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Environmental Maintenance and Scholastic Accomplishment

Victor Chukwubueze Nkedishu*, Omokaro Adams Ekwevugbe, Steve Ogheneoseme Akpoguma

Department of Educational Management and Foundations, Delta State University Abraka. *Corresponding Author's Email: chuksjp@gmail.com

Abstract

This study investigated the environmental maintenance culture and scholastic accomplishments in Universities in Delta State, Nigeria. Using a descriptive survey research of the ex-post-facto design, data were collected from 500 students selected through stratified random sampling from five universities in Delta State. Two research instruments were employed: The primary instrument for data collection was a structured questionnaire titled the Environmental Maintenance Questionnaire (EMQ) with Cronbach's alpha of .79 and the Students' Academic Result Checklist (SARC) which documented academic performance through CGPA grades. Data analysis utilized descriptive statistics with a benchmark mean of 2.50 and Pearson's correlation coefficient at 0.05 significance level. The findings revealed that university facilities are generally well-maintained, with functioning sanitation systems and active participation from institutional stakeholders in environmental maintenance activities. Results demonstrated a significant positive correlation between environmental maintenance culture and students' academic achievements. However, several challenges were identified that impede effective maintenance implementation, including inadequate funding allocations, ineffective administrative oversight, and insufficient skilled maintenance personnel. The study recommends increased budgetary provisions for environmental maintenance, implementation of timely repair protocols, establishment of sustainable waste management systems, and development of environmental awareness programs. These findings emphasized the importance of environmental maintenance as a critical factor in enhancing academic performance and overall educational quality in Delta State universities.

Keywords: Academic Performance, Educational Facilities, Environmental Maintenance, Learning Environment, School Environment.

Introduction

The significance of environmental maintenance in enhancing educational achievement has garnered substantial attention in academic discussion. Universities, as epicentres of knowledge dissemination and innovation, require a conducive environment to optimize student learning outcomes and staff productivity. In the context of this study, environmental maintenance is the overall management and maintenance of the university infrastructure, including buildings, classrooms, laboratories, sanitation systems, waste management, utilities (water, electricity), and green areas. It covers both routine cleaning activities and more extensive environmental practices such as sustainable waste disposal, infrastructure rehabilitation and maintaining a functioning educational environment to support training activities. A culture of environmental maintenance, therefore, represents a consistent institutional commitment to these maintenance practices and a collective behaviour of stakeholders to maintain a healthy physical learning environment. Environmental maintenance culture, defined as the consistent practice of managing and preserving institutional facilities, infrastructure, and resources, plays a significant role in influencing the academic performance of students. Globally, research has highlighted a strong correlation between well-maintained educational environments and student performance. Studies in developed nations have demonstrated that clean and safe facilities promote student engagement and improve academic results. Students in well-maintained schools scored higher on standardized tests than those in poorly maintained facilities (1). Similarly, it has reported that the quality of school facilities is directly related to student behaviour and performance, with better-maintained schools experiencing fewer disciplinary issues and higher

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attendance rates (2). In contrast, evidence from developing countries often highlights deficiencies in this area. Many African universities operate under suboptimal conditions, which lead to diminished educational outcomes (3). Inadequate funding, poor maintenance culture, and a lack of infrastructure development have been reported as a contributing factor to these challenges. For this reason, a study in Anambra State, Nigeria, revealed that environmental factors, including the state of physical facilities, significantly affect scholastic accomplishments (4). The above study concluded that well-maintained facilities enhance learning by providing a conducive environment that improves students' academic outcomes.

Research in cognitive psychology and education has shown strong correlations between the physical learning environment and cognitive outcomes. Studies have shown that environmental quality factors such as light, sound, air quality and temperature significantly influence attention, memory and information processing (5). In addition, well-maintained environments have been shown to reduce cognitive load, enabling students to allocate more mental resources to learning tasks rather than to coping with distractions and discomfort (6). Physical layout and condition of learning spaces have also been found to affect student engagement, collaborative learning opportunities and overall academic motivation (7). These cognitive effects ultimately translate into measurable differences in academic performance, with students in well-adjusted settings consistently showing higher scores on a variety of assessment measures.

