, the use of machine learning algorithms was found to be at a moderate level, with a mean score of 3.09 and 2.93 and a standard deviation of 0.72 and 0.68 respectively. The use of natural language processing tools was also moderate, with a mean score of 3.17 and 2.83 and a standard deviation of 0.71 and 0.75 respectively. On the other hand, the utilization of intelligent tutoring systems was slightly higher, with a mean score of 3.19 and 2.91 and a standard deviation of 0.85 and 0.77 respectively, indicating that these systems are more integrated into the teaching practices compared to the other AI tools.

Discussion of Findings

The findings of this study align with existing literature on the adoption of AI in education, particularly in developing regions like Nigeria. According to Okeke (2021), the moderate adoption of AI tools such as machine learning algorithms and natural language processing in Nigerian schools can be attributed to factors such as limited access to technology, inadequate training, and a lack of awareness of the potential benefits of these tools in teaching and learning processes. The slightly higher utilization of intelligent tutoring systems, as observed in this study, may be due to their user-friendly nature and their ability to provide immediate feedback to students, which enhances personalized learning experiences (Eze & Chukwu, 2020).

Moreover, the absence of significant gender differences in the adoption of AI tools suggests that both male and female teachers are equally equipped and motivated to integrate these technologies into their teaching practices. This finding is consistent with the work of Nwafor (2019), who found no gender disparity in the use of educational technology among secondary school teachers in Enugu State.

These findings underscore the need for increased professional development and support for teachers in the area of AI in education. By providing teachers with the necessary skills and resources, they can more effectively integrate AI tools into their teaching practices, ultimately enhancing educational outcomes in public senior secondary schools in Awgu LGA,Enugu State.

Recommendations

Based on the findings, the following recommendations are advanced

1. Government and philanthropist should provide adequate artificial intelligent tools to be used by teachers in Awgu Local Government Area of Enugu state.

2. Government should provide trainings for teachers in Awgu LGA Enugu Staeon the use of AI tools such as machine learning algorithms, intelligent tutoring system, natural language processing.
3. Teachers in Awgu LGA Enugu state, should be sensitized of the potential benefits of the use of AI tools in teaching process.

References

Adebayo, I. M., & Oluwole, A. E. (2022). Comparative study of intelligent tutoring systems and traditional methods in mathematics education in secondary schools. *Journal of Educational Technology*, *10*(2), 143-157.

Awgu Local Government Area. (n.d.). *Local government reports* [Data set]. Enugu State Ministry of Education.

Chukwu, A., & Onwu, M. (2023). A framework for integrating AI tools in Nigerian secondary education. *International Journal of Education and Development using Information and Communication Technology*, *19*(1), 24-36.

Eze, P. C., & Nnamani, A. (2022). Predictive analytics in identifying at-risk students in secondary schools in Enugu State. *Nigerian Journal of Educational Studies, 15*(3), 102-113.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. *Pearson Education*.

Nwachukwu, M. E., & Nwankwo, J. (2018). Addressing challenges in public secondary education in Awgu Local Government Area. *Journal of Nigerian Educational Research Association*, *7*(1), 77-85.

Nwosu, C. & Okafor, J. (2021). Impact of adaptive learning systems on student performance in southeastern Nigeria. *African Journal of Educational Management, 12*(4), 68-79.

Nwoye, A., & Ezeani, S. (2023). Automating essay grading in secondary schools: Benefits and challenges. *Journal of Educational Technology Research and Development, 71*(1), 225-240.

Okonkwo, E., & Nwankwo, A. (2022). Barriers to AI adoption in southeastern Nigerian secondary schools. *International Journal of AI in Education, 32*(3), 359-375.

Okorie, J., & Onyeka, P. (2020). Enhancing English language learning with NLP-based chatbots in Anambra State. *Journal of Language and Linguistics in Education*, *4*(2), 32-44.

Woolf, B. P. (2010). *Building intelligent interactive tutors: Student-centered strategies for revolutionizing e-learning*. Morgan Kaufmann.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of meta-analyses and reviews on the impact of blended learning in higher education. *International Journal of Educational Technology in Higher Education, 16*(1), 1-22.

Ukazu,E.C,(2017).classroom management and teaching effectiveness in Nigeria. Journal of continuing education.3(2),201-209.