

SCHOOL-BASED FACTORS AND WASTE MANAGEMENT IN TERTIARY INSTITUTIONS IN CALABAR EDUCATION ZONE, CROSS RIVER STATE, NIGERIA

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ABSTRACT

This study investigated the influence of school-based factors on waste management in tertiary institutions within the Calabar Education Zone of Cross River State, Nigeria. The research specifically examined three independent variables: waste disposal equipment, enforcement mechanisms, awareness creation strategies and their relationship with waste management practices as the dependent variable. A descriptive survey design was adopted, targeting students and staff from selected tertiary institutions in the study area. Stratified sampling technique was employed to select a total of respondents, and the school-Based Factors and Waste Management Questionnaire (SBFWMQ) served as the primary instrument for data collection. Data were collected, prepared, coded, and analyzed using inferential statistics (Pearson Product-Moment Correlation and Multiple Regression Analysis). The findings revealed that adequate waste disposal equipment, effective enforcement mechanisms, regular awareness creation significantly influenced the management of waste on campus. The study concluded that school-based factors played a critical role in the effectiveness of waste management practices in tertiary institutions. Based on the findings, recommendations were made for improving waste management through provision of facilities, enforcement of institutional policies, continuous awareness creation.

Key words: School, School-Base, School-Based Factors and Waste Management, Tertiary Institutions

Introduction

Waste management has become a pressing environmental and public health issue globally, especially in settings where populations interact with complex daily socio-economic activities. Within Higher Education Institutions (HEIs), the volume, diversity, and characteristics of waste produced, ranging from food remnants and plastics to paper and e-waste, reflect a microcosm of broader societal waste management challenges. Studies show that HEIs bear a dual responsibility:

not only to manage their own waste responsibly, but also to model sustainable waste practices for their communities (Ardiantama & Nawanir, 2024). In such contexts, effective waste management must involve both technical systems (e.g., disposal infrastructure and collection logistics) and behavioural components such as awareness, participation, and enforcement of institutional rules.

Effective waste management in HEIs depends on the availability and adequacy of waste disposal equipment and facilities. In many Nigerian tertiary institutions, basic waste control materials such as garbage cans, trash baskets, waste bags, and logistics for regular collection are either lacking or poorly managed. This infrastructural gap often results in indiscriminate dumping and burning of refuse, contributing to health risks and environmental degradation on campus environments (HIGENEPLUS, 2022). Furthermore, when waste bins and segregation containers are insufficient or not strategically placed, for example, at high traffic points like lecture halls, hostels, cafeterias, and pedestrian pathways, students and staff have limited opportunity or incentive to dispose of waste appropriately. Closely tied to infrastructural limitations are institutional enforcement mechanisms, the formal policies, regulations, and supervisory structures that govern waste management practices within academic institutions. Although many universities and colleges enact waste management policies, research from Nigerian HEIs highlights the persistent gap between policy formulation and implementation, often due to inadequate monitoring, enforcement, or accountability mechanisms. Waste management systems without clear enforcement components tend to underperform, resulting in routine violations like open dumping, littering, and non-segregation of waste streams even in the presence of formal rules.

Research within Nigerian campuses emphasizes that the presence of policies alone does not ensure compliance; rather, meaningful enforcement often requires periodic waste audits, clearly defined sanctions, and active oversight by institutional bodies. In the absence of such

enforcement mechanisms, improper disposal becomes normalized and organizational culture continues to downplay individual responsibilities for waste reduction and segregation (Assessment of Solid Waste Management Practices, 2024). Even where infrastructure and enforcement exist, campus-based awareness creation strategies play a significant role in shaping waste management behaviours among students, faculty, and staff. Awareness campaigns, including seminars, workshops, social media drives, environmental blog posts, and waste classification campaigns, help enhance understanding of sustainable waste practices and stimulate participation across campus communities. For example, Abiodun and Taiwo (2025) observed that interactive, community-engagement campaigns combined with the provision and strategic placement of waste bins can significantly enhance positive waste management behaviours among students and staff in higher education institutions.