Universities in Nigeria, face significant challenges related to environmental maintenance. Issues such as dilapidated buildings, inadequate sanitation, and poorly maintained classrooms are prevalent, and may hinder academic success. A study conducted at the University of Nigeria, Nsukka, assessed the current state of public building maintenance within the institution. Their findings indicated that approximately 80% of the buildings required immediate maintenance, with specific needs in areas such as plumbing, electrical installations, and structural repairs. The study concluded that a lack of maintenance policy and funding was a major cause of building deterioration in universities (8). Similarly, research at the University of Ilorin identified factors such as a lack of maintenance policy and inadequate funding as significant contributors to maintenance challenges. The study recommended the development of comprehensive maintenance policies to ensure regular upkeep of infrastructure (9). Relevance of physical facilities in enhancing the level of motivation and academic performance of senior secondary school students in Southwest Nigeria have been examined and it was found that a significant relationship between physical facilities and students' motivation and academic performance, suggesting that well-maintained facilities can enhance learning outcomes (10). Impacts of campus green infrastructure on enhancing the learning environment and improving scholastic accomplishments in tertiary institutions in South-West Nigeria was explored and it was concluded that the provision of green infrastructures is crucial for enhancing the learning environment and improving scholastic accomplishments (11).

The interface between environmental maintenance and wider socio-economic factors, educational funding mechanisms and governance structures are critical mediating factors influencing both maintenance practice and academic performance. In Delta State, the different levels of socio-economic development in the various regions lead to differences in the quality of university infrastructure and in the resources available for maintenance. Universities in economically more advantaged areas often benefit from better initial infrastructure and higher financial capacity for on-going maintenance, which can create an environmental advantage that can contribute to differences in academic performance regardless of the quality of teaching. Moreover, the educational funding models in Nigeria, which are characterised by uneven federal allocations and varying levels of internally generated income, have a direct impact on the ability of universities to implement sustainable maintenance practices. The tension between the allocation of scarce resources to immediate training needs and the maintenance of infrastructure over the long term creates administrative problems which often lead to deferred maintenance and subsequent deterioration of infrastructure. Local governance structures, including university governance models and relations with government agencies, also influence maintenance prioritisation and

implementation efficiency. These interdependent factors create a complex ecosystem in which environmental protection is influenced by and depends on broader socio-economic and governance realities.

To address these challenges, it has been stressed that it is essential for Nigerian universities to develop and implement comprehensive maintenance policies that prioritize the regular upkeep of facilities (12). Adequate funding should be allocated for maintenance activities, and a preventive maintenance culture should be adopted to address issues before escalating to major problems (13). Engaging stakeholders, including government agencies, university management, staff, and students, in maintenance activities can foster a sense of ownership and responsibility towards institutional facilities (14). Additionally, incorporating green infrastructures and ensuring the availability of adequate and functional physical facilities can create a more conducive learning environment, thereby enhancing scholastic accomplishments. Regular assessments and feedback mechanisms should be established to monitor the state of the facilities and ensure timely intervention when necessary (11-13).

Research indicates that Nigerian universities' environmental maintenance culture is suboptimal. Issues such as inconsistent funding, lack of skilled maintenance personnel, and poor administrative oversight (15). In the Delta State, specific challenges include outdated facilities, poor waste management systems, and limited resources for infrastructure repair (16). Comparatively, universities in developed countries invest significantly in maintenance, resulting in enhanced student engagement and better academic outcomes (17). Moreover, neglect of maintenance practices often leads to a cycle of degradation. Facilities, such as lecture halls, libraries, and laboratories, are left to deteriorate, causing disruptions in academic activities and reducing the overall quality of education. Universities with well-maintained facilities report higher levels of student satisfaction and academic achievement. Environmental factors play a critical role in academic success (18). Clean, well-maintained classrooms and laboratories enhance student focus and teacher effectiveness (18). Conversely, deteriorating infrastructure and unsanitary conditions can demotivate students and negatively affect their performance. Studies in Nigerian universities have shown a correlation between a poor maintenance culture and low academic achievement (19). For example, a study revealed that students in universities with clean and adequately maintained environments performed better on standardized tests compared to those in poorly maintained institutions (19). Similarly, poorly lit classrooms, broken furniture, and malfunctioning equipment can hinder the teaching-learning process, leading to lower academic outcomes (20). The psychological impact of studying under substandard conditions cannot be overstated, as students often feel undervalued and demoralized.

Key barriers to effective maintenance include financial constraints, administrative inefficiency, and a lack of awareness among stakeholders. Insufficient budget allocation often results in delayed repair and maintenance (20). Additionally, the absence of a robust maintenance policy exacerbates the problem, leading to the neglect and further deterioration of facilities (21). Another significant challenge is the lack of skilled personnel for performing maintenance tasks. Many universities rely on untrained staff, which often results in substandard work and frequent breakdown of repaired facilities (22). Furthermore, cultural attitudes towards maintenance, in which repairs are only undertaken after significant damage, contribute to the high costs and inefficiencies of the system. Studies have also identified corruption and mismanagement of allocated funds as critical barriers to effective maintenance in Nigerian universities. Improving environmental maintenance requires a multi-faceted approach. Suggested strategies include increased funding, capacity building for maintenance staff, and the adoption of preventive maintenance practices (23). Community engagement and stakeholder collaboration are also critical in fostering a culture of responsibility and care in university facilities. Preventive maintenance, which involves regular inspections and timely repairs, has been successfully implemented in several institutions worldwide. For instance, universities in Malaysia have adopted maintenance management systems that prioritize preventive practices, resulting in lower operational costs and improved facility conditions (20, 23). Universities can benefit from similar

approaches by investing in training programs for maintenance staff and establishing clear policies and accountability frameworks. Additionally, leveraging technology for maintenance management, such as computerized maintenance management systems (CMMS), can streamline processes and improve efficiency. Public-private partnerships (PPPs) have also been proposed as a viable solution to address funding gaps, allowing universities to collaborate with private entities to maintain and upgrade facilities (21, 23).

