

The Impact of Social Norms and Environmental Messaging on Recycling Behaviour

Emmanuel Temitope Bankole¹, Abimbola Mary Bankole², Useni Femi Victor³

{Temitope.bankole@eksu.edu.ng¹ bankolemary8@gmail.com² mcmanuel77@yahoo.com³}

Department of Psychology and Behavioural Studies, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria¹

Department of Guidance and Counseling, Ekiti State Polytechnic, Isan-Ekiti, Ekiti State, Nigeria²

Department of Psychology and Behavioural Studies, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria³

Abstract. This study examined the impact of social norms and environmental messaging on recycling behaviour among university students. Using a cross-sectional survey design, data were collected from 198 students with the Social Norm Espousal Scale (SNES), Environmental Communication Scale (ECS), and Recycling Attitude Scale (RAS). Results showed that social norms did not significantly predict recycling attitudes ($R^2 = .01$, $p > .05$). In contrast, environmental messaging significantly influenced recycling attitudes ($R^2 = .14$, $F(3, 194) = 10.32$, $p < .01$), with confirming messages exerting a positive effect and dismissing messages a negative effect. The combined influence of social norms and environmental messaging was not significant ($R^2 = .02$, $F(2, 195) = 1.86$, $p > .05$). No significant gender differences were observed in recycling attitudes ($t(196) = 0.56$, $p > .05$). The findings underscore the importance of effective environmental communication in promoting sustainable recycling behaviour in universities.

Keywords: Social Norms, Environmental Messaging, Recycling Behaviour, Undergraduate.

1 Introduction

As global concerns about environmental degradation and resource depletion continue to grow, understanding the factors that influence individual recycling practices has gained paramount importance [1]. Recycling, the process of converting waste materials into new materials and objects, plays a pivotal role in mitigating environmental degradation, conserving natural resources, and reducing greenhouse gas emissions [2]. Despite the apparent benefits of recycling and increased awareness of environmental issues, recycling rates vary significantly across different communities and demographics. This disparity reflects the complex nature of human behaviour and the multifaceted factors that influence individual decisions to recycle. Among these factors, social norms and environmental messaging have been identified as potent forces shaping recycling behaviour [3]. Social norms, the unwritten rules that guide behaviour within a society, exert a powerful influence on individual actions. In the context of recycling, these norms can manifest as peer pressure, community expectations, or cultural values that either promote or discourage sustainable waste management practices. The impact of social norms on recycling behaviour is twofold: descriptive norms reflect what most people do in a given situation, and injunctive norms represent what most people approve or disapprove [4]. Strong social approval for recycling can motivate individuals to engage in the behaviour, even if it requires additional effort. When individuals perceive recycling as a common practice within

their community, they are more likely to adopt similar behaviours [5]. Concurrent with the influence of social norms, environmental messaging has evolved dramatically in recent decades. From traditional public service announcements to sophisticated digital campaigns, the methods of conveying environmental information have diversified. These messages aim not only to educate but also to motivate action by highlighting the consequences of waste mismanagement and the benefits of recycling [6]. The effectiveness of environmental messaging in promoting recycling behaviour depends on various factors, including message framing, emotional appeal, and the credibility of the information source [7]. The interplay between social norms and environmental messaging creates a complex dynamic that influences recycling behaviour. While some campaigns successfully leverage social proof to encourage recycling, others may inadvertently reinforce negative perceptions or fail to resonate with their target audience [8]. Understanding this interplay is crucial for developing effective strategies to promote sustainable waste management practices [9]. Recent research has also highlighted the importance of considering both self-reported attitudes and observed behaviours when studying recycling practices [10]. Additionally, the role of economic incentives in conjunction with social influence has been explored as a means to overcome barriers to household waste separation [11]. These findings underscore the need for a multifaceted approach to promoting recycling behaviour, one that considers psychological, social, and economic factors [12].

