RESEARCH ARTICLE

Understanding university students' recycling behaviours: An analysis using the Theory of Planned Behaviour

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Abstract:

This cross-sectional study aimed to elucidate the determinants of recycling behaviour among university students employing the Theory of Planned Behaviour (TPB) as the analytical framework. Of the 176 participants, 76% (n=134) reported engaging in recycling activities on campus. A significant association was observed between on-campus residency and recycling behaviour (p=0.01). No significant association were found between recycling habits and either the students' degree courses (p=0.12) or area of origin (p=0.24). Attitudes towards recycling emerged as a crucial predictor, with notable findings in the TPB constructs (p<0.05). Similarly, subjective norms, reflecting social pressures, also significantly influenced recycling intentions (p<0.05). Moreover, perceived behavioral control was also identified as a significant determinant of recycling behaviour among students (p<0.05). The study underscores the integral roles of attitudes, subjective norms, and perceived behavioral control in shaping recycling behaviour among university students. The significant link between residency status and recycling suggests that targeted educational and awareness programs could enhance recycling practices. These findings provide a foundation for universities to develop strategic interventions that foster sustainable behaviours, thereby contributing to environmental conservation efforts. In conclusion, the application of the TPB highlights the multifaceted nature of recycling behaviours, offering critical insights for promoting sustainability within academic institutions.

Keywords: University student, Recycling behaviour, Theory of planned behaviour

1. INTRODUCTION

The escalation in global waste production is primarily driven by expanding populations, economic growth, increased consumption, and a prevailing culture of disposability (Liza et al., 2021). Despite a growing interest in recycling and its pivotal role in sustainable practices, there remains a notable paucity of academic research in this area (Abas, 2019). Universities, with their diverse populations engaged in resource-intensive activities, are regarded as influential communities within society. As hubs of innovation and education, universities are uniquely positioned to lead the way in promoting sustainable waste management practices. By integrating comprehensive recycling programs and sustainability initiatives into their operations, universities can serve as exemplary models for broader societal change, fostering a culture of environmental responsibility and stewardship.

Developing countries, experiencing rapid population growth, urbanization, and industrialization, often face a significant increase in waste generation. This surge is driven by evolving consumption patterns, accelerated economic development, and insufficient waste management infrastructure. The recycling rates in these nations exhibit considerable variability, influenced by factors such as the

effectiveness of waste management policies, the availability of infrastructure, cultural attitudes towards recycling, and economic incentives. The interplay of these elements creates complex challenges for waste management in developing countries. Effective solutions require a multifaceted approach, encompassing policy reform, investment in infrastructure, public awareness campaigns, and economic incentives to encourage recycling. Addressing these issues is crucial for mitigating environmental impacts and promoting sustainable development in these rapidly evolving regions (Gupta et al., 2015).

In 2019, Malaysia produced over 360 tonnes of electronic waste (e-waste), with a mere 25% being effectively collected and recycled. This leaves a staggering 75% of e-waste untreated, posing significant environmental hazards due to potential heavy metal contamination of groundwater sources (The Star, 2022). The improper disposal of e-waste has long-term detrimental effects on environmental and public health. Malaysia's overall waste generation has been increasing, driven by factors such as population growth, urbanization, and economic development. The latest population estimates indicate that approximately 14 million tonnes of municipal solid waste were generated in 2021 (MHLG, 2015). Household waste constitutes the majority of municipal solid waste at 65%, followed by commercial and institutional waste at 28%, and industrial waste at 7% (GSR, 2012).

Recycling contamination, which occurs when materials are incorrectly sorted or improperly cleaned, leads to a decline in the quality of recycled goods (Rachelson, 2023). Workers in recycling facilities, particularly those handling hazardous substances, face significant health risks from exposure to harmful chemicals such as acids, cadmium, mercury, and lead. The damp environments characteristic of many recycling plants may further exacerbate these risks (Okeme & Arrandale, 2019). Proper sorting of recyclable materials at the household level is crucial to prevent contamination. This practice not only enhances the quality of recycled goods but also makes the sorting process at recycling facilities more efficient and safer. Encouraging accurate sorting at the source can significantly reduce the health risks associated with handling contaminated materials and improve the overall effectiveness of recycling efforts.

