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SWOT ANALYSIS OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) IN PUBLIC TERTIARY INSTITUTIONS IN ENUGU STATE

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Abstract

This study was carried out as SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the application of Artificial Intelligence (AI) in public tertiary institutions in Enugu State. The study adopted a descriptive survey design of mixed methods. Four (4) research questions and two (2) null hypotheses guided the study. A multi-stage sampling technique was used firstly to randomly draw University of Nigeria, Nsukka from the public tertiary institutions in the state and secondly, Taro Yamane's Sampling technique to draw 81 Heads of Departments out of 102 as sample. The instrument used for primary data collection was a questionnaire titled SWOT Analysis of Artificial Intelligence Questionnaire (SAAIQ). The instrument was validated by 3 experts from the Faculty of Education, University of Nigeria, Nsukka and Cronbach Alpha measure was used to determine the internal consistency reliability which yielded a co-efficient of 0.77, and this indicated that the instrument was reliable. The secondary data was sourced from existing empirical studies, journals and publications. Mean and standard deviation were used to answer the research questions, while t-test statistic was used to test the hypotheses at 0.05 level of significance. Results showed that the application of AI in tertiary institutions in Enugu State has strengths in personalized learning and automated administrative tasks, the weaknesses are lack of infrastructure and high implementation costs, the opportunities are government and NGOs support; and enhancement of curriculum development, while the threats are resistance to change and fear of job displacement. Each of $H_0$1 and $H_0$2 was rejected because in both cases t-cal > t-crit and p-value < 0.05. The study concluded that AI holds significant promise for educational transformation in the state but faces several challenges that need to be addressed and thereby recommended that to have a very successful implementation of application of AI in tertiary institutions in Enugu State, there should be increased government support, personnel training and infrastructural improvement.

Keywords: SWOT analysis, artificial intelligence, tertiary

Introduction

The education sector is inherently susceptible to change due to its close connection to societal, technological, and political development. As society evolves, so do the demands on education, from shifts in job markets requiring new skills to cultural changes influencing curriculum content. Technological advancement drive innovation in teaching methods and educational management, with tools like online learning platforms and artificial intelligence reshaping how education is delivered and accessed. Furthermore, global events like pandemics or climate change force educational institutions to adapt quickly to new realities. This susceptibility ensures that the education system remains a dynamic, evolving structure, but it also presents challenges in maintaining consistency and quality while embracing necessary change. The focus of this study is on artificial intelligence which is driving a major transformation in education, reshaping how students learn and how educators teach.

Authors and researchers have defined what artificial intelligence is, the types, the components and the application in the education system.

Glover (2024) defined Artificial intelligence as the technology that allows machines to simulate human intelligence and cognitive capabilities. AI can be used to help make decisions, solve problems and perform tasks that are normally accomplished by humans. Artificial Intelligence (AI) according to Nwakunor (2021) is the computer-controlled robots that think intelligently like human. These robots are controlled electronically with the aid of the computer by mimicking the competencies of the human mind. Also, Stryker and Kavlakoglu (2024) defined Artificial intelligence (AI) as technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity and autonomy. This definition is adopted for the study. AI is broadly classified into three types, according to Lumenalta (2024), they are: Narrow AI, which is designed for specific tasks (e.g., virtual assistants, recommendation systems), General AI, which aims to mimic human cognitive abilities across various domain and SuperAI (Artificial Super Intelligence). The main components of AI as catalogued by Mitchell (2024) are: Speech Recognition (SR), Machine Learning (ML), Deep Learning, Computer Vision (CV), Robotics, Natural Language Processing (NLP) and Expert Systems (ES). Speech recognition is when Artificial Intelligence voice recognition essentially converts spoken words to digital signals that are interpreted and analyzed by robots (Sinha, 2023). Machine Learning (ML) on the other hand is a subset of AI that facilitates the analysis of large data sets and enhances pattern recognition, it allows computers to automatically anticipate and adapt to certain outcomes. Ahramovich (2023) stated that ML is useful in education for adaptive learning, inclusive learning, dropout mitigation, AI tutor and chatbots, robot teachers, task automation, targeted market, real-time translation, corporate training platforms and fraud detection. Deep learning is a type of machine learning that uses artificial neural networks to learn from data. Artificial neural networks are inspired by the human brain, and they can be used to solve a wide variety of problems, including image recognition, natural language processing, and speech recognition (Google Cloud, 2024).