These awareness efforts are most effective when they go beyond one-off activities and are integrated into broader campus life, including through student clubs, co-curricular events, and sustainability projects that encourage ongoing engagement. Environmental education initiatives help reshape the perceptions of campus users, moving away from seeing waste management as solely the duty of sanitation workers to viewing it as a shared institutional responsibility (Assessment of Solid Waste Management Practices, 2024). In addition to infrastructure, policy, and awareness, the role of school-based waste disposal personnel, such as environmental officers, custodial staff, and sanitation workers is indispensable. These personnel often undertake the day-to-day tasks of collecting, transporting, and ensuring compliance with safe waste handling procedures. However, studies reveal that one of the major limitations to effective institutional waste management in Nigeria is inadequate staffing, training, and professional capacity among these key actors (MedCrave, 2025). Without adequate manpower and relevant training in waste

segregation, occupational safety, and sustainability practices, even the best policies and equipment may be underutilized or mismanaged.

Therefore, this study focuses on understanding the influence of school-based factors on waste management practices in tertiary institutions in the Calabar Education Zone. Specifically, it will examine how waste disposal facilities, institutional enforcement mechanisms, campus-based awareness creation strategies methods shape the effectiveness of waste management systems on these campuses. The findings will provide evidence-based insights for policymakers, institutional leaders, and stakeholders who aim to promote sustainable waste management and create healthier, cleaner educational environments in Cross River State and beyond.

Statement of hypotheses

The following hypotheses were formulated to guide the study:

1. There is no significant influence of waste disposal equipment on waste management practices in tertiary institutions in the Calabar Education Zone.
2. Enforcement mechanisms have no significant effect on waste management practices in tertiary institutions in the Calabar Education Zone.
3. Awareness creation strategies have no significant influence on waste management practices in tertiary institutions in the Calabar Education Zone.

Literature review

Empirical Review on Waste Disposal Equipment and Waste Management

In a study of waste management practices across higher education institutions in the Makurdi Metropolis of Benue State, Nigeria, it was reported that the lack of collection and disposal equipment was among the most significant challenges facing waste management in these institutions. The study found that “lack of collection and disposal equipment (mean score = 4.291)

was a major factor contributing to solid wastes being left unattended for long periods, which validated the observation that inadequate waste infrastructure undermined effective campus sanitation (Assessment of Solid Waste Management Practices, 2025).

Similarly, research conducted at the University of Lagos highlighted that even where coloured waste bins were placed on campus to facilitate segregation and recycling, students and staff were not consistently complying with their intended use due to challenges in waste handling and facility management. The authors observed that “staff and students were not following university policy with respect to discarding their waste material, as no significant difference was found between the waste compositions of the blue, green, and red bins in the waste-generating areas”, indicating that physical facilities alone without proper maintenance and complementary systems may not lead to effective waste disposal (Akingbala et al., 2022).

These findings are supported by broader research on environmental regulation in Nigeria, which demonstrated that the provision of waste disposal facilities such as trash bins was a necessary condition for environmental policies to have any positive effect. The study concluded that without facilities, the law alone generated no environmental effects, emphasizing that regulatory frameworks need to be backed by adequate physical infrastructure to influence waste management outcomes (2024).

In higher education contexts outside Nigeria, evidence from public universities in Côte d’Ivoire also underscored the importance of facilities. At Nangui Abrogoua University, solid waste generated across campus was conditioned in bins and garbage bags at activity sites and outside areas, before being transported to consolidation points for collection by private service providers. The authors noted the use of various types of bins to condition waste, demonstrating how

institutional provision of disposal containers formed an integral part of waste handling systems (Assessment of Solid Waste Management Practices in Côte d'Ivoire, 2025).

Furthermore, studies from integrated waste management pilots in African HEIs suggested that strategic placement and optimization of waste bin locations was essential to improving waste collection efficiency. For example, an investigation at the Federal University of Technology Akure recommended increasing and strategically positioning waste bins across campus from initial points to higher numbers based on building proximity and transportation routes, concluding that such adjustments could enhance the capture and processing of recyclables and reduce open burning (Sustainable Integrated Solid Waste Management, 2024).

