OPTIMIZING SCHOOL FACILITIES AND INFRASTRUCTURE THROUGH ARTIFICIAL INTELLIGENCE IN PUBLIC SECONDARY SCHOOLS IN EDO SOUTH SENATORIAL DISTRICT

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Abstract

The study was conducted to ascertain the extent to which AI applications are utilized in managing school facilities and infrastructure in public secondary schools in Edo South Senatorial District using descriptive survey research design. Six research questions were raised to guide the study. The population of the study comprise 148 public secondary school principals in the seven local government areas that make up Edo South Senatorial District. A stratified random sampling technique was use to select 74 principals who formed the sample of the study. Data was collected using a structured questionnaire titled Optimizing School Facilities and Infrastructure Through Artificial Intelligence (OSFITAI). The instrument had an r-co-efficient of .974. Data were analyzed using descriptive statistics such as Mean Score, and Standard Deviation while Pearson r was used to analyze hypotheses at .05 alpha level of significance. The mean score was used to determine the extent to which AI applications are utilized in managing school facilities and infrastructure. Pearson r value of .48 is greater than the alpha level of .05 indicating a moderate positive relationship between AI utilization and efficient utilization of school facilities. Findings of the study revealed that AI applications are not yet widely utilized in the management of school facilities and infrastructure in public secondary schools in Edo South Senatorial District. The study recommended that government and stake holders in education should increase budgetary allocation to enable the provision of AI tools to public secondary schools.

Keywords: Artificial Intelligence, Facilities, Optimizing.

Introduction

Facilities in the school, are designed to accommodate staff and upgrade their profitability in the instructing learning process. They assist learners to learn faster and effortlessly, play a pivotal role in the actualization of the national education goals as stipulated in the national policy on education, Federal Republic of Nigeria (FRN) (2013), and ensure the actualization of curriculum goals and objectives. The successful implementation of educational programme depends largely on the quality of school facilities provided for such programme. No effective education programme can exist where facilities and infrastructures are poorly managed. King and Nart (2016) stated that school facilities are costly investments in education by the society and take a lot of time, material resources and efforts to put them in place. Therefore, maintaining these facilities will protect investments. Maintenance of school facilities and infrastructure protect their educational value in terms of appearance, usefulness, and the learning atmosphere they create. Caine and Caine (2016) noted that school heads are saddled with the responsibility of keeping school facilities and infrastructure in good condition. The general

condition of facilities in the school are the striking basis upon which many parents and friends of any educational institution make judgement about the quality of activities that goes on in the school.

Facilities and infrastructure required to enhance educational activities in today's world are quite advanced in comparison to what was in use in the immediate past as noted by Atkin and Bildsten (2017) hence, relying on the intelligence of the school head alone to ensure that facilities and infrastructure are fully utilized to achieve educational goals and objectives has become impossible. The introduction of Artificial Intelligence (AI) to assist in the onerous task of ensuring that available resources are put to efficient use has become imperative. AI is assisting educational managers by providing an improved method of planning, organizing, coordinating, and utilizing existing facilities and infrastructure to meet educational demands of students. According to Abdelalim et al. (2025), AI enables school administrators make data-driven decisions, reduce operational costs, enhance safety, and create a more conducive learning environment. With the assistance of AI school administrators are equipped with accurate information on the lifespan of existing facilities and infrastructure and therefore are able to prepare an effective maintenance plan that can elongate the lifespan of facilities and infrastructure in the school. In today's world the benefit of AI in optimizing facilities and infrastructure in the school are considered immeasurable, however, a third world country like Nigeria, may not be able to fully utilize AI to its full potential because most amenities needed for its optimal utilization may not be readily available.

The study is anchored on the Technology Acceptance Model (TAM) propounded by Fred Davies (1989). The theory examines the willingness of school administrators and staff to adopt AI systems in managing school facilities and infrastructure. The theory focuses on perceived usefulness and perceived ease of use. A school premises with dilapidated facilities and infrastructure transmits to people the message that the school premises lack informal social control, and so is unable or unwilling to defend itself against an external invasion. The inclusion of AI systems into facilities and infrastructure management reduces pressure on the school administrator, a successful strategy for effective management of existing school facilities and infrastructure is to carry-out predictive maintenance on the facility to address the problem when they are small. This is possible with the assistance of AI system to provide adequate and timely information on existing facilities (Masud et al., 2025; Tan, 2023; Mobayo et al., 2021). This theory is relevant to this study because it x-rays the importance of technology in the management of school facilities and infrastructures.