In Delta State, anecdotal evidence and preliminary studies suggest a gap in environmental maintenance culture, necessitating a detailed investigation of its effects on scholastic achievement. Common issues include poor waste management, deteriorating infrastructure, and inadequate maintenance of facilities. These shortcomings contribute to an unconducive learning environment that potentially leads to reduced student performance and satisfaction. Despite numerous policy initiatives aimed at addressing these challenges, little progress has been made as maintenance practices are often sporadic and poorly implemented. The impact of environmental maintenance culture on scholastic accomplishments remains underexplored, particularly in the Delta State. Existing studies have predominantly focused on broader educational challenges without delving into the specific role of the maintenance culture. This gap in the literature highlights the need for empirical research to ascertain how environmental conditions affect student achievement in Delta State universities. Thus, this study aims to examine the current state of environmental maintenance practices in Delta State universities, determine the extent to which these practices influence academic performance, identify challenges to effective environmental maintenance, and propose actionable strategies to improve the maintenance culture and enhance scholastic outcomes. It is of interest to note that this research aligns with multiple United Nations Sustainable Development Goals (SDGs). It primarily addresses SDG 4 (Quality Education) through its focus on academic accomplishment in higher education, specifically targeting the enhancement of learning outcomes and the creation of effective learning environments in universities. The study's emphasis on environmental maintenance culture supports SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action) by promoting sustainable campus environments, advocating for resilient educational infrastructure, and fostering environmentally conscious practices within academic institutions. The research contributes to SDG 9 (Industry, Innovation and Infrastructure) through its examination of educational infrastructure maintenance, emphasizing the critical role of well-maintained facilities in supporting academic excellence and institutional efficiency. Furthermore, the study aligns with SDG 15 (Life on Land) through its consideration of campus environmental sustainability, promoting responsible stewardship of institutional grounds and green spaces, which directly impacts the learning atmosphere. Additionally, the research supports SDG 16 (Peace, Justice and Strong Institutions) through its focus on strengthening educational institutions, by promoting effective, accountable, and transparent facilities management practices that enhance institutional capacity and educational outcomes. These alignments emphasize the study's contribution to both local educational advancement and global sustainability objectives. The following questions were raised; what is the current state of the environmental maintenance culture in universities in the Delta State? To what extent does environmental maintenance culture affect scholastic accomplishments in universities in Delta State? What challenges hinder effective environmental maintenance at universities in the Delta State? What strategies can be adopted to improve the environmental maintenance culture of universities in the Delta State? This hypothesis was tested; environmental maintenance culture is not significantly correlated with scholastic accomplishments at universities in the Delta State.

Methodology

This study adopts a descriptive survey research of the ex-post-facto design. This study employed a cross-sectional survey approach within the descriptive ex-post-facto research design. This methodology was chosen to capture data at a specific time point in a number of universities, allowing for a comparative analysis while exploring the relationships between existing variables without experimental manipulation. This approach has made it easier to collect quantitative