Enforcement Mechanisms and Waste Management

A critical analysis of solid waste management legal frameworks in Nigeria revealed that existing legislation alone was insufficient without robust enforcement systems. Akintububo (2025) observed that the disconnect between legislative intent and practical implementation was attributed to inadequate funding, limited institutional capacity, and weak enforcement mechanisms”, suggesting that effective waste management required more than laws; it required active enforcement and coordination. Similarly, studies in Eastern Uganda demonstrated that weak enforcement undermined solid waste management outcomes. Eumu, Edaku, and Meza (2025) reported that urban centres had insufficient policy enforcement, monitoring and financing, which decreased the effectiveness of solid waste management”. This finding indicated that weak institutional enforcement, even when policies existed, led to ineffective waste collection and disposal.

In the context of tertiary institutions, Onyilokwu, Ugochukwu, and Ade (2024) examined waste management practices in Nigerian universities and found that institutional rules were often

poorly implemented due to weak supervision. The study concluded that “weak enforcement and behavioural resistance, along with students’ lack of self-discipline, undermined consistency in waste management”, demonstrating that enforcement mechanisms were crucial for translating policy into practice on campus. Research from Zimbabwe also reinforced these findings. Kanyasa (2024) observed that while legal frameworks for solid waste management existed, poor enforcement, limited monitoring, and lack of inspection systems resulted in ineffective waste control practices and environmental degradation. This evidence suggested that without strong enforcement, even well-formulated laws failed to produce desired waste management outcomes.

Moreover, Ologunagba, Ogunbode, and Owoeye (2025) highlighted that public perception studies in Nigeria revealed inconsistent compliance with environmental sanitation regulations. They reported that inadequate regulatory compliance reduced the effectiveness of solid waste management programmes, emphasizing that enforcement mechanisms, combined with stakeholder engagement, were necessary to improve waste management outcomes. From these empirical studies, it was evident that institutional enforcement mechanisms were critical determinants of effective waste management systems. Strong enforcement ensured that policies translated into action, encouraged compliance with sanitation regulations, and reduced environmental hazards. Conversely, weak or absent enforcement even in contexts where formal policies existed resulted in poor disposal behaviours, unchecked littering, and systemic inefficiencies in waste handling. This empirical evidence confirmed that effective institutional enforcement mechanisms were foundational to sustainable waste management in both public and institutional contexts.

Odo *et al.*, (2018) to analyze barriers to undergraduate students’ participation in solid waste management with focus on a case study of the University of Nigeria, Nsukka. All undergraduates in the school made up the population while each of simple random and accidental sampling

techniques was employed to select 392 subjects. Collecting data with a questionnaire, one of the study's research questions was designed to ascertain barriers to undergraduates' effective participation in solid waste management in school. Analyzing collected data with frequency counts and percentage scores (descriptive statistics), the result showed the respondents indicating the following as major barriers (i) lack of enforcement of environmental laws; (ii) poor environmental sanitation monitoring by student union executives or other authorities, and; (iii) non-adherence by undergraduates to policies guiding solid waste management in the school. The study of Odo *et al.*, (2018) found relevance for this review based on its analysis of barriers to undergraduates' participation in solid waste management.

Awareness Creation Strategies and Waste Management

According to Abiodun and Taiwo (2025), multiple awareness interventions—including “interactive, community-engagement campaigns, provision of infrastructure, combined with strategic placement of waste bins within the campus and activities like waste classification and recycling”—significantly enhanced positive waste management behaviours among students and staff. They emphasized that effective awareness creation could influence attitudes and encourage proactive participation in sustainable waste practices.

Similarly, Onyilokwu, Ugochukwu, and Ade (2024) reported that in Nigerian tertiary institutions, both formal education programmes and awareness campaigns were necessary to reinforce policy and infrastructural interventions. Their study highlighted that students who received continuous education on waste segregation and recycling were more likely to engage in responsible disposal practices. This finding underscores that awareness strategies are most effective when they complement existing institutional policies and facilities. Evidence from Vietnam also supported the importance of structured awareness programmes. Tran and Nguyen

(2025) conducted a case study at Tan Trao University and found that although students' awareness of solid waste management was generally moderate to high, gaps remained in actual waste sorting practices. They noted that "awareness alone may not guarantee practice unless it is coupled with structured support and reinforcement from institutional actors and clear communication strategies", highlighting the need for well-coordinated campus programmes.