Statement of the Problem

Facilities in the school are the major determinant of the quality of the teaching-learning process. School facilities such as classrooms, laboratories, libraries, Information and Communication Technology (ICT) centre, and other infrastructures constitute essential resources for achieving educational objectives. However, many public secondary schools in Edo South Senatorial District are continuously faced with problems of poor maintenance of facilities, inefficient utilization of available facilities, poor infrastructure planning, escalating maintenance costs, and ineffective resource allocation. These shortcomings often result in overcrowded classrooms, deteriorating physical structures, under-utilization of available facilities, and an in-conducive learning environment.

Artificial Intelligence (AI) has proven to be innovative in solving problems relating to data collection, automated monitoring, and space management. AI applications have the potential to improve the utilization, maintenance, and sustainability of school facilities and infrastructure (Saba et al., 2020). However, the extent to which educational institutions have leveraged these AI applications for optimizing school facilities and infrastructure remains uncertain. Furthermore, there is limited empirical evidence on the effectiveness of AI in addressing existing infrastructural management challenges in schools, particularly in developing countries. It is against this background that this study seeks to examine the optimization of school facilities and infrastructure through Artificial Intelligence with a view to determining the potentials of AI applications in enhancing efficiency, improving infrastructure management practices, and promoting effective educational administration.

Objectives of the Study

The study sought to achieve the following objectives:

1. Examine the extent to which AI applications are utilized in managing school facilities and infrastructure in public secondary schools in Edo South Senatorial District.
2. Determine the influence of AI applications on the efficient utilization of school facilities in public secondary schools in Edo South Senatorial District.
3. Investigate the role of AI in predictive maintenance of school infrastructure in public secondary schools in Edo South Senatorial District.
4. Examine the influence of AI on resource allocation and infrastructure planning in public secondary schools in Edo South Senatorial District.
5. Determine the challenges associated with the adoption of AI for school facilities and infrastructure management in public secondary schools in Edo South Senatorial District.
6. Suggest strategies for enhancing the effective utilization of AI in optimizing school facilities and infrastructure management in public secondary schools in Edo South Senatorial District.

Methods

The descriptive survey research design was adopted for this study. This design was considered appropriate for this study, because it involves the collection and analysis of data using a sample size representative of the entire population. The population of the study comprised all 148 public secondary school principals in Edo South Senatorial District. The sample size of the study is 74 public secondary school principals' which represent 50% of the total population. The names of all the public secondary schools in Edo South Senatorial District was written on pieces of paper and squeezed. A stratified random sampling technique was adopted in selecting the number of sampled public secondary schools in the district. A questionnaire titled Optimizing School Facilities and Infrastructure Through Artificial Intelligence (OSFITAI) was used to collect data for the study. The questionnaire was validated by two professors in the Department of Educational Management, Faculty of Education, University of Benin. Their suggestions were used to modify the questions before the final questionnaire was produced and administered to respondents. The questionnaire constituted a four-point scale to measure the extent of AI application to facilities and infrastructure management in schools. The options in the scale are: Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points, Strongly Disagree (SD) = 1 point. Data collected were analyzed using descriptive statistics such as mean score and standard deviation, while Pearson r was used to analyze hypothesis at .05 alpha level of significance. A criterion mean of 2.50 was used to determine the extent of AI application to school facilities and infrastructure management.

Results

Research Question 1: To what extent are AI applications utilized in the management of school facilities and infrastructure in public secondary schools in Edo South Senatorial District?

Table 1

Mean and Standard Deviation on the Utilization of AI Applications in School Facilities Management

S/N	Item	Mean	SD	Decision
1	AI technologies are used to manage school facilities.	2.08	.83	Disagree
2	AI assists in monitoring the condition of school infrastructure.	2.15	.79	Disagree
3	AI supports effective record-keeping of school facilities.	2.21	.76	Disagree
4	AI is used to monitor classroom and laboratory utilization.	2.03	.87	Disagree
5	AI applications improve school infrastructure management.	2.18	.81	Disagree
	Grand Mean	**2.13**	**.81**	**Disagree**

The grand mean of 2.13 is below the criterion mean of 2.50, indicating that AI applications are not widely utilized in managing school facilities and infrastructure in public secondary schools in Edo South Senatorial District.