data using standardised tools and to document academic performance, which makes it suitable to examine the correlation between environmental maintenance culture and academic performance in their natural learning context. The study population comprised all students at Delta State universities. According to recent records, the combined population comprises approximately 48,886 undergraduates from Delta State University, Abraka, Dennis Osadebay University, Asaba, Nigerian Maritime University, Okerenkoko, Southern Delta University, Ozoro, and the University of Delta Agbor. A sample size of 500 participants was selected using stratified random sampling. The strata focus on institutions and academic levels to ensure representativeness. Proportional sampling was used to determine the number of participants in each stratum. Prior to data collection, written informed consent was obtained from all participants after they were briefed about the study's purpose, procedures, and their right to withdraw at any time. The primary instrument for data collection was a structured questionnaire titled the Environmental Maintenance Questionnaire (EMQ) and the Students' Academic Result Checklist (SARC). The Environmental Maintenance Questionnaire (EMQ) was structured into four sections measuring the current state of environmental maintenance, influence of environmental maintenance culture on students' academic performance, challenges that hinder effective environmental maintenance, and strategies adopted to improve environmental maintenance culture. Each of the sections contained ten [10] questions that students rated on a four-point scale of strongly agree, agree, disagree, and strongly disagree with a coding of 4, 3, 2, and 1, respectively. The Students' Academic Result Checklist (SARC) was structured as a pro format that aided the collection of students' academic grades. It contained a CGPA grading of 5-4.50, 4.49-3.50, 3.44-2.40, and 2.39-1.50, representing the first class, second class upper division, second class lower division, and pass with a rating scale of 4, 3, 2, and 1, respectively. The Environmental Maintenance Questionnaire (EMQ) underwent rigorous validation procedures. Content validity was established through expert review by three professors in educational management and two measurement and evaluation specialists who checked item relevance, clarity, and comprehensiveness. For reliability assessment, the instrument was pilot-tested with 50 participants from a university not included in the main study. Internal consistency was determined using Cronbach's alpha coefficient, which yielded values of .79 for the overall instrument and .77, .81, .75, and .83 for the four respective sections. Test-retest reliability was also assessed with a two-week interval between administrations, yielding a stability coefficient of .82, indicating strong temporal consistency. These reliability metrics collectively demonstrated that the instrument possessed sufficient psychometric properties for the research objectives. Data obtained from the field were analyzed using descriptive statistics of mean rating and standard deviation of 2.50 as benchmark while inferential statistics Pearson's r was adopted to test the hypothesis at a significance level of 0.05.

Results

Table 1: Mean Rating and Standard Deviation on Current State of Environmental Maintenance Culture

S/N	Current State of Environmental Maintenance Culture	Mean	SD	Remark
1.	University facilities (e.g., classrooms, laboratories, hostels) are regularly cleaned and maintained.	2.53	0.85	Agree
2.	University has a well-structured maintenance schedule for facilities.	2.39	0.90	Disagree
3.	The sanitation and waste disposal systems in my university are effective.	2.62	0.80	Agree
4.	There are clear policies and guidelines for environmental maintenance in my university.	2.48	0.88	Disagree
5.	University management and maintenance staff respond promptly to environmental issues.	2.26	0.92	Disagree
6.	Students and staff actively participate in environmental maintenance activities.	2.82	0.75	Agree

7.	Adequate funds are allocated for environmental maintenance in my university.	2.15	0.95	Disagree
8.	Infrastructure repairs and renovations take place frequently in my university.	2.00	1.00	Disagree
9.	Essential amenities (e.g., water supply, electricity, ventilation) are consistently available.	2.71	0.78	Agree
10	The general environmental condition of my university campus is well-maintained.	2.36	0.85	Disagree

What is the Current State of the Environmental Maintenance Culture in universities in the Delta State?

Table 1 shows the mean rating and standard deviation of the current state of the environmental maintenance culture. The results revealed that the respondents had a mixed reaction on the items. Specifically, respondents agreed that university facilities (e.g., classrooms, laboratories, hostels) are regularly cleaned and maintained, sanitation and waste disposal systems in universities are effective, students and staff actively participate in environmental maintenance activities, and essential amenities (e.g., water supply, electricity, and ventilation) are consistently available with mean ratings of 2.53, 2.62, 2.82, and 2.71, respectively. However, respondents disagree that universities have a well-structured maintenance schedule for facilities, there are clear policies and guidelines for environmental maintenance at my university, university management and maintenance staff respond promptly to environmental issues, adequate funds are allocated for environmental maintenance in my university, infrastructure repairs and renovations take place frequently in my university, and the general environmental condition of my university campus is well maintained with mean ratings of 2.39, 2.48, 2.26, 2.15, 2.00, and 2.36, respectively. This indicates that the current state of environmental maintenance culture in Delta State universities includes that university facilities (e.g., classrooms, laboratories, and hostels) are regularly cleaned and maintained, sanitation and waste disposal systems in universities are effective, and students and staff actively participate in environmental maintenance activities and essential amenities (e.g., water supply, electricity, and ventilation) are consistently available.

Table 2: Mean Rating and Standard Deviation on Extent Environmental Maintenance Culture Affect Scholastic Accomplishment

S/N	Extent Environmental Maintenance Culture affect Scholastic Accomplishment	Mean	SD	Remark
1.	A well-maintained classroom environment improves my concentration and learning.	3.57	0.50	High
2.	Poorly maintained lecture halls negatively impact student participation in learning activities.	3.43	0.55	High
3.	Well-maintained learning facilities (e.g., laboratories, ICT centers) enhance academic performance.	3.61	0.48	High
4.	Poor environmental maintenance has contributed to health-related issues among students.	3.20	0.60	High
5.	Poorly maintained school infrastructure reduces student morale.	3.32	0.58	High
6.	Students in universities with better environmental maintenance perform better academically.	3.41	0.52	High
7.	The condition of university hostels influences students' academic engagement and study habits.	3.16	0.65	High
8.	Infrastructure defects (e.g., broken chairs, poor lighting, leaking roofs) disrupt academic activities.	3.31	0.57	High
9.	Noise pollution from poor environmental management affects student concentration.	3.27	0.61	High

10	A well-maintained learning environment contributes to better student outcomes.	3.50	0.50	High
Average mean rating		3.38	0.56	High

To What Extent Does Environmental Maintenance Culture affect Scholastic Accomplishments in Universities in the Delta State?