Further, Rusli and Fajri (2022) observed that structured environmental education in university settings improved students' knowledge and engagement regarding waste management, although direct behavioural changes required additional incentives and systemic support. Their findings suggest that awareness initiatives are effective in changing attitudes, which may gradually lead to sustainable disposal behaviours when combined with supportive policies and infrastructure. Research by Chidimma and Onah (2025) confirmed that environmental awareness programmes influenced waste disposal behaviours across educational contexts. They noted that environmental awareness programmes, when well-designed and consistently implemented, can alter behavioural intentions and actual practices over time. This evidence suggests that awareness creation strategies, especially when interactive and continuous, are critical to shaping waste management habits among students and staff. Collectively, these studies demonstrate that campus-based awareness creation strategies significantly contributed to shaping attitudes, knowledge, and participatory behaviours related to waste management. However, the effectiveness of these programmes was maximized when coupled with institutional support, clear guidelines, proper facilities, and continuous engagement, thereby reinforcing positive waste disposal practices across campus communities (Abiodun & Taiwo, 2025; Onyilokwu, Ugochukwu, & Ade, 2024; Tran & Nguyen, 2025; Rusli & Fajri, 2022; Chidimma & Onah, 2025).

A quasi-experimental design was utilized by Bakare (2018) to investigate how to ensure sustainable environment and development with focus on a study of solid waste management in the University of Lagos, Nigeria. The population comprised of all residents within the school campus. A sample of 250 respondents was selected using proportionate systematic random sampling technique and one of the study's objectives was to examine the effect of an intervention awareness creation programme on adherence to the 3Rs (reduce, reuse and recycle) initiative within the school. Data collection was achieved using each of a questionnaire and an interview. Data analysis with descriptive statistics (frequency counts and percentage scores revealed a profound effect of the intervention programme on adherence to the 3Rs initiative as more than 75% of the respondents demonstrated willingness to adhere towards the 3Rs initiative. This study was considered pertinent for this review on account of its assessment of the effect of an intervention awareness creation programme on adherence to the 3Rs (reduce, reuse and recycle) initiative within a school.

Methodology

Design

A survey design adopted for this study is a descriptive survey. The descriptive survey is particularly suitable for this study when the researcher intends to describe existing phenomena as they occur without manipulating variables. This design also enabled the researcher to correlate school-based factors with observed waste management outcomes, thus addressing the objectives of the study.

Population

The study population consisted of all students and staff in the major tertiary institutions located within the Calabar Education Zone of Cross River State, Nigeria. These institutions were

purposively selected because they are the largest and most active in the zone, making them ideal for examining waste management practices.

Sample

The sample of this study comprised three hundred and ninety-five (395) respondents, drawn from the population of students, academic staff, non-academic staff, and waste disposal personnel in tertiary institutions within the Calabar Education Zone, Cross River State, Nigeria. The sample was selected using a stratified random sampling technique, which ensured that all subgroups were adequately represented in proportion to their population size.

Instrumentation

The instrument that was used for data collection in this study was a structured questionnaire titled “School-Based Factors and Waste Management Questionnaire (SBFWMQ)”. The questionnaire was designed by the researcher after an extensive review of relevant literature on waste management, school-based factors, environmental education, and institutional management practices. The instrument was divided into two major sections: Section A examined Demographic Information which consisted of items that elicited information on respondents’ demographic characteristics. Section B: School-Based Factors and Waste Management Variables and contained items that measured the major variables of the study.

Results and discussion

Hypothesis one

Waste disposal equipment/facilities have no significant relationship with waste management in tertiary institutions. The independent variable was waste disposal equipment/facilities while the dependent variable was waste management in tertiary institutions. The result obtained from the analysis is presented in table 1.

TABLE 1

PPMC analysis of the relationship between waste disposal equipment/facilities and waste management in tertiary institutions (N=395)

Variable	\bar{X}	SD	r-value	p-level
Waste disposal equipment/facilities	17.705	2.243	.173*	.001
Waste management in tertiary institutions	26.461	6.139		

*Significant at .05, $p \leq 0.05$; $df = 558$.