Research Question 2: How does the utilization of AI influence the efficient use of facilities in public secondary schools in Edo South Senatorial District?

Table 2

Mean and Standard Deviation on the Utilization of AI influence the Efficient Use of Facilities.

S/N	Item	Mean	SD	Decision
1	AI helps reduce under-utilization of school facilities.	2.24	.80	Disagree
2	AI improves classroom allocation and scheduling.	2.18	.78	Disagree
3	AI enhances utilization of laboratories and libraries.	2.26	.74	Disagree
4	AI contributes to efficient use of school resources.	2.31	.71	Disagree
5	AI improves planning for facility usage.	2.27	.76	Disagree
	Grand Mean	**2.25**	**.76**	**Disagree**

Respondents generally disagreed that AI currently contributes to the efficient utilization of school facilities with a grand mean of 2.25. This suggests that AI technologies have not yet been sufficiently adopted to influence facility management practices. This further revealed that AI has not substantially influenced the efficient utilization of school facilities. predictive maintenance, or infrastructure planning. This suggests that most schools continue to rely on traditional administrative methods rather than AI-driven systems for managing educational resources.

Research Question 3: What role does AI play in predictive maintenance of school infrastructure in public secondary schools in Edo South Senatorial District?

Table 3

Mean and Standard Deviation on the Roles AI Play in Predictive Maintenance of School Infrastructure

S/N	Item	Mean	SD	Decision
1	AI identifies faults before serious failure.	2.12	.82	Disagree
2	AI reduces maintenance costs.	2.18	.79	Disagree
3	AI improves maintenance scheduling.	2.09	.85	Disagree
4	AI prolongs the lifespan of facilities.	2.20	.77	Disagree
5	AI enhances timely maintenance.	2.16	.80	Disagree
	Grand Mean	**2.15**	**.81**	**Disagree**

The findings shows a grand mean of 2.15 which indicate that AI currently plays only a limited role in predictive maintenance of school infrastructure in public secondary schools in Edo South Senatorial District.

Research Question 4: How does AI influence resource allocation and infrastructure planning in public secondary schools in Edo South Senatorial District?

Table 4

Mean and Standard Deviation on the Influence of AI Resource Allocation and Infrastructure Planning

S/N	Item	Mean	SD	Decision
1	AI assists administrators in infrastructure planning.	2.22	.77	Disagree
2	AI improves resource allocation decisions.	2.27	.74	Disagree
3	AI predicts future infrastructure needs.	2.19	.79	Disagree
4	AI supports data-driven planning.	2.24	.76	Disagree
5	AI contributes to infrastructure budgeting.	2.16	.82	Disagree
	Grand Mean	**2.22**	**.78**	**Disagree**

With a grand mean of 2.22, respondents disagreed that AI significantly influences resource allocation and infrastructure planning, suggesting that AI-based planning tools are largely absent from school management practices.

Research Question 5: What challenges hinder AI adoption in public secondary schools in Edo South Senatorial District?

Table 5

Mean and Standard Deviation on the Challenges that Hinder AI Adoption

S/N	Item	Mean	SD	Decision
1	Poor funding hinders AI adoption.	3.71	.50	Agree
2	Poor ICT infrastructure limits implementation.	3.76	.46	Agree
3	Lack of technical expertise affects utilization.	3.58	.60	Agree
4	Poor electricity and internet connectivity hinder AI use.	3.81	.42	Agree
5	Resistance to technological change affects implementation.	3.39	.71	Agree
	Grand Mean	**3.65**	**.54**	**Agree**

Respondents, with a grand mean of 3.65, strongly agreed that inadequate funding, poor ICT infrastructure, lack of technical expertise, unreliable electricity supply, inadequate internet connectivity, and resistance to technological change are major barriers to AI adoption.

Research Question 6: What strategies can enhance AI utilization in public secondary schools in Edo South Senatorial District?