Table 2 shows the mean rating and standard deviation of the extent to which the environmental maintenance culture affects scholastic accomplishments. The data in the table reveal that respondents rated all items as high. Specifically, respondents rated high with a mean rating of 3.57, 3.43, 3.61, 3.20, 3.32, 3.41, 3.16, 3.31, 3.27, and 3.50, indicating that a well-maintained classroom environment improves my concentration and learning, poorly maintained lecture halls negatively impact student participation in learning activities, well-maintained learning facilities (e.g., laboratories, ICT centers) enhance academic performance, poor environmental maintenance has contributed to health-related issues among students, poorly maintained school infrastructure reduces student morale, students in universities with better environmental maintenance perform better academically, the condition of university hostels influences students' academic engagement and study habits, infrastructure defects (e.g., broken chairs, poor lighting, leaking roofs) disrupt academic activities, noise pollution from poor environmental management affects student concentration, and a well-maintained learning environment contributes to better student outcomes. However, an average mean rating of 3.38 and SD of 0.56, revealed that the extent to which environmental maintenance culture affects scholastic accomplishment in Delta State universities was high.

Table 3: Mean Rating and Standard Deviation on Challenges Hinder Effective Environmental Maintenance

S/N	Challenges that hinder effective environmental maintenance	Mean	SD	Remark
1.	Inadequate funding is a major challenge to environmental maintenance.	3.71	0.45	Agree
2.	Poor administrative oversight contributes to maintenance problems.	3.53	0.52	Agree
3.	Lack of skilled maintenance personnel to manage infrastructure repairs.	3.65	0.48	Agree
4.	Bureaucratic delays hinder the timely implementation of maintenance initiatives.	3.57	0.50	Agree
5.	Students' negligence and poor attitudes contribute to environmental degradation.	3.39	0.55	Agree
6.	Regular environmental assessments and inspections are not conducted.	3.40	0.52	Agree
7.	Corruption leads to the mismanagement of funds allocated for environmental maintenance.	3.72	0.47	Agree
8.	The lack of preventive maintenance culture leads to rapid infrastructure deterioration.	3.60	0.49	Agree
9.	The absence of clear maintenance policies hinders effective environmental upkeep.	3.54	0.50	Agree
10	Improper use of facilities contributes to maintenance challenges.	3.44	0.53	Agree

What Challenges Hinder Effective Environmental Maintenance at Universities in the Delta State?

Table 3 shows that the mean rating and standard deviation of the challenges hinder effective environmental maintenance. The data in the table show that respondents agree on all items, with a mean rating above 2.50. Therefore, challenges that hinder effective environmental maintenance in Delta State universities include inadequate funding, poor administrative oversight, lack of skilled maintenance personnel to manage infrastructure repairs, bureaucratic delays hindering the timely implementation of maintenance initiatives, students' negligence and

poor attitudes contributing to environmental degradation, lack of regular environmental assessments and inspections, corruption leading to the mismanagement of funds allocated for environmental maintenance, lack of preventive maintenance culture leading to rapid infrastructure deterioration, absence of clear maintenance policies hindering effective environmental upkeep, and improper use of facilities contributing to maintenance challenges.

Table 4: Mean Rating and Standard Deviation on Strategies that can be Adopted to Improve Environmental Maintenance Culture

S/N	Strategies Adopted to Improve Environmental Maintenance Culture	Mean	SD	Remark
1.	Increased budgetary allocation.	3.80	0.42	Agree
2.	The adoption of preventive maintenance strategies.	3.71	0.45	Agree
3.	Training programmes for maintenance staff.	3.67	0.48	Agree
4.	Students and staff should be actively involved in maintaining university facilities.	3.53	0.50	Agree
5.	Implementing a university-wide environmental sustainability policy.	3.75	0.46	Agree
6.	Using technology-based maintenance solutions (e.g., CMMS) will enhance efficiency in facility management.	3.61	0.47	Agree
7.	Collaborating with private-sector organizations.	3.52	0.50	Agree
8.	Environmental awareness campaigns.	3.45	0.53	Agree
9.	Stricter policies and accountability measures.	3.77	0.45	Agree
10	Alumni associations and external donors should be involved in supporting environmental maintenance initiatives.	3.10	0.49	Agree

What Strategies can be adapted to improve the Environmental Maintenance Culture in Universities in the Delta State?