In Nigeria, the challenges and opportunities surrounding recycling and waste management take on unique dimensions. As Africa's most populous country and largest economy, Nigeria faces significant environmental pressures due to rapid urbanization, population growth, and increasing consumption patterns [13]. The country generates an estimated 32 million tons of solid waste annually, with only a small fraction being recycled [14]. This situation presents both a critical environmental challenge and a potential opportunity for sustainable development. In Nigeria urban centers, particularly in cities like Lagos, Kano, and Abuja, the issue of waste management has become increasingly pressing. Inadequate infrastructure, limited public awareness, and inconsistent policy implementation have contributed to the accumulation of waste in public spaces, waterways, and landfills [15]. However, recent years have seen a growing recognition of the need for improved waste management practices, including recycling initiatives. The influence of social norms on recycling behaviour in Nigeria is particularly noteworthy. Traditional values of resource conservation and community cleanliness coexist with more recent consumerist tendencies, creating a complex landscape for environmental messaging [16]. In many Nigerian communities, informal recycling networks have long existed, with waste pickers and small-scale recyclers playing a crucial role in resource recovery. Formalizing and expanding these networks presents both challenges and opportunities for improving recycling rates [17]. Environmental messaging in Nigeria has evolved in recent years, with government agencies, non-governmental organizations, and private sector actors increasingly engaging in public awareness campaigns. These efforts often aim to bridge the gap between environmental knowledge and action, addressing unique cultural and socioeconomic factors that influence recycling behaviour in the Nigerian context [18]. The effectiveness of these campaigns varies, highlighting the need for tailored approaches that resonate with diverse Nigerian audiences. The interplay between social norms, environmental messaging, and recycling behaviour in Nigeria is further complicated by infrastructural and policy challenges. While there is growing awareness of environmental issues, the lack of consistent and accessible recycling facilities in many areas poses a significant barrier to sustainable waste management practices [19]. This underscores the importance of integrating behavioural interventions with improvements in

recycling infrastructure and policy implementation. Recent initiatives in Nigeria have begun to address these challenges through innovative approaches. For example, incentive-based recycling programs in some urban areas have shown promise in increasing participation rates [20]. Additionally, the use of digital technologies and social media platforms to promote recycling awareness and facilitate waste collection has emerged as a potential strategy for engaging younger, urban populations [21].

2 Statement of the Problem

In Nigeria, efforts to promote recycling face significant challenges despite growing environmental awareness. While recognition of recycling's benefits is increasing, particularly in urban areas, translating this awareness into widespread behaviour remains elusive [22]. This gap suggests that factors beyond awareness, particularly social norms and environmental messaging, play crucial roles in shaping recycling behaviour. Social norms in Nigerian communities significantly influence individual actions, often overshadowing environmental concerns [23]. Moreover, the effectiveness of environmental messaging varies widely, depending on how well it resonates with different social groups and their existing norms [24]. The situation is further complicated by insufficient recycling infrastructure and inconsistent waste management policies across Nigeria [25]. The informal recycling sector, while contributing significantly to resource recovery, operates largely outside formal policy frameworks and faces social stigma [26]. Additionally, rapid urbanization and changing consumption patterns in Nigeria cities are altering the volume and composition of waste, necessitating adaptive approaches to waste management and recycling promotion [27].

3 Objectives of the Study

The primary objective of this study is to explore the impact of social norms and environmental messaging on recycling behaviour. Specifically, the study aims to:

- i. Investigate the influence of descriptive norms (perceptions of what others commonly do) and injunctive norms (perceptions of what is socially approved) on recycling behaviour.
- ii. Evaluate the effectiveness of different types of environmental messaging (e.g., informational, emotional, and normative appeals) in promoting recycling.
- iii. Examine the interaction between social norms and environmental messaging and their combined effect on recycling behaviour.
- iv. Provide actionable insights for policymakers, environmental organizations, and communicators to design more effective strategies for promoting recycling.

4 Significance of the Study

This study on the impact of social norms and environmental messaging on recycling behaviour is relevant because it explores key psychological and social factors influencing recycling behaviour.

The research has practical applications in designing better recycling campaigns and policies. It offers a potentially cost-effective approach to boosting recycling rates through social influence and targeted messaging. The findings are relevant to policymakers for creating impactful initiatives and could potentially apply to other pro-environmental behaviours.

The study's interdisciplinary nature, bridging environmental science, psychology, and public policy, contributes to a more comprehensive understanding of environmental behaviour. Ultimately, this research can help create more sustainable, long-term changes in waste management and environmental conservation efforts by addressing the underlying motivations for recycling behaviour.

