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ASSESSMENT OF THE BROKEN WINDOWS THEORY AND LITTERING BEHAVIOUR AMONG STUDENTS IN A NIGERIAN UNIVERSITY: IMPLICATION ON POST COVID-19 CLASSROOM LITTERING

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Abstract
Littering behaviour causes aesthetic challenges, it is unhealthy, and due to its pervading nature especially among the youth, practical intervention is urgently required. This study examined the applicability of the broken windows theory and the two stage process model to classroom littering. The time of day litter is produced most and what items constitutes litter by students were examined. Four classrooms of a faculty in a university where different levels of students received lectures constitute the setting for this study. Litter collection took place for 5 days across 4 lecture periods per day with each classroom cleared of any litter prior to the commencement of lectures. Litter was collected, sorted and weighed according to the types of litter. Also, the hours of the day that students litter their classrooms most were observed. The broken windows theory was not endorsed, but students engaged in passive littering. Food wrappings constitute the major type of litter produced (F-ratio is significant at p<0.01; Eta square of .839). Also, students littered their classrooms throughout the day, not only in the afternoons as suggested by literature. This knowledge has implications for post-covid-19 littering behaviour of students, especially with the disposal of face masks. The onus lies with the school management to develop advocacy campaign that will focus on the significant variables examined in this study.

Key Words: *Broken windows theory, Littering, Classroom, Nigeria*

Introduction

Research on littering the environment has received the attention of numerous investigators (Schultz *et al*., 2013), but has defied permanent solution. Littering constitutes a major environmental problem with a health, environmental and economic implications (Bateson *et al*., 2015; Wanjohi, 2016; Al-mosa *et al*., 2017). Like many social problems, litter is caused by human behaviour (Schultz, 2011). This problem is growing steadily and still attracting great attention among scholars and government institutions (Wanjohi, 2016). Additional environmental challenges now includes disposal of face masks (Singn *et al*., 2020).

This present study is motivated by the incessant litter left behind by students after lecture hours. This behaviour has caused the janitorial team and management worry because all attempts to ensure litter free classrooms has failed.

Previous studies have affirmed the hypothesis that a litter-free environment will encourage proper disposal of litter (Reiter *et al.,* 2006). This hypothesis is grounded in the Broken Windows Theory (BWT) propounded by Wilson *et al*. (1982). The BWT suggests that the presence of disorder in an environment is likely to encourage more disorderly behaviour. This assertion was extended from criminal domain to littering behaviour where the rate of litter was less in a clean environment (Reiter *et al*., 2006); in hospital settings (Ellis *et al*., 2020) and academic common room (Ramos *et al*., 2012). There are dissenting views however, with some empirical research outcomes disputing the BWT hypothesis (Wicherts *et al*., 2014). In spite of the controversy, no study has been conducted in Nigeria to confirm the applicability of the BWT. An empirical outcome in a classroom environment has not been studied, thus we hope the findings of this study will add to research knowledge in educational settings. Thus, in this present study, the authors examined the validity of the Broken Windows Theory (Wilson *et al*., 1982) by examining how a litter-free classroom will discourage students from littering their classrooms during lecture hours. This is considered necessary to the current litter challenges experienced by educational institutions.

The school environment is characterized by open spaces outside of the classrooms. Thus, uncontrolled and improperly disposed litter in the classrooms can be tossed by the wind from the classrooms to open spaces and then to destinations such as water ways where pollution and flooding (Baker, 2020) may take place. Furthermore, uncontrolled disposal of classroom litter may become a source of grave concern and work load on cleaning janitorial personnel of educational institutions.

Campuses in Nigeria provide residential halls to enable easy accessibility to lecture classrooms. This living arrangement requires students to provide their meals from different sources. Thus, students either cook or buy food and snacks from vendors within their campuses (Mapotse *et al.*, 2017). Therefore, for students whose lecture hours are fixed by 8am, the tendency to purchase packaged foods and snacks is high. Food packed in plastic bags and other materials render the students highly vulnerable to littering the classrooms where they consume the foods (Msezane *et al.*, 2014). Msezane *et al.* (2014) suggests that indiscipline, lack of respect and dereliction of duty by students may be responsible for degradation of the environment. In Nigeria, some studies have investigated littering behaviour of Nigerians, and proffered solutions (Ifegbesan, 2010; Ojedokun *et al*., 2011; Ifegbesan *et al.*, 2017). But the problem still persists.

The University environment is one that houses different designs of classrooms and administrative buildings. Thus, students make several trips between classrooms and within lecture hours. In the University of Lagos, undergraduate lecture hours are between 8am to 4pm; making a total of four lectures of 2 hours each. This signifies that some students may not have the luxury of having their breakfast before setting out in the morning. Hence, the possibility that students will snack between these hours is high. Snacking, and invariably drinking of water and beverages are inevitable. The mode of disposing the packaging and wrappings creates a challenge that results

in littering. Thus, the identification of lecture periods and types of litter produced by students may unlock the panacea for a successful intervention for a significant reduction of classroom littering behaviour.