Table 4 shows the mean rating and standard deviation of strategies that can be adopted to improve the environmental maintenance culture. Responses from respondents proved that they agreed on all items, with a mean rating above the benchmark mean of 2.50. This indicates that strategies such as increased budgetary allocation, the adoption of preventive maintenance strategies, training programs for maintenance staff, students, and staff should be actively involved in maintaining university facilities, implementing a university-wide environmental sustainability policy, using technology-based maintenance solutions (e.g., CMMS) will enhance efficiency in facility management, collaborating with private sector organizations, environmental awareness campaigns, stricter policies, and accountability measures, and alumni associations and external donors should be involved in supporting environmental maintenance initiatives to improve environmental maintenance culture in Delta State Universities. Environmental maintenance culture is not significantly correlated with scholastic accomplishments at universities in the Delta State.

Table 5: Pearson Correlation between Environmental Maintenance Culture and Scholastic Accomplishment

Variables	Mean	SD	R	P-value	Remark
Environmental maintenance culture	3.45	0.62	0.58	0.001	Strong Positive
scholastic accomplishment	3.12	0.54			Correlation

Result in Table 5 shows the Pearson correlation analysis revealed a positive relationship ($r = 0.58$, $p = 0.001$) between environmental maintenance culture and scholastic accomplishments in delta-state universities. A significant p-value ($p < 0.05$) indicates that environmental maintenance culture is significantly correlated with scholastic accomplishments in universities in Delta State. This relationship is statistically meaningful, suggesting that improvements in environmental maintenance culture are associated with higher scholastic accomplishments.

Discussion

The findings indicate that the current state of environmental maintenance culture in universities in Delta State includes that university facilities (e.g., classrooms, laboratories, hostels) are regularly cleaned and maintained, sanitation and waste disposal systems in universities are effective, and students and staff actively participate in environmental maintenance activities and essential amenities (e.g., water supply, electricity, and ventilation) are consistently available. The current state of environmental maintenance culture in Delta State universities is a result of both institutional efforts and persistent infrastructural challenges. Regular cleaning and maintenance of university facilities, including classrooms, laboratories, and hostels, indicate an awareness of the need for conducive learning environments. Effective sanitation and waste disposal systems contribute to hygiene and safety and promote student well-being. Additionally, active participation by students and staff in environmental maintenance suggests shared responsibility for facility maintenance. The consistent availability of essential amenities such as water supply, electricity, and ventilation further enhance academic engagement and comfort. However, these maintenance efforts are often undermined by structural and administrative deficiencies, necessitating targeted improvement. It has been revealed that buildings required immediate maintenance. The study identified significant needs in areas such as plumbing, bathrooms, toilets, doors, windows, paintings, walls, floors, roofs, and electrical installations, indicating challenges in maintaining university facilities (23). Findings suggest that factors such as lack of maintenance policy and inadequate funding significantly contributed to maintenance failures, affecting the regular upkeep of university facilities (24). Furthermore, a study examined the facility maintenance culture in a Nigerian public university, identifying delayed responses to maintenance requests, insufficient funding, and the absence of a maintenance policy as key factors influencing maintenance culture. This study highlights the need for proactive maintenance strategies to improve facility conditions (25). It has been discovered that factors such as a lack of maintenance strategy, non-availability of maintenance manuals, and failure to adopt appropriate maintenance cycles adversely affected the condition of facilities, emphasizing the need for structured maintenance approaches (26). Also, it has been revealed that while structures for maintenance exist, they often lack formal hierarchies and are staffed by inexperienced personnel. This situation leads to inefficiencies in maintaining essential amenities such as water supply, electricity, and ventilation, affecting their consistent availability (27).

The findings reveal that the extent to which environmental maintenance culture affects scholastic accomplishment in universities in Delta State is high. The high impact of environmental maintenance culture on scholastic accomplishments emphasizes the critical role of a well-maintained learning environment in fostering academic success. Clean, well-ventilated classrooms, properly equipped laboratories, and functional hostels create a comfortable and motivating environment for students. Research has established that environmental factors significantly influence cognitive function, concentration, and academic performance. When university facilities are properly maintained, students are more likely to remain engaged in their studies, whereas faculty members can effectively deliver instruction. Conversely, poor maintenance conditions, such as inadequate lighting, broken furniture, and erratic power supply, disrupt learning processes, leading to diminished academic outcomes. Empirical studies have consistently demonstrated the significant impact of the environmental maintenance culture on academic performance in Nigerian universities. Effective maintenance practices are crucial for academic excellence (27). Similarly, it was found that the availability and adequacy of well-maintained facilities positively correlated with enhanced academic outcomes (28). It has been revealed that a lack of maintenance culture adversely affects both staff productivity and student learning environments. The role of maintenance culture in socioeconomic development, emphasizing that poor maintenance practices hinder the effectiveness of educational infrastructure (29).