Another component of AI is Computer Vision (CV) which is a science that focuses on enabling computers to identify and understand objects and people in images and videos. Like other types of AI, computer vision seeks to perform and automate tasks that replicate human capabilities (Microsoft Azure, 2024). While robotics is the intersection of science, engineering and technology that produces machines, called robots, that replicate or substitute for human actions (Urwin,2024). Educational robots can serve various purposes in enhancing learning experiences. They can promote active engagement, problem-solving, and collaboration among students as active learning tools. Expert System (ES) which Lutkevich (2024) defined as a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expertise and experience in a particular field and Gray (2019) reported that it is used extensively in online tutoring systems, it represents a system of diagnosing and remediating shortcomings in a pupil's or a teacher's knowledge base, but this would always be limited by the ability of an individual system to update its own knowledge as well as transcend cultures.

The application of Artificial Intelligence in education is now enhancing quality education in areas of personalized learning, curriculum development, teachers' development, support for learners with disability, support for research, increase in digital knowledge among learners and educators. According to Okunade (2024), artificial

intelligence (AI) in education is the application of sophisticated technology, namely machine learning algorithms and computational models, to enhance the learning process, boost educational results, and customize instruction to meet the unique requirements of each student. In addition, AI also supports school management in areas of automated administrative tasks, security and surveillance, financial management, communications, scheduling and school plant management (Adetarami and Okeke, 2025). The integration of AI into teaching and learning, and overall school management is not without obstacles, and notable ones were highlighted by Ogunode and Gregory (2023) as job displacement, electricity problem, unstable internet service, lack of technical expertise and resources, bias and discrimination, lack of transparency and interpretability, data privacy and security breaches, lack of ethical and legal guidelines, but the benefits far outweigh the challenges. Conclusively, AI holds the potential to revolutionize teaching and learning in Nigeria by eradicating challenges associated with conventional educational methods. The application of AI in teaching and learning has come to stay, and Nigeria will likely leverage AI to achieve its educational goals, including enhanced knowledge acquisition.

Statement of the Problem

The rapid integration of artificial intelligence (AI) in tertiary education has created both opportunities and challenges for educators, students, and institutions in Enugu State. While AI-powered tools promise to enhance learning experiences through personalized education, automated assessments, and efficient administrative support, their implementation also raises concerns about accessibility, data privacy, academic integrity, and the quality of education delivered. Despite the increasing adoption of AI in higher education across the state, there is limited research on its long-term impact on student engagement, critical thinking, and teacher-student interactions. Furthermore, disparities in technological infrastructure and digital literacy often hinder the equitable deployment of AI systems across diverse educational environments. This research aims to explore the strengths, weaknesses, opportunities, and threats to the usage of AI in tertiary education in the state, providing insights into how AI can be harnessed to improve learning outcomes and school management without compromising educational quality and fairness.

Purpose of the Study

The general purpose of the study was to explore the overall perception of the academics on the application of Artificial Intelligence (AI) in the teaching, learning and management of public tertiary institutions in Enugu State. Specifically, the study sought to:

1. identify the strengths of the application of AI in teaching, learning and management of public tertiary institutions in Enugu State.
2. examine the weaknesses associated with the application of AI in teaching, learning and management of public tertiary institutions in Enugu State.
3. assess the opportunities available in the application of AI in teaching, learning and management of public tertiary institutions in Enugu State.
4. find out the threats to the application of AI in teaching, learning and management of public tertiary institutions in Enugu State.

Research Questions

The following research questions were answered for the study:

1. What are the strengths of the application of Artificial Intelligence in teaching, learning and management of public tertiary institutions in Enugu State?

2. What are the weaknesses of the application of Artificial Intelligence in teaching, learning and management of public tertiary institutions in Enugu State?
3. What are the opportunities in the application of Artificial Intelligence in teaching, learning and management of public tertiary institutions in Enugu State?
4. What are the threats to the application of Artificial Intelligence in teaching, learning and management of tertiary institutions in Enugu State?

Hypotheses

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

$H_0$1. There is no significant difference between the mean scores on perceptions on the strengths and, on opportunities of the application of AI in tertiary education in Enugu State.

$H_0$2. There is no significant difference between the mean scores on perceptions on the weaknesses and, on threats to the application of AI in tertiary education in Enugu State.