Understanding the composition of litter produced by students will give an insight into the importance of the problem and enable appropriate classification of student's waste for informed policy formulation by the institutions' management. It is equally important to ask these questions: why do students litter a clean classroom and do students litter in the mornings and afternoons alike? The following objectives sought to answer the research questions raised in this study. Firstly, to investigate the validity of the broken windows theory by observing if a clean classroom environment will deter students from littering the classrooms. Secondly, this study aims to confirm if passive or active littering exists among the students. Thirdly, the authors will examine the type of litter that students produce during their lecture periods and lastly investigate and identify the time of the day that students litter the most. Answers to these investigations will give an insight into the appropriate interventions required for littering among students in the university instead of applying general interventions (Wever *et al*., 2010)

Theoretical and Literature Review

Broken Windows Theory (BWT)

The broken windows theory (Wilson *et al.*, 1982) assumes that there are objects that act as cues for inappropriate behaviour. Litter-like objects such as graffiti, or broken windows found in public places projects norm-violating behaviour (Kelling *et al.*, 1998), which in turn attracts further negative behaviour. This theory associates disorder and incivility within a community to subsequent occurrences of serious crime. The implication of this for littering literature is that the presence of disorder further entrenches littering. It is thought that removing broken windows graffiti, litter, and other signs of disorder removes an important cue for further disorder. For example, while littering may be frowned upon, there may be a lot of litter in a particular location that may promote further littering behaviour in that location. The broken windows hypothesis will be tested in this study to investigate if a clean classroom at the commencement of a lecture will encourage proper disposal of student litter.

The Two-Stage Process Model

The two-stage process model of littering behaviour describes the different ways in which people litter. According to Sibley *et al.* (2003), littering behaviour can be classified into two; active and passive littering. Active littering occurs when litter is placed or dropped on the floor while a person is in motion without stopping. In this case, littering is obvious and is actively exhibited. Passive littering occurs when a person holds litter for the period that the person occupies an area. In this case, the person and the litter are situated in the same area. However, as the person vacates the area, the litter is left behind. It has been established that passive littering takes place in public places where people occupy temporarily. Passive littering is arguably the type that occurs in the classrooms. Students occupy sitting spaces in the classrooms for the period of their lectures spanning two hours in one instance. In this case, the tendency for passive littering to occur is high. The students can place the litter in the area of

occupation, and leave the litter behind after their classes.

The motivation for pro-environmental behaviour originating from visible appropriate behaviour may be a panacea for littering behaviour. Otherwise known as social diffusion, the study of Mckenzie-Mohr (2013), suggested that commitment from friends or people who exhibit appropriate environmental behaviour could be made visible through visual communication devices. For example, pasting of pictures of friends disposing litter properly may be mounted in places that are visible to encourage pro-environmental behaviour.

In Keep America Beautiful (KAB) (2007) study, litter was counted and categorized according to litter types. Similar to this is the study by Ocean Conservancy (2007), where cigarette butts constituted 27% of all items collected, food wrappers constituted 10%, caps and lids 9%, bags 8%, plastic beverage bottles, 7%, plastic utensils 5%, and glass beverage bottles 5 percent of all the items collected (Ocean Conservancy, 2007).

An important research question contextual to this study relates to the relevance of existing litter in the environment. Thus, in Al-mosa, *et al.* (2017) study in Saudi Arabia, it was affirmed that presence of litter was a relevant and effective variable influencing littering. The findings of this present study will advance knowledge by confirming the applicability of this hypothesis in classroom settings. In Ramos *et al.* (2012), students who were studied in a clean environment littered by 18% compared to students who were studied in a littered environment (50%). In Sagebiel *et al.* (2020), the broken windows theory was tested with cigarette butts to affirm the influence of a littered environment. The effect of a 0.5% reduction of cigarette butts due to a no-cigarette-butt environment was reported to be insignificant in influencing additional costs related to cleaning the environment. Thus, insufficient arguments on the presence or absence of litter influencing environmental littering still persist. The need to develop intervention strategies may be based on contextual situation.

Methodology

This study was conducted in a university campus in Lagos, Nigeria; where each of the lecture classrooms accommodates an average of 70 students at the same time. Four classrooms that were similar in sizes and arrangement were engaged for the experiments at different lecture hours of the day. At the entrances of the classrooms, plastic litter bins were situated for trash disposal. Additionally, signs were engraved on metals stuck to the walls with the inscription 'No food or drink is allowed' in all the classrooms.