Findings show that challenges hinder effective environmental maintenance in universities in the Delta State; inadequate funding, poor administrative oversight, lack of skilled

maintenance personnel to manage infrastructure repairs, bureaucratic delays hinder the timely implementation of maintenance initiatives, students' negligence and poor attitudes contribute to environmental degradation, regular environmental assessments and inspections are not conducted, corruption leads to the mismanagement of funds allocated for environmental maintenance, the lack of preventive maintenance culture leads to rapid infrastructure deterioration, the absence of clear maintenance policies hinders effective environmental upkeep, and improper use of facilities contributes to maintenance challenges. The challenges hindering effective environmental maintenance in Delta State universities stem primarily from systemic inefficiencies and resource constraints. Inadequate funding limits institutions' ability to perform regular maintenance and infrastructure repair. Poor administrative oversight and bureaucratic delays often result in slow responses to maintenance issues, allowing minor problems to escalate into major infrastructure failures. Additionally, the absence of a skilled maintenance workforce leads to substandard repairs, thereby reducing the longevity of facilities. The corruption and mismanagement of funds exacerbate these issues, diverting resources meant for environmental upkeep. Furthermore, student negligence, lack of maintenance policies, and improper facility usage contribute to environmental degradation, creating an unsustainable maintenance culture. Empirical studies have consistently highlighted the challenges hindering effective environmental maintenance in Nigerian universities. It has been found that inadequate funding and the absence of a maintenance policy as the primary causes of building deterioration (5, 29). Similarly, a study found that factors such as a lack of maintenance policy and insufficient funds significantly contribute to maintenance failures (10, 30). Finding revealing that while structures for maintenance exist, they often lack formal hierarchies and are staffed by inexperienced personnel, leading to inefficiencies (27, 31). Furthermore, a study in Nigerian public university highlighted delayed responses to maintenance requests and insufficient funding as the key factors affecting maintenance culture (31). These studies collectively underline systemic issues such as inadequate funding, poor administrative oversight, and a lack of skilled personnel as significant barriers to effective environmental maintenance in Nigerian universities.

The findings indicate that strategies such as increased budgetary allocation, the adoption of preventive maintenance strategies, training programs for maintenance staff, students, and staff should be actively involved in maintaining university facilities, implementing a university-wide environmental sustainability policy, using technology-based maintenance solutions (e.g., CMMS) will enhance efficiency in facility management, collaborating with private-sector organizations, environmental awareness campaigns, stricter policies, and accountability measures, and alumni associations and external donors should be involved in supporting environmental maintenance initiatives that can be adopted to improve environmental maintenance culture in universities in Delta State. The proposed strategies for improving the environmental maintenance culture are justified by their potential to address the root causes of these challenges. Increased budgetary allocations will ensure that universities have the necessary funds for regular facility upgrades and repairs. Preventive maintenance strategies, including routine inspections and scheduled repairs, can mitigate infrastructure deterioration and reduce long-term costs. Training programs for maintenance staff will equip them with the necessary skills to efficiently handle repairs. Engaging students and staff in environmental sustainability initiatives will foster a culture of shared responsibility, whereas the adoption of technology-based maintenance solutions, such as Computerized Maintenance Management Systems (CMMS), will enhance efficiency in tracking and managing facility maintenance. Collaboration with private organizations, stricter accountability measures, and external support from alumni and donors will provide additional resources to sustain long-term environmental maintenance efforts. Several studies have proposed alternative strategies for addressing these challenges. It has been recommended that universities develop comprehensive maintenance policies to ensure regular upkeep of infrastructure (31). Establishing a formal organogram to clearly delineate maintenance responsibilities and to train

maintenance staff to enhance their competencies has been suggested (32). Adequate funding allocation to maintenance departments to facilitate prompt responses to maintenance needs and the adoption of proactive preventive maintenance cultures has been advocated (22). Additionally, involving alumni in supporting the maintenance of university facilities, suggesting that alumni contributions can supplement funding and provide additional resources for maintenance activities, has been emphasized (25). These strategies aim to create a sustainable maintenance culture that ensures the longevity and functionality of university facilities.