The analysis presented in Table 1 reveals that the calculated p-value of 0.001 is less than the acceptable 0.05 significant level, it therefore means that the r-value of 0.173 is significant at 558 degrees of freedom. This means that there was a significant relationship between waste disposal equipment/facilities and waste management in tertiary institutions. The null hypothesis that waste disposal equipment/facilities have no significant relationship with waste management in tertiary institutions was therefore rejected while the alternate was accepted.

Hypothesis two

There is no significant relationship between institution-based enforcement mechanisms and waste management in tertiary institutions. The independent variable was institution-based enforcement mechanisms while the dependent variable was waste management in tertiary institutions. The result is as presented in Table 2.

TABLE 2

PPMC analysis of the relationship between institution-based enforcement mechanisms and waste management in tertiary institutions (N=395)

Variable	\bar{X}	SD	r-value	p-level
Institution-based enforcement mechanisms	14.182	3.596	.069*	.002
Waste management in tertiary institutions	26.461	6.139		

*Significant at .05, $p \leq 0.05$; $df = 558$.

The analysis presented in Table 2 reveals that the calculated p-value of 0.002 is less than the acceptable 0.05 significant level, it therefore means that the r-value of 0.69 is significant at 558 degrees of freedom. This means that there was a significant relationship between institution-based enforcement mechanisms and waste management in tertiary institutions. The null hypothesis that there is no significant relationship between institution-based enforcement mechanisms and waste management in tertiary institutions was therefore rejected while its alternate was accepted.

Hypothesis three

Campus-based awareness creation strategies have no significant relationship with waste management in tertiary institutions. The independent variable was campus-based awareness creation strategies while the dependent variable was waste management in tertiary institutions. The result of the analysis is as presented in Table 3.

TABLE 3

PPMC analysis of the relationship between campus-based awareness creation strategies and waste management in tertiary institutions (N=395)

Variable	\bar{X}	SD	r-value	p-level
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Campus-based awareness creation strategies	15.679	4.329		
			.456*	.001
Waste management in tertiary institutions	26.461	6.139		

*Significant at .05, $p \leq 0.05$; $df = 558$.

The analysis presented in Table 3 reveals that the calculated p-value of 0.001 is less than the acceptable 0.05 significant level, it therefore means that the r-value of 0.456 is significant at 558 degrees of freedom. This means that there was a significant relationship between campus-based awareness creation strategies and waste management in tertiary institutions. The null hypothesis that campus-based awareness creation strategies have no significant relationship with waste management in tertiary institutions was therefore rejected while the alternate was accepted.

Discussion of findings

Waste disposal equipment have no significant relationship with waste management in tertiary institutions. The result of the first hypothesis revealed that waste disposal equipment is a significant correlate of waste management in tertiary institutions. This meant that the null hypothesis was rejected while the alternate was accepted. By implication, the finding is that waste disposal equipment/facilities have a positive relationship with waste management in tertiary institutions. Thus, this appears to imply that the extent of adequacy of equipment/facilities for waste collection and disposal processes has a connection with how waste is managed in tertiary institutions.

The finding is in consonance with that of Abubakar *et al.*, (2019) who observed that most of the respondents agreed that there was waste disposal equipment available for waste disposal. Chukwu and Osaigbovo (2020) asserted that the majority of the respondents reported the availability of waste disposal equipment/facilities provided within their school. In their study,

Ikpesu *et al.*, (2024) showed respondents asserting that there was an appropriate availability of waste disposal and collection equipment within the school. On the other hand, Ajayi (2019) reported that majority of the respondents indicated the non-availability of waste disposal equipment for waste disposal. Also, Mokuolu and Alabi (2023) observed a very low level of availability of waste bins for storage and collection of waste. Lastly, Wuraola *et al.*, (2023) revealed that most students did not have access to waste disposal equipment on campus thus implying their above average unavailability.