In this study, students were not directly involved. Only the litter produced by them was studied, hence, students were not informed of the study before litter was collected to avoid exhibition of appropriate littering behaviour. However, the class lecturers were informed of the study because the janitorial staff was required to clear the litter prior to each lecture period. Students were debriefed the following week. Experimental design using randomized block design was utilized in this study. The sample students are relatively homogenous with respect to year of study. Thus, they are blocked into 100 level, 200 level, 300 level and 400 level. Blocking is appropriate because the elements within each block are more homogenous than the entire sample.

The authors identified lecture venues for four different lecture periods of the day; 8:00am to 10:00am, 10:00am to 12:00pm, 12:00pm to 2:00pm and 2:00pm to 4:00pm respectively. Prior to the commencement of a new lecture, litter was cleared from selected lecture venues after each class session ending by 10 am, 12 noon, 2 pm and 4 pm with the help of three volunteers who were given incentives (call cards). Each litter bag was labeled according to the lecture hours, and day of the study. The litter bags were taken to the psychology laboratory for analysis. The field work for litter collection lasted for 5 lecture days.

Hypotheses

1. A litter-free classroom prior to a lecture period will discourage students from littering.
2. Students will leave behind their litter after their lectures
3. Students will significantly produce litter similar to those associated with food items.
4. Time of day will have a significant positive effect on littering behavior among students.

Results

Table 1: Mean and Standard Deviation of Weights after Each Lecture Period

Descriptive Statistics	Hours of the Day			
	10:00am	12:00oon	2:00pm	4:00pm
Mean	.453	.884	1.726	1.885
SD	.233	.257	.219	.388

Table 1 reveals the analysis result for hypotheses one and two

Table 2: Mean and Standard Deviation of Weights by Trash Types

Descriptive Statistics	Plastic Bottles	Ceramics Bottles	Empty Soda Cans	Nylon Wrappings	Paper of all kinds	Food Packs
Mean	2.254	.484	.216	.408	.966	.384
SD	.248	.530	.161	.194	.437	.314

Table 2 reveals the mean and standard deviation of trash types

Table 3: Summary of Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-ratio	Pv
Between Groups	14.540	5	2.908		
Within Groups	2.789	24	.116	*25.022	P<.01
Total	17.329	29			

* F-ratio is significant at p<0.01; Eta square of .839.

Table 3 shows a One-Way Analysis of Variance for trash types. Thus, table 2 and 3 confirms our statement in hypothesis three. Result reveals that students produced litter similar to those associated with food items and which yielded a total sum of 3.746kg as compared to other types of litters generated. The associated eta square of .839 shows that 83.9% of times students will always produce litters associated with food items. The F-ratio (25.022) in table 3 suggests that this variation is significant and not by chance.

Hypothesis 4 examined the significant influence of time of the day on littering behaviour among students. Table 4 presents a 5X6 Factorial ANOVA Test of Between-Subject Effect.

Table 4: 5X6 Factorial ANOVA Test of Between-Subject Effect

Source	Type III Sum of Squares	Df	Mean Square	F-ratio	sig
Day	.829	4	.207	.688	p>.05
Hours	6.807	3	2.269	7.540*	P<.05
Day * Hours	2.009	8	.251	.834	p>.05
Error	1.204	4	.301		
Total	40.823	20			

* F-ratio is significant at p<0.05; R Square = .893 (Adjusted R Square = .489).

In table 4, test of between –subject effect reveals significant main effects of time of the day on students littering behaviour (F-ratio = 7.540*, at p<0.05). In table 1, mean weights of 1.726kg and 1.885kg of litters were generated by 2:00pm and 4:00pm respectively. Day and interaction between day and time did not show significant effect of littering behaviour (F-ratio = .688; at p>0.05) and F-ratio = .834, at p>0.05) respectively (table 4).

Additionally, post hoc multiple comparison analysis was conducted to establish the significance of the observed mean differences between the hours of the day. In table 5, significant mean weight difference was observed between 10:00am 2:00pm (mean difference = -1.386* at p<0.01), likewise between 10:00am and 4:00pm in the evening (mean difference = -1.423* at p<.05).

Table 5: Multiple Comparison of difference of Mean Weight of Litter by Times of the Day

Hours of the day		Mean Differences	Std. Error	sig
10:00am	12:00noon	-.510	.294	.419
	2:00pm	-1.386*	.270	.001
	4:00pm	-1.423*	.397	.021
12:00noon	10:00am	.510	.294	.419
	2:00pm	-.876	.285	.054
	4:00pm	-.913	.407	.212
2:00pm	10:00am	1.386*	.270	.001
	12:00noon	.876	.285	.054
	4:00pm	-.036	.390	1.00
4:00pm	10:00am	1.423*	.397	.021
	12:00noon	.913	.407	.212
	2:00pm	.036	.390	1.00