Environmental maintenance culture is significantly correlated with scholastic accomplishments at universities in the Delta State. The significant correlation between environmental maintenance culture and scholastic accomplishments in Delta State universities is justified by the strong link between a well-maintained learning environment and students' academic performance. A conducive educational setting characterized by clean classrooms, functional laboratories, well-ventilated hostels, and reliable amenities enhances students' concentration, motivation, and overall learning experience. Research has consistently shown that physical learning environments affect cognitive development, retention rate, and student engagement. Conversely, universities with poor environmental maintenance experience frequent disruptions, discomfort, and health hazards, all of which negatively affect students' academic performance. Therefore, the significant correlation observed in this study reflects how infrastructure quality, cleanliness, and overall environmental upkeep directly contribute to improved student outcomes. The significant correlation between environmental maintenance culture and students' academic performance is empirically supported. It has been discovered that availability and adequacy of well-maintained physical facilities positively correlated with enhanced academic outcomes among undergraduate students (22). Similarly, it was reported that approximately 80% of the buildings required immediate maintenance, and the lack thereof adversely affected the learning environment (23). Maintenance failures in university buildings negatively affect both staff and students, thereby hindering academic performance (24). A study that explored the environmental factors that affect students' academic performance found that the provision of adequate and good quality school facilities, maintained through a strong maintenance culture, significantly enhanced students' academic outcomes (30). Research indicated that well-maintained school facilities contribute significantly to improved student performance, highlighting the importance of regular maintenance and management (31). In another study, that investigated the management and maintenance of buildings in secondary schools in the Delta State concluded that effective maintenance strategies are crucial for creating a conducive learning environment, which positively affects students' academic achievement (32). Furthermore, a study on maintenance and management of available secondary school facilities in Nigeria found that inadequate maintenance adversely affects students' academic performance, emphasizing the need for a robust maintenance culture (33).

Conclusion

The findings of this study highlight the critical role of environmental maintenance culture in fostering scholastic accomplishments in universities in Delta State. The study revealed that well-maintained university facilities, effective sanitation systems, and the active participation of students and staff contribute to a conducive learning environment. The extent of the influence of environmental maintenance culture on scholastic accomplishments was found to be significant, emphasizing its importance in educational success. However, challenges, such as inadequate funding, poor administrative oversight, bureaucratic delays, and corruption, hinder effective maintenance. To address these issues, strategies such as increased budget allocation, preventive maintenance, staff training, technology-driven solutions, and stakeholder collaboration are recommended. While this study establishes a significant relationship between environmental maintenance culture and scholastic accomplishments, it is important to acknowledge other critical factors that influence academic achievement. Lecturer quality remains a fundamental determinant of educational outcomes, with professional competence, subject

knowledge, and pedagogical skills directly impacting instructional effectiveness regardless of environmental conditions. Family engagement, particularly parental involvement in students' academic activities and support systems, creates essential reinforcement for university learning experiences. Student nutrition and overall wellness significantly affect cognitive function and learning capacity, influencing academic performance independently of environmental factors. Additionally, school budgetary allocations determine resource availability across multiple educational domains beyond maintenance, including instructional materials, technology access, and academic support services. These factors operate within an interconnected educational ecosystem where environmental maintenance represents one important, but not exclusive, contributor to scholastic accomplishments. Future research should examine how environmental maintenance interacts with these factors to produce combined effects on academic outcomes, potentially revealing synergistic relationships that could inform more comprehensive educational improvement strategies. Based on the findings, the following recommendations were made: The Delta State government and university administrations should increase budgetary allocations for environmental maintenance and ensure timely repairs, regular facility upgrades, and sustainable waste management systems. Universities should implement preventive maintenance strategies by conducting routine inspections, establishing maintenance schedules, and training staff for proactive facility management to prevent infrastructure deterioration. A university-wide environmental sustainability policy should be developed and enforced, mandating the active participation of students and staff in maintaining cleanliness, proper waste disposal, and the responsible use of facilities. Universities should adopt technology-based maintenance solutions, such as Computerized Maintenance Management Systems (CMMS), to enhance efficiency in facility management, track maintenance activities, and improve resource allocation.

Abbreviations

CMMS: Computerized Maintenance Management Systems, EMQ: Environmental Maintenance Questionnaire, PPPs: Public-private partnerships, SARC: Students Academic Result Checklist, SDGs: Sustainable Development Goals, UNESCO: United Nations Educational, Scientific, and Cultural Organization, UNSDGs: United Nations Sustainable Development Goals.

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Author Contributions

Nkedishu Victor Chukwubueze: Conceptualization, methodology design, data collection supervision, data analysis and interpretation, original draft preparation, final manuscript review, Ekwevugbe Omokaro Adams: Research design consultation, data validation, critical review of intellectual content, manuscript editing, Akpoguma Steve Ogheneoseme: Data collection coordination, literature review, manuscript writing, editing.

Conflict of Interest

The authors declare no conflicts of interest.

Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki for research involving human participants. Ethical approval was obtained from the Ethical Committee of the Department of Educational Management and Foundations, Faculty of Education, Delta State University, Abraka, Nigeria (approval number: DEL/FOE/EMF/0132, granted on August 2, 2024). All participants provided informed consent before participating in the study.

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