5 Research Hypotheses

- Social norms will significantly predict recycling attitudes.
- There will be a significant influence of environmental messages dimensions on recycling attitude.
- Social norms and environmental messages will have a significant joint influence on recycling attitudes.
- There will be a significant difference in recycling attitudes between male and female.

6 Methods

6.1 Research Design and Sample

A cross-sectional survey design was employed for this study. This design is appropriate for examining the impact of social norms and environmental messaging on recycling behaviour at a point in time. The survey method allows for the collection of data from a large number of participants, providing a snapshot of the relationships between variables.

6.2 Sampling Technique

The participants for this study were 198 undergraduate students purposely selected from the population of Ekiti State University, Ado-Ekiti. The sample comprised of 103(52.02%) male students and 95(47.98%) female students. The age of participants ranges from 16-28 years with a mean age of 21.58 and a standard deviation of 2.51.

7 Procedure

Before the data for this study were collected, approval was granted to carry out this research by the Research and Ethics Committee of Ekiti State University, Ado-Ekiti.

Before the questionnaire was administered, the researchers sought and obtained the informed consent of the participants. The participants were told they could withdraw from the study at any stage if they felt uncomfortable. After the informed consent had been obtained, the researchers personally administered the questionnaire to the respondents and also personally retrieved the copies of questionnaires from the respondents while thanking them for their participation. In all, two hundred and fifty (250) copies of questionnaire were administered to the participants but only two hundred and twenty-six (226) were retrieved while one hundred

and ninety-eight (198) copies were eventually scored and used for analysis because twenty-eight (28) copies were filled inappropriately.

8 Measures

Social norm was assessed using the Social-Norm Espousal Scale (**SNES**) developed by [28]. Social norm was measured on a 5-point Likert scale ranging from Extremely uncharacteristic (1) and Extremely characteristic (5). Sample items include 'I go out of my way to follow social norms', 'If more people followed society's rules, the world would be a

better place', 'Our society is built on unwritten rules that members need to follow'. [29] obtained convergent validity coefficients ranging between .21 and .57 by correlating the SNES with associated social constructs such as social responsibility and social desirability. Similar to alpha coefficient value reported by the scale author, a Cronbach alpha value of .76 was obtained for the SNES in the present study. Moreover, a test-retest reliability was carried out to assess the internal reliability of the SNES was acceptable over a 10-week interval. At Time 1 ($\alpha = .71$) and at Time 2 ($\alpha = .73$). In addition, scores at Time 1 and Time 2 were highly correlated, $r = .73$, $p < .001$.

9 Environmental Communication Scale (ECS)

The Environmental Communication Scale (ECS) is a self-report inventory developed by [30] to assess the degree to which individuals engage in communication related to environmental issues. It goes beyond measuring environmental attitudes or beliefs and focuses specifically on communication behaviours. The ECS consists of 20 items that measure key dimensions related to environmental messaging, including practicing dimension, dismissing dimension, and confirming dimension. Each dimension is assessed through a series of statements to which participants indicate their level of agreement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

The ECS has demonstrated strong psychometric properties. Internal consistency is high across all dimensions, with Cronbach's Alpha values ranging from 0.78 to 0.82. Additionally, the scale shows strong convergent validity, as indicated by significant correlations with established measures of environmental attitudes and communication effectiveness, with coefficients ranging from 0.67 to 0.72 [31].

10 Recycling Attitude Scale (RAS)

The Recycling Attitude Scale (RAS) is a self-report inventory designed to assess participants' attitudes toward recycling and other pro-environmental behaviours. The RAS consists of 32 items that measure key dimensions of recycling attitudes. The scale has sub-scales knowledge and awareness, economic value. Each dimension is evaluated through a series of statements to which participants indicate their level of agreement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

The RAS has demonstrated strong psychometric properties. Internal consistency is high across all dimensions, with Cronbach's Alpha values ranging from 0.78 to 0.84. Additionally, the scale

shows robust convergent validity, evidenced by significant correlations with established measures of recycling behaviour and environmental concern, with coefficients ranging from 0.68 to 0.73 [32].