Table 6

Mean and Standard Deviation on the Strategies that can Enhance AI Utilization

S/N	Item	Mean	SD	Decision
1	Government should provide adequate funding.	3.82	.39	Agree
2	Administrators should receive AI training.	3.74	.48	Agree
3	Schools should invest in ICT infrastructure.	3.86	.35	Agree
4	AI policies should be developed.	3.68	.55	Agree
5	Collaboration with technology experts should be encouraged.	3.79	.43	Agree
	Grand Mean	**3.78**	**.44**	**Agree**

Respondents agreed that increased funding, staff training, investment in ICT infrastructure, supportive AI policies, and collaboration with technology experts are necessary for effective AI implementation with a grand mean of 3.78.

Hypothesis 1: There is no significant relationship between AI utilization and efficient uutilization of school facilities in public secondary schools in Edo South Senatorial District.

Table 7

Pearson Correlation for the Relationship between AI Utilization and Efficient Utilization of School Facilities

Variables	N	r	p	Decision
AI Utilization × Efficient Utilization	74	.48	.001	Reject H_0

A moderate positive relationship was found between AI utilization and efficient utilization of school facilities ($r = .48$, $p < .05$). The null hypothesis is therefore rejected.

Hypothesis 2: There is no significant relationship between AI-driven predictive maintenance of school infrastructure in public secondary schools in Edo South Senatorial District.

Table 8

Pearson Correlation for the Relationship between AI-driven Predictive Maintenance of School Infrastructure.

Variables	N	r	p	Decision
AI Utilization × Predictive Maintenance	74	.52	.000	Reject H_0

The result indicates a significant positive relationship between AI utilization and predictive maintenance ($r = .52$, $p < .05$). Therefore, the null hypothesis is rejected.

Hypothesis 3: There is no significant relationship between AI utilization and effective resource allocation in public secondary schools in Edo South Senatorial District.

Table 9

Pearson Correlation for the Relationship between AI Utilization and Effective Resource Allocation.

Variables	N	r	p	Decision
AI Utilization × Resource Allocation	74	.55	.000	Reject H_0

AI utilization showed a significant positive relationship with effective resource allocation ($r = .55$, $p < .05$). The null hypothesis is therefore rejected.

Hypothesis 4: There is no significant relationship between the use of AI and infrastructure planning in public secondary schools in Edo South Senatorial District.

Table 10

Pearson Correlation for the Relationship between the Use of AI and Infrastructure Planning.

Variables	N	r	p	Decision
AI Utilization × Infrastructure Planning	74	.59	.000	Reject H_0

The result indicates a statistically significant positive relationship between AI utilization and infrastructure planning ($r = .52$, $p < .05$). Therefore, the null is rejected.

Discussion

The findings on the extent AI applications are utilized revealed that AI applications are not yet widely utilized in the management of school facilities and infrastructure in public secondary schools in Edo South Senatorial District. Findings from hypotheses one, two, three, and four revealed that there is a positive significant relationship between AI utilization and efficient utilization of school facilities, between AI utilization and predictive maintenance, between AI utilization and effective

resource allocation, between AI utilization and infrastructure planning in public secondary schools in Edo South Senatorial District. This implies that public secondary schools in Edo South Senatorial District have limited access to AI applications, however, if these applications are made available, it will enhance the management of school facilities and infrastructure. This finding agrees with the finding of Marzouk and Zaher (2020) who found that AI application aids facility managers in their tasks and decreases the maintenance cost of facilities by maintaining, upgrading, and operating assets cost effectively.

Conclusion and Recommendations

The application of Artificial Intelligence in accomplishing tasks faster than it use to be cannot be overemphasized. AI is almost taking over prophetic jobs as they are able to predict correctly outcomes beyond human knowledge. This study finds that AI applications are not yet utilized in the management of public secondary school facilities and infrastructure. This may be because they are not readily available, however, their importance cannot be overlooked as public secondary school principals' believe strongly that the inclusion of AI applications in facilities management will enhance facilities utilization in public secondary schools in Edo South Senatorial District. Further research covering private secondary schools can be conducted to enrich literature.

Based on the findings of this study the following recommendations were made:

1. Government and stake holders in education should increase budgetary allocation to enable the provision of AI tools to public secondary schools.
2. Public secondary school principals should often organize extra-curricular activities such as science fair and exhibition and invite government officials and parents to the school premises so that they can show demonstrations on the importance of AI tools such as CCTV cameras within the school premises to enhance security.
3. Routine training on utilization of AI applications on facilities and infrastructure management should be organized for public secondary school teachers, as this will give them a sense of belonging and co-opt them into protecting available facilities.

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