Discussion

The result of this present study did not confirm the broken windows theory. Our result did not agree with Dur *et al.* (2015), who reported that litter is higher in an environment that is already littered. Our result suggests there are more underlying behavioural challenges that could cause littering by students. A culture of poor maintenance of the environment may be a factor. It may also be attributed to habitual practices that develop from socialization processes during childhood development. These habits have formed over the years

and have thus become part of their behaviour (Schultz *et al*., 2013). It is therefore necessary to develop behavioural change strategies to bring about litter disposal practices among the students. Another possible reason for the broken windows theory to be negated in this study may be linked to subconscious behaviour actively playing a role, and which the students may not be aware of (Curnow *et al.*, 1997). Students may litter subconsciously, especially when the management does little or nothing about it. It is therefore imperative for concerned authorities to intervene periodically by introducing measures to deter littering.

The results in table 1 suggest that the two stage process model was applicable to this study. This may reveal an unconscious habitual behaviour, and not a deliberate attempt to litter. There may be indications that the students may forget the litter. In this case, memory arousing cues may be placed at strategic locations in the classrooms to remind the students of the need to dispose their litter properly.

A crowded classroom may also be a motivating factor in two ways. Firstly, when a classroom is crowded, and many people violate the norm of proper disposal of litter, more people may behave likewise (Keizer *et al.*, 2011). Secondly, a crowded classroom may provide adequate anonymity for littering to occur. When classrooms are designed in a manner that provides a shield when students litter, the situation may encourage littering because the possibility of being sighted while littering will be low.

The result in table 2 suggests that participants littered their classrooms with litter similar to those associated with food items. The F-ratio (25.022, $p< 0.01$) shows that this variation is significant and not by chance. This is however not in agreement with the findings of Torky (2017) where 16% of the student participants litter with paper, followed by food remnants. The students in this present study littered their classrooms majorly with plastic bottles, empty soda cans, nylon wrappers and food packaging among the other types of litter. The need to satisfy their hunger pangs may be the basis for littering the classrooms. This is in agreement with Ifegbesan (2010).

The other type of litter identified in this study is paper. Paper litter is not surprising since students use paper for their lecture notes. This knowledge has implications for post-covid-19 littering behaviour of students, especially with the disposal of face masks. Face masks could easily be disposed just as paper, and may constitute a new trend in litter disposal. The knowledge that food associated wastes constitute majority of the littered items suggests that policies aimed at regulating eating habits should be pursued by the school management. It is suggested that a total ban on eating in classrooms may be considered by the school authority. Also, the school lecture hours may be adjusted to allow students time to satisfy their hunger pangs.

Apart from hunger, high volume of littering collected during the afternoon hours may also be related to other uses of the classrooms. When classrooms are not used for lectures, some students hang around especially while waiting for future lecture periods later in the day. On such hours, litter could be dropped by such students due to binge eating. Paper materials used for tutorials and personal studying may also be disposed in higher quantities. Literature have documented students littering, but none according to the knowledge of the current authors, have studied the student's littering behaviour

across the school hours to determine when litter occur most during the day.

Conclusion

The broken windows theory was tested to ascertain its validity in the study setting. The finding could not endorse the hypothesis. This suggests that littering could be an internalized behaviour that has become habitual in the students. Therefore, consistent monitoring over an appreciable period of time is required to change the behaviour of the students. Also, faculty members may be asked to devout some of their lecture hours to educate students on the benefits of proper litter disposal.

Our findings reveal that students commit passive littering. Hence, a vigorous, content-related intervention programme is required to bring about behaviour change. Additionally, covert behavioural change mechanisms such as those associated with unlearning of behaviour is required.

We have also identified three associated variables of littering among students in this current study. Our results affirm that food items constitute the main object littered most by students. This has been confirmed by some studies, but the only study in Nigeria identified paper as the most littered item though, among secondary school students. Our result will significantly assist the university management to make informed decisions on advocacy for relevant campaign content in regulating eating in classrooms.

A significant finding in this study is the identification of the hours that litter is produced. The generation of litter, and improper disposal in the mornings is a cause for concern. This may require further investigation to probably unravel any covert cause. In line with literature, it was revealed that volume of litter is higher in the afternoons, which indicates lunch period. This is a veritable hint that intervention may be targeted significantly at lunch hours of the day.

Study Limitation

The findings of this study present significant information to reduce littering behaviour among students. However, there are shortcomings that we would like to highlight for future assignments. It may be necessary to investigate more lecture hours and longer days to ascertain more variations of different lecture periods that litter could be produced. Additionally, a cause and effect relationship could not be established for litter behaviour. The student may be interviewed to examine what drives their littering behaviour in spite of a litter free environment. Additionally, research method of obtaining data is necessary to provide a holistic outcome to solve the problem of litter among students.

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