11 Statistical Analyses

Descriptive statistics and correlations were performed with the aid of IBM SPSS Statistics version 29.0. In order to test the formulated hypotheses in this study, a simple linear regression was performed to test hypothesis one. Similarly, a multiple regression was conducted to test the independent and joint influences of environmental messaging dimension on recycling behaviour. Finally, an independent samples t-test was performed to test for the differences between male and female participants in recycling behaviour.

12 Results

Table 1. Means (M), Standard Deviations (SD) and Bivariate relationship between age, social norms, environmental messages dimensions and recycling attitude

Variable	M (SD)	Recycling Attitude (r)
Age	21.51 (2.65)	.14*
Social Norms	42.55(6.25)	.08
Practicing	24.33(5.69)	.10
Dismissing	15.79(3.69)	-.20**
Confirming	21.05(4.16)	.34**
Recycling attitude	46.88(7.12)	-

** $p < .001$, $p < .05$ (2-tailed)

Bivariate correlation results in table 1 showed that age has a weak but significant positive relationship with recycling attitude $r = .14$, $p < .05$. The table also showed that there is a significant negative relationship between Dismissing (subscale of environmental messages) and recycling attitude $r = -.20$, $p < .01$; indicating that the higher the participants' dismissive disposition to environmental messages; the lower are their positive recycling attitude. Finally, it was revealed that there is a significant positive relationship between confirming environmental messages and recycling attitude $r = .34$, $p < .01$.

12.1 Hypothesis One

Social norms will significantly predict recycling attitudes.

Table 2. Simple Linear Regression Analysis Showing the Association Between social norms and recycling attitude

Model	<i>B</i>	SE	<i>B</i>	R ²	F
Social norms	0.09	.08	.08	.01	1.216

Results in Table 2 showed that social norms did not significantly predict recycling attitude $R^2 = .01$, $F(1,196) = 1.216$, $P > .05$. Specifically, social norms were not significantly associated with recycling attitudes. Thus, hypothesis one was not supported.

12.2 Hypothesis Two

There will be a significant influence of environmental messages dimensions on recycling attitude.

Table 3. Summary of multiple regression showing the independent and joint predictive influence of environmental messages dimensions on recycling attitude

Predictors	<i>B</i>	t	P	R	R ²	F	P
Practicing	-.06	-.83	>.05				
Dismissing	-.14	-2.09	<.05	.37	.14	10.32	<.01
Confirming	0.34	4.41	<.01				

Table 3 shows that the three dimensions of environmental messages jointly predict recycling attitude $R^2 = .14$, $F(3, 194) = 10.32$, $p < .01$. This means that the dimensions (practicing, dismissing and confirming) jointly account for 14% variation in recycling attitude. Similarly, it was revealed that dismissing $\beta = -.14$, $t = -2.09$, $p < .05$ and confirming $\beta = 0.34$, $t = 4.41$, $p < .01$ independently predict recycling attitude. Specifically, an increase in dismissing environmental messages predicts a decrease in positive recycling attitudes while an increase in confirming environmental messages predicts a corresponding increase in positive recycling attitudes. Therefore, hypothesis two was supported.

12.3 Hypothesis Three

Social norms and environmental messages will have a significant joint influence on recycling attitudes.

Table 4. Summary of multiple regression showing the joint predictive influence of social norms and environmental messages on recycling attitudes

Predictors	<i>B</i>	t	P	R	R ²	F	P
Social norms	.04	.46	>.05				
Environmental messages	.12	1.58	>.05	.14	.02	1.86	>.05

The regression summary in Table 4 showed no significant joint influence of social norms and environmental messages on recycling attitude $R^2 = .02$, $F(2, 195) = 1.86$, $p > .05$. Therefore, hypothesis three was not supported.

12.4 Hypothesis Four

There will be a significant difference in recycling attitudes between male and female

Table 5. Independent t-test table showing sex differences in recycling attitudes

	Sex				$t_{(196)}$	P
	Male (n = 103)		Female (n = 95)			
	M	SD	M	SD		
Recycling attitudes	47.16	7.71	46.59	6.47	0.56	>.05

Independent samples t-test summary above showed that there is no significant difference between male and female participants in recycling attitudes $t(196) = 0.56$, $p > .05$. Therefore, hypothesis four was not supported.