Methods

The study adopted a descriptive survey research design of mixed methods; commonly referred to as methodological triangulation of quantitative and qualitative approaches of enquiry. Data was collected from both primary and secondary sources. The mixed methods were appropriate for the study because according to Nwankwo and Emunemu (2015), they combine the strength and at the same time compensate for each other's weakness of both qualitative and quantitative research. The population of the study consisted of all the public tertiary institutions in Enugu State which is inclusive of the universities, polytechnics and colleges of education. Multi-stage sampling technique was used, firstly University of Nigeria was randomly selected and secondly, Taro Yamane's sampling technique was used to obtain a sample of 81 heads of departments out of the 102 heads of departments from the 15 faculties in the University of Nigeria, Nsukka as sample for the study. The primary data was obtained with the researchers developed questionnaire titled SWOT Analysis of Artificial Intelligence Questionnaire (SAAIQ). The questionnaire had 4 clusters and 41 statement items. The instrument was face validated by 3 experts, 2 from the Department of Educational Foundations and, 1 from Science Education Department, Faculty of Education, University of Nigeria, Nsukka, their suggestions were incorporated into the final draft. The instrument was trial tested at Nnamdi Azikiwe University, Awka using 10 heads of departments and Cronbach Alpha measure was used to determine the internal consistency reliability which yielded a co-efficient of 0.77 and this indicated that the instrument was reliable. The four point rating scales of Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1) were used to answer the questionnaire. Mean and standard deviation were used to answer the 4 research questions, while t-test statistic was used to test the 2 hypotheses at 0.05 level of significance. The benchmark was that any item of 2.50 mean and above was taken as "Accepted" while any item of mean of 0.01 – 2.49 was taken as "Rejected". The secondary data was obtained from previous empirical studies, journals and publications. 81 questionnaires were administered and 75 were retrieved.

Results

Table 1: Mean Ratings and Standard Deviation on the Strengths of using Artificial Intelligence (AI) in teaching, learning and management of public tertiary institutions in Enugu State

S/N	Item Statement	X	SD	Decision
1.	AI improves personalized learning and adaptive education.	3.40	0.82	A
2.	AI is useful for automated administrative tasks.	3.67	0.66	A
3.	AI enhances students' engagement and gamification.	3.12	0.83	A
4.	AI supports inclusive education for students with disability.	3.28	1.01	A
5.	AI is useful for teacher support & professional development.	3.69	1.40	A
6.	AI is useful for school security and monitoring (Physical &online).	3.55	0.70	A
7.	AI powers assessments & feedback in the school system.	3.39	0.88	A
8.	AI supports language learning & real-time translation.	3.51	0.88	A
9.	AI gives access to quality education.	3.51	0.70	A
10.	AI is bridging the digital divide.	3.07	0.52	A
	Aggregate Mean and Standard Deviation	**3.42**	**0.84**	**A**

Table 1 shows that all the 10 items in the cluster have mean ratings between 3.07 to 3.69 with standard deviation ranging from 0.52 to 1.40. This shows that each of the items has mean rating above the 2.50 set as benchmark. The table also shows an aggregate mean of 3.42 which is above the 2.50 benchmark. This implied that all the items in the cluster were accepted as strengths of the application of AI in public tertiary education in Enugu State.

Table 2: Mean Ratings and Standard Deviation on the weaknesses associated with using Artificial Intelligence (AI) in teaching, learning and management of public tertiary institutions in Enugu State

S/N	Item Statement	X	SD	Decision
11.	AI has high implementation costs.	3.03	0.66	A
12.	There is limited infrastructure/ internet and electricity to support AI.	2.97	0.95	A
13.	There is digital training gap among educational practitioners.	3.12	1.00	A
14.	AI has over-reliance on technology.	3.15	0.86	A
15.	There is data privacy and security issues on AI application in schools.	3.00	0.88	A
16.	AI has cultural and language barriers.	3.45	0.71	A
17.	AI implementation depends on external support.	3.43	0.67	A
18.	There are ethical and legal concerns.	3.07	0.77	A
19.	There is reduction in student-teacher interaction with the use of AI.	3.64	0.53	A
20.	AI lacks technical maintenance and support at the	3.51	0.77	A

	local level.			
21.	AI has limited parental support and awareness.	2.99	0.91	A
	Aggregate Mean and Standard Deviation	**3.21**	**0.79**	**A**

Data in Table 2 shows the mean scores and standard deviation of the weaknesses of the application of AI in public tertiary institutions in Enugu State. Table 2 indicates that items 11-21 had mean ratings above the criterion mean of 2.50. The aggregate mean score was 3.21 while the standard deviation was 0.79. Therefore, the respondents accepted the 11 items in the cluster as the weaknesses of the application of AI in public tertiary institutions in Enugu State.