There is no significant relationship between institution-based enforcement mechanisms and waste management in tertiary institutions. The result of the study's second hypothesis revealed that institution-based enforcement mechanisms had a significant relationship with waste management in tertiary institutions. This meant that the study's second alternate hypothesis was accepted while the null hypothesis was rejected. Thus, the finding indicates that institution-based enforcement mechanisms are linked with the how waste is managed in tertiary institutions. Therefore, the impression created by the finding is that the various ways enforcement mechanisms applied by schools to ensure compliance with waste handling are linked with how waste is managed in tertiary institutions.

The finding of this study is in agreement with that of Odo *et al.*, (2018) who analyzed barriers to undergraduate students' participation in solid waste management and reported the following as major barriers – (i) lack of enforcement of environmental laws; (ii) poor environmental sanitation monitoring by student union executives or other authorities, and; (iii) non-adherence by undergraduates to policies guiding solid waste management in the school. Oluwatuyi *et al.*, (2020) enquired possible solutions to barriers of proper waste management

practices and observed that asserting sanctions against poor disposal of waste as one of the very possible solutions. Nweke and Ajibo (2022) queried how effective the waste management rules were in school and reported that majority of the respondents indicated that the rules were ineffective. Lastly, Olabode and Salako (2023) verified the presence of penalties and sanctions for improper waste disposal and revealed almost 72% of the respondents indicating the absence of penalties and sanctions for improper waste disposal by students.

Campus-based awareness creation strategies have no significant relationship with waste management in tertiary institutions. The result of the study's third hypothesis revealed that campus-based awareness creation strategies are a significant correlate of waste management in tertiary institutions. This meant that the study's third null hypothesis was rejected while the alternate hypothesis was accepted. Thus, the finding indicates that campus-based awareness creation strategies are associated with the manner in which waste is managed in tertiary institutions. Therefore, this signifies that all manner of campus-based awareness creation strategies through which students and staff can be informed are associated with the manner in which waste is managed in tertiary institutions.

The study's finding is supported by that of Bakare (2018) who examined the effect of an intervention awareness creation programme on adherence to the 3Rs (reduce, reuse and recycle) initiative within a school and revealed a profound effect of the intervention programme on adherence to the 3Rs initiative as more than 75% of the respondents demonstrated willingness to adhere towards the 3Rs initiative. Joel *et al.*, (2020) examined factors militating against solid waste management and showed that lack of campus-based orientation programmes on solid waste management was a significant factor. Aikowe and Mazancová (2021) determined whether

students' school-based environmental volunteering activities (being part of an environmental club) would positively impact their waste sorting intentions in school and found out that students' school-based environmental volunteering activities (being part of an environmental club) positively impacted on their waste sorting intentions in school. Ogunyemi and Ifegbesan (2022) ascertained whether having been exposed to theoretical aspects of waste management programmes would ensure students' participation in school-based waste management efforts. The result showed that the respondents had very appreciable tendencies towards environmental sanitation and good waste management practices based on exposure to the theoretical aspects of waste management programmes in school.

Conclusion

The findings of the study provided insights into the availability and adequacy of waste disposal equipment, the effectiveness of enforcement mechanisms, the role of campus-based awareness strategies and the methods of waste disposal employed in the institutions. The study also assessed the overall level of waste management on campus and identified the factors that significantly influenced it.

In conclusion, the study contributed to understanding how school-based interventions and institutional policies affect the management of waste in tertiary institutions, highlighting areas for improvement and providing recommendations for enhancing waste management practices in the study area.

Recommendations

Based on the findings, the study made the following recommendations:

1. **Provision of Adequate Facilities:** Tertiary institutions should ensure that sufficient waste disposal equipment, including labeled dustbins and recycling containers, are provided and properly maintained to encourage proper disposal among students and staff.
2. **Strengthening Institutional Enforcement Mechanisms:** Schools should develop and strictly enforce policies on waste management, including monitoring compliance and imposing sanctions for non-compliance. This will promote adherence to proper disposal practices and reduce environmental pollution.
3. **Continuous Awareness Creation:** Institutions should conduct regular awareness campaigns, workshops, seminars, and orientation programs to educate students and staff on the importance of proper waste management and environmental hygiene.

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