13 Discussion

Hypothesis one states that social norms will significantly predict recycling attitudes. However, results of data analysis showed that social norms did not significantly predict recycling attitudes. While a significant body of previous perspectives report the positive influence of social norms on recycling behaviour [33], in line with present study, some studies have identified instances where social norms did not significantly impact recycling engagement.

One such finding comes from a study by [34] who, using a nationally representative sample, found that while private environmental values and personal norms were influential in promoting recycling of plastic water bottles, social norms regarding how a household's recycling behavior is perceived by others had little independent effect. Recent research has also shown that such social expectations may not be universally effective in promoting positive environmental attitudes and behaviour.

One such recent study was conducted by [35] who found that descriptive norms information about what others are doing did not significantly impact participants' willingness to engage in energy conservation behaviours. Despite being informed that the majority of their peers were conserving energy, individuals did not significantly alter their behavior compared to the control group.

This finding suggests that social norms may be less effective when individuals perceive the promoted behaviour as inconvenient or when they have low personal efficacy or environmental concern. [36] further support this interpretation by demonstrating that norm-based interventions often fail when not accompanied by internal motivation or structural support. In their study on urban recycling behaviours, the presence of normative messages had little effect unless paired with incentives or improved infrastructure.

In consensus with [37] argue that in collectivist cultures, injunctive norms (what people approve of) may be more persuasive than descriptive ones, but even then, the translation into behaviour is not guaranteed unless it agrees with personal identity and contextual factors. This calls into question the assumption that norm-based appeals can be universally applied to foster environmental behaviour.

Hypothesis two states that there will be a significant influence of environmental messages dimensions on recycling attitude. It was found that environmental messaging dimensions significantly influence recycling behaviour. The hypothesis suggests that various aspects of environmental communication can play a crucial role in shaping people's attitudes towards recycling. Consistent with this study, [38] found that environmental messages with specific, actionable calls to action (e.g., "Separate your plastic waste daily") led to more positive recycling attitudes than general appeals (e.g., "Please recycle").

In the same vein, recent research accentuates the power of environmental messaging in encouraging environmental beneficial behaviour. For example, [39] found that targeted environmental messages emphasizing personal responsibility and tangible benefits significantly increased participants' engagement in energy-saving behaviours over a four-week period. Participants exposed to messages reflecting both environmental impact and cost savings showed a 27% reduction in electricity usage compared to a control group that received no messaging.

Hypothesis three states that social norms and environmental messages will significantly jointly influence recycling attitudes. While both social norms and environmental messaging have independently been shown to influence pro-environmental behaviours [40], this study indicates that their combined or joint effect may not always produce a significant change in recycling attitudes. This challenges the assumption in environmental psychology that layering persuasive strategies necessarily leads to additive or synergistic effects.

14 Conclusion

This study investigated the impact of social norms and environmental messaging on recycling behaviour among undergraduate students at Ekiti State University, Ado-Ekiti, Nigeria, contributing to the broader discourse on environmental psychology and sustainable waste management practices.

The findings provide nuanced insights into the psychological and social factors influencing recycling attitudes, with significant implications for designing effective interventions in academic settings and beyond.

The research tested four hypotheses:

- (1) social norms would significantly predict recycling attitudes,
- (2) environmental messaging dimensions would influence recycling attitudes,
- (3) social norms and environmental messaging would have a significant joint influence on recycling attitudes,
- (4) there would be a significant difference in recycling attitudes between male and female students.

The results partially supported these hypotheses, revealing key patterns that both align with and challenge existing literature. Contrary to expectations, social norms did not significantly predict recycling attitudes ($R^2 = .01$, $p > .05$), suggesting that descriptive and injunctive norms may have limited influence in the context of this study's sample.

This finding aligns with prior research, such as [41], which found that personal values and internal motivations often outweigh social norms in driving recycling behaviour, particularly when structural barriers (e.g., lack of accessible facilities) or low personal efficacy are present.

Similarly, [42] noted that descriptive norms may fail to influence behaviour when perceived as irrelevant or inconvenient, a factor particularly relevant in Nigeria, where inadequate recycling infrastructure and inconsistent policy implementation pose significant challenges [43].

The lack of significant influence from social norms may also reflect cultural dynamics in collectivist societies, where injunctive norms (social approval) may be more persuasive than descriptive norms, but only when aligned with personal identity and contextual factors [44].