Table 3: Mean Ratings and Standard Deviation on the opportunities available in using Artificial Intelligence (AI) in teaching, learning and management of public tertiary institutions in Enugu State

S/N	Item Statement	X	SD	Decision
22.	A new lucrative career is possible in AI implementation.	2.99	0.82	A
23.	Government and NGO can support AI implementation.	3.81	0.40	A
24.	Collaboration with EDTech companies is possible.	3.77	0.41	A
25.	Use of AI brings improved digital literacy.	3.57	0.54	A
26.	AI can be Integrated with local curriculum.	2.93	0.84	A
27.	AI supports remote and hybrid learning.	3.01	0.94	A
28.	Teacher support and training.	2.97	0.89	A
29.	AI enhances curriculum development.	3.08	0.85	A
30.	AI offers intelligent tutoring system.	2.88	1.04	A
31.	AI now assists students in research and thesis writing.	3.17	1.02	A
	Aggregate Mean and Standard Deviation	**3.22**	**0.78**	**A**

Data in Table 3 reveals that items 22-31 have mean ratings above the 2.50 benchmark for acceptance, therefore all of the items in the cluster were accepted, the aggregate mean and standard deviation of the cluster is 3.17 and 0.78 respectively, which gives an overall acceptance to the cluster as the opportunities in the application of AI in public tertiary institutions in Enugu State.

Table 4: Mean Ratings and Standard Deviation on the threats to using Artificial Intelligence in teaching, learning and management of public tertiary institutions in Enugu State

S/N	Item Statement	X	SD	Decision
32.	Resistance to change by some educational managers and practitioners.	2.95	1.02	A
33.	Digital divide in ICT skills among educational practitioners	2.83	0.93	A
34.	AI is biased in decision making	2.25	1.07	R
35.	Sustainability Issues	2.99	0.75	A
36.	Job displacement concerns	3.20	0.79	A
37.	Lack of human connection and emotional intelligence	3.13	0.82	A
38.	AI has quality control issues	2.48	1.06	R
39.	Bias in Algorithms	2.80	1.04	A

40.	Over-reliance on AI reduced critical thinking	3.32	0.77	A
41.	Limited ability to handle complex and unstructured problems	3.07	0.76	A
	Aggregate Mean and Standard Deviation	**2.90**	**0.90**	**A**

Table 4 above shows that the respondents accepted items 32, 33, 35, 36, 37, 39, 40 and 41 while items 34 and 38 were rejected. The accepted items have mean values of 2.95, 2.83, 2.99, 3.20, 3.13, 2.80, 3.32 and 3.07 respectively. These mean scores are up to 2.50 which was the criterion value. This implies that the respondents agreed that the threats to the application of AI in public tertiary institutions in Enugu State are resistance to change by some educational managers and practitioners, digital divide in ICT skills among educational practitioners, sustainability issues, job displacement concerns, lack of human connection and emotional intelligence, bias in algorithms, over-reliance on AI reduced critical thinking and limited ability to handle complex and unstructured problems. Items 34 and 38 with mean scores 2.25 and 2.48 respectively were rejected because their mean scores were not up to the slated 2.50 benchmark. This implies that the respondents did not agree with statements that AI is biased in decision making and also that AI has quality control issues.

Table 5: Summary of t-test on the difference between the mean scores on the perceptions on the strengths and opportunities in the application of AI in public tertiary institutions in Enugu State

Measure	Mean	SD	N	dif	t-cal	t-crit	p-val	sig
Strength	3.42	0.84	175	74	1.79	1.67	0.04	0.05
Opportunities	3.17	0.78						

Data in table 5 above shows the summary of t-test on the difference between the mean scores on the perceptions on the strengths and opportunities in the application of AI in tertiary education in Enugu State. Based on the analysis, the t-calculate value of 1.79 is greater than the t-critical value of 1.67, and also the p-value of 0.04 is less than the significance level of 0.05 indicating that the null hypothesis was rejected. Therefore, there is no significant difference between the mean scores on perceptions on the strengths and, on opportunities in the application of AI in public tertiary institutions in Enugu State.

Table 6: Summary of t-test on the difference between the mean scores on the perceptions on the weaknesses and threats to application of AI in public tertiary institutions in Enugu State

Measure	Mean	SD	N	dif	t-cal	t-crit	p-val	sig
Weaknesses	3.21	0.79	75	74	2.21	1.67	0.015	0.05
Threats	2.90	0.90						

Data in table 6 shows the summary of t-test on the difference between the mean scores on the perceptions on the weaknesses and threats to the application of AI in public tertiary institutions in Enugu State. Based on the analysis, the t-calculate value of 2.21 is greater than the t-critical value of 1.67, and also the p-value of 0.015 is less than the significance level of 0.05 indicating that the null hypothesis was rejected. Therefore, there is no significant difference between the mean scores on perceptions on the weaknesses and, on threats to the application of AI in public tertiary institutions in Enugu State.

Discussion

The findings of the study revealed the perceived strengths, weaknesses, opportunities and threats to the application of AI in public tertiary institutions in Enugu State. The strengths are AI improves personalized learning and adaptive education, AI is useful for automated administrative tasks, AI enhances students' engagement and gamification, AI supports inclusive education for students with disability, AI is useful for teacher support and professional development, AI is useful for school security and monitoring and others. The result agreed with the findings of Nkedishu and Okonta (2024), Chogwu and Adi (2024) and this was further confirmed by Ogunode and Gregory (2023) that the use of AI in schools enhances quality teaching and learning, teachers' development and administrative efficiency. The weaknesses of the application of AI in public tertiary institutions in Enugu State according to the results are high implementation costs, limited infrastructure, poor internet and electricity supply, digital training gap among educational practitioners and others. The finding is consistent with Ahmed, Bashir and Abubakar (2024) who asserted that shortage of Al facilities, poor implementation of ICT policies, high cost of Al, unstable power supply, poor internet service, high cost of maintenance and poor funding of Al programme were the problems militating against deployment of Al for effective curriculum implementation in public schools.

The opportunities in the application of AI in tertiary education according to the results are the possibilities of a new lucrative career in AI, government and NGOs can support AI implementation, collaboration with EDTech companies is possible, use of AI brings improved digital literacy, AI can be integrated with local curriculum and AI supports remote and hybrid learning. This conforms with Ewa (2024) and Nguyen (2023) who laid credence to the fact that implementation of AI in schools needs more government intervention, that AI can be adopted into the local curriculum and greater result can be achieved when schools collaborate with EdTech companies. Threats to the application of AI as revealed by the results are fear of job displacement, resistance to change, lack of ICT skills, lack of human connection and emotional intelligence. The findings were supported by Makanjuola-Agbola and Idakwoji (2023). However, the rejection of item 34 that AI is biased in decision making contradicts the finding of Okunade (2024) which stated that there is bias in AI systems, which might inadvertently perpetuate pre-existing prejudices in the data used for training, poses an additional ethical dilemma, this was further confirmed by Ogunode and Gregory (2023). The rejection of item 38 that AI faces quality control issues is in disparity with the findings of Nkedishu and Okonta (2024) and Simonova (2024), these studies confirmed that an AI model is only as good as the dataset used to train it. The two hypotheses that guided the study – $H_0$1 and $H_0$2 were both rejected, this is because for $H_0$1, t-cal. 1.79> t-critical 1.67 and p-val. 0.04 < 0.05, also in $H_0$2, 2.21> t-critical 1.67 and p-val. 0.015 < 0.05. In the two hypotheses, the t-calculate is greater than the t-critical and the p-value is less than the 0.05 significance level, therefore the alternative hypotheses were embraced.

Conclusion

This study has confirmed that AI is an assistive technology being deployed into the education system globally to revolutionize it and to eradicate challenges associated with conventional educational methods. AI is enhancing quality education and this study has clearly identified the strengths, weaknesses, opportunities and threats to the implementation of AI in public tertiary institutions in Enugu State. Application of AI supports personalized learning, automated administrative tasks, useful for institutional

security and lecturers' development. The barriers (weaknesses) are high cost of implementation, lack of supporting infrastructure, poor electricity and internet service and AI provides new career opportunity, possibility of government and NGO's support, partnership with EdTech companies, hybrid learning and integration with the local curriculum. Common threats to AI implementation are likely job displacement, resistant to change, ethical issues and lack of quality assurance. Stakeholders in education in the state are to work together to explore the strengths and opportunities inherent in the application of AI and at the same time manage the weaknesses and threats. The benefits of the use of AI far outweigh the challenges.

Recommendation

Based on the analysis done and the findings of the study, the following recommendations should be considered:

1. There should be increased funding for education with special budget for the implementation of the use of assistive technologies such as AI.
2. Lecturers and institutional managers should be adequately trained on the use of the computer, applications and software related to artificial intelligence.
3. There should be partnership among the government, NGOs and other private organizations on the implementation of artificial intelligence in tertiary institutions.
4. Students, lecturers and institutional managers should have repeated interface or experience with artificial intelligence to arouse their interest and acceptance.
5. Improved provision of infrastructure, electricity and internet services in the institutions

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