In contrast, the dimensions of environmental messaging practicing, dismissing, and confirming demonstrated a significant influence on recycling attitudes ($R^2 = .14$, $F(3, 194) = 10.32$, $p < .01$), with confirming messages (e.g., those reinforcing positive environmental actions) positively predicting recycling attitudes ($\beta = 0.34$, $t = 4.41$, $p < .01$) and dismissing messages negatively impacting them ($\beta = -.14$, $t = -2.09$, $p < .05$).

This finding underscores the power of carefully crafted environmental communication, supporting studies like [45], which found that specific, actionable messages (e.g., "Separate your plastic waste daily") are more effective than vague appeals.

The significant role of confirming messages highlights the importance of positive reinforcement and tangible benefits in shaping attitudes, as also evidenced by [46], who reported increased engagement with energy-saving behaviours when messages emphasized personal responsibility and cost savings.

Unexpectedly, the joint influence of social norms and environmental messaging on recycling attitudes was not significant ($R^2 = .02$, $F(2, 195) = 1.86$, $p > .05$), challenging the assumption in environmental psychology that combining persuasive strategies yields synergistic effects [47].

This suggests that layering social norms with environmental messaging may not always enhance effectiveness, particularly in contexts where structural barriers or low personal efficacy dominate, as noted in the Nigerian setting [48].

Additionally, no significant gender differences were found in recycling attitudes ($t(196) = 0.56$, $p > .05$), indicating that interventions may not need to be gender-specific in this population, a finding that contrasts with some studies suggesting gender-based differences in environmental behaviors [49]. The study's findings have significant implications for promoting sustainable waste management in Nigerian universities and similar settings.

The effectiveness of environmental messaging suggests that universities can leverage targeted communication campaigns to foster positive recycling attitudes, particularly by emphasizing actionable steps and positive outcomes.

However, the limited influence of social norms highlights the need to address structural barriers, such as inadequate recycling facilities, and to enhance personal efficacy and motivation, as suggested by [50]. The Nigerian context, characterized by rapid urbanization, informal recycling networks, and cultural dynamics [51], underscores the importance of tailoring interventions to

local realities, including leveraging digital platforms to engage younger populations [52]. Despite its contributions, the study has limitations that warrant consideration.

The cross-sectional survey design, while effective for capturing a snapshot of attitudes, limits causal inferences about the long-term impact of social norms and messaging on recycling behavior. The reliance on self-reported measures (e.g., SNES, ECS, RAS) may introduce social desirability bias, as actual recycling behavior may differ from reported attitudes [53].

The sample, consisting of 198 undergraduate students from a single university, may not fully represent the diversity of Nigerian university populations or broader community contexts. Additionally, the study's focus on social norms and messaging did not account for other potential influences, such as economic incentives or infrastructural access, which are critical in Nigeria [54].

Future research should address these limitations by employing longitudinal or experimental designs to explore the sustained effects of environmental messaging and social norms on recycling behaviour. Studies could also incorporate observational measures of actual recycling practices to complement self-reported data, as suggested by [55]. Expanding the sample to include diverse populations across Nigeria's urban and rural areas would enhance generalizability, particularly given regional variations in waste management infrastructure [56].

Further investigation into the role of cultural values, peer influence in tight-knit communities, or crisis events (e.g., environmental campaigns during waste crises) could clarify when social norms become more influential, as suggested by [57].

Exploring the integration of economic incentives, digital technologies, and infrastructure improvements with behavioural interventions could also yield more effective strategies, as evidenced by [58] and [59].

In conclusion, this study highlights the critical role of environmental messaging in shaping recycling attitudes among Nigerian university students, while underscoring the limited influence of social norms in this context. By identifying the effectiveness of confirming messages and the need for context-specific interventions, the research offers valuable insights for policymakers, environmental organizations, and academic institutions aiming to promote sustainable waste management. Addressing structural barriers and leveraging tailored communication strategies will be essential for translating awareness into action, contributing to Nigeria's sustainable development goals and global efforts to combat environmental degradation.

15 Recommendations

Based on the findings of this study and the broader context of recycling challenges in Nigeria, the following actionable recommendations are proposed to enhance recycling behaviour among university students and similar populations:

- a. **Develop Targeted Environmental Messaging Campaigns:** Governments, universities, and environmental organizations should prioritize well-designed communication strategies that emphasize specific, actionable instructions (e.g., "Sort your waste into recyclables and non-recyclables daily") and positive emotional appeals, such as pride in contributing to environmental conservation or responsibility

toward future generations. These messages should highlight tangible outcomes, such as reduced landfill waste or cost savings, as supported by [56]. Campaigns should leverage credible sources (e.g., university authorities, local environmental NGOs) to enhance trust and effectiveness, as suggested by [61] White et al. (2019). Digital platforms, including social media and university apps, should be utilized to reach younger audiences, building on the potential of digital engagement noted by [62].

b. Enhance Recycling Infrastructure in Universities: The lack of significant influence from social norms in this study underscores the role of structural barriers, such as inadequate recycling facilities, in limiting behavior change [63]. Universities should invest in accessible, clearly labeled recycling bins across campuses, particularly in high-traffic areas like lecture halls, hostels, and cafeterias. These facilities should be accompanied by signage that reinforces confirming messages (e.g., “Join 80% of students recycling on campus”), aligning with the effectiveness of confirming dimensions found in this study ($\beta = 0.34$, $p < .01$). Partnerships with local waste management agencies can ensure regular collection and processing, reducing barriers to participation.

c. Integrate Behavioral Interventions with Incentives: Given the limited impact of social norms alone, interventions should combine normative messaging with economic or social incentives, as supported by [64]. For example, universities could implement reward programs, such as discounts on campus services or recognition schemes (e.g., “Green Student of the Month”), to motivate recycling. Incentive-based programs have shown promise in Nigeria [65] and could be tailored to student populations through gamification or competitions, leveraging peer influence in academic settings.

d. Foster Peer-Led Initiatives to Enhance Normative Influence: While social norms were not significant predictors in this study, their influence may be amplified in tight-knit communities or during specific events, as noted by [66]. Universities should establish student-led environmental clubs or campaigns that promote recycling through peer influence, such as workshops, campus clean-up drives, or social media challenges. These initiatives can create localized injunctive norms, particularly in collectivist cultures where social approval is valued [67], and bridge the gap between awareness and action.

e. Conduct Longitudinal and Experimental Research: To address the study’s limitation of a cross-sectional design, future research should adopt longitudinal or experimental approaches to assess the sustained impact of environmental messaging and social norms on recycling behavior. For instance, randomized controlled trials could test the effectiveness of different message framings (e.g., emotional vs. informational) over time, as suggested by [68]. Observational studies of actual recycling behaviour, as recommended by [69], would provide a more accurate measure of intervention outcomes, mitigating self-report biases.

f. Tailor Interventions to Nigeria’s Socio-Cultural Context: The study’s findings and the Nigerian context highlight the importance of culturally relevant interventions [70]. Messaging campaigns should incorporate traditional values of resource conservation and community cleanliness, which resonate with many Nigerian communities, while addressing modern consumerist tendencies. Collaborations with local leaders,

community organizations, and informal recyclers can enhance the cultural relevance and credibility of campaigns, as supported by [71].

g. Support Policy Development for Formalizing Informal Recycling Networks: The informal recycling sector in Nigeria plays a critical role in resource recovery but faces social stigma and operates outside formal systems [72]. Policymakers should develop initiatives to integrate waste pickers and small-scale recyclers into formal waste management systems, providing training, equipment, and recognition to enhance their contributions. Universities can pilot such programs by partnering with informal recyclers to manage campus waste, creating a model for scalable solutions.

h. Monitor and Evaluate Intervention Outcomes: To ensure the effectiveness of recycling interventions, universities and environmental organizations should implement monitoring and evaluation frameworks. These should track participation rates, waste diversion metrics, and attitudinal changes over time, using both quantitative (e.g., waste audits) and qualitative (e.g., focus groups) methods. Such evaluations can identify which strategies are most effective and inform iterative improvements, aligning with the need for evidence-based approaches noted by [73].

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Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article. The Tunji Olowolafe Foundation (TOF), which sponsored the lead author's participation in the Maiden African International Conference 2025 at the University of Bradford, UK, had no role in the study design, data collection, analysis, interpretation of results, or decision to publish.

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