Universities, as hubs of learning and innovation, are crucial in fostering sustainable behaviors. By instilling effective recycling practices and promoting proper sorting of materials, universities can enhance the quality of recycled goods and streamline the recycling process. This early education helps students carry these habits into their future communities, preventing issues at recycling facilities and ensuring safer operations. Student engagement in recycling is significantly impacted by the accessibility and availability of recycling infrastructure. Strategies such as well-placed recycling bins and clear signage can boost recycling rates, while poor accessibility and inefficient collection methods can impede efforts (Dabo, 2023; DiGiacomo et al., 2018).

Despite various initiatives promoting the 3Rs—reduce, reuse, recycle (Brown, 2017)—recycling rates among college students remain low (Omran et al., 2017). This deficiency contributes to significant environmental concerns. Limited awareness and engagement, particularly among youth, underscore the urgency of addressing this issue (Sulaiman et al., 2019). Although university students are often educated on the benefits of recycling, participation rates remain disappointingly low (Wu et al., 2021). The critical role of lifestyle consumption in contributing to climate change makes increased environmental awareness imperative.

Understanding the intricacies of individual decision-making regarding recycling presents significant challenges. One effective approach to decipher this complexity is through psychological models such as the theory of plan behaviour (TPB). Given that behaviour is multifaceted and influenced by a myriad of factors, employing comprehensive models like the TPB is essential for robust analysis. The TPB is a psychological framework used to understand human behaviour. It posits that behavioral intentions are influenced by three main factors: attitudes, subjective norms, and perceived behavioural control. Attitudes refer to an individual's evaluation of a behaviour as positive or negative. Subjective norms involve perceptions of social pressure to perform or not perform a behaviour. Perceived behavioral control relates to the individual's perception of their ability to perform the behaviour. Together, these factors help predict and explain human behaviour across various contexts, including recycling practices (Ajzen, 2011).

This study sought to examine the elements of the TPB in relation to the recycling behaviour of university students, with potential implications for university administration. The outcomes of this investigation could provide insights for the development of effective strategies aimed at reducing littering on campus and fostering a recycling culture among students. To the best of our knowledge, no previous research has specifically addressed this issue. The objectives of this study were to assess the proportion of health sciences students involved in recycling practices, to compare recycling behaviour across health sciences courses, and to investigate the relationship between the TPB and students' recycling practices.

2. MATERIALS AND METHODS

This cross-sectional study, conducted from April 2023 to March 2024, was undertaken at Universiti Teknologi MARA (UiTM) Puncak Alam, Selangor Campus, Malaysia (3°11'53"N 101°26'45"E). The focus was on undergraduate students from the Faculty of Health Sciences to explore their recycling practices and attitudes. The design aimed to capture a snapshot of recycling behaviours and attitudes among students in health-related disciplines during the study period.

Participants included 1,648 undergraduate students across eight programs within the Faculty of Health Sciences: Nursing, Physiotherapy, Nutritional and Dietetic, Environmental Health and Safety, Medical Imaging, Optometry, Medical Lab Technology, and Occupational Therapy. This selection ensured broad representation and minimized biases related to specific program characteristics.

Sample size calculations, using Universiti Sains Malaysia's sample size calculator version 1.7, indicated a recommended sample of 428 to achieve a 95% confidence level with a 10% dropout rate. However, logistical constraints limited data collection to 176 respondents. This reduced sample size may limit generalizability, but still provides valuable insights. Future studies should consider mixed recruitment methods to enhance participation. Prior to survey implementation, ethical approval was secured from the UiTM Ethical Committee.

Undergraduate students were purposely selected, with class representatives facilitating the distribution of questionnaires. Participants were instructed to complete the questionnaires within a set time-frame. To ensure data integrity, measures were implemented to maintain confidentiality and reduce response bias, including anonymity to mitigate social desirability bias.

The structured questionnaire utilized Likert scale responses (strongly agree/agree/neutral/disagree/strongly disagree) and binary (Yes/No) questions. It covered demographic information, recycling behaviors, attitudes, subjective norms, and perceived behavioral control. Standardization of the questionnaire was maintained, and participants were assured of the confidentiality of their responses. Reliability for the questionnaire was considered acceptable.

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 26.0. Descriptive statistics were used to determine proportions, while hypothesis testing employed the Fisher-Exact test due to the categorical nature of the variables. The association between the intention to recycle and actual recycling behaviour was assessed, with mean and standard deviation used to report Likert scale responses for each of the TPB domain. A significance level (α) of 0.05 was set. Potential outliers were identified and addressed to minimize bias in the analysis.

3. RESULTS AND DISCUSSION

3.1 Demographic characteristics of study sample

A total of 176 students participated in this study, comprising 68% female (n=119) and 32% male (n=57). Participants' ages ranged from 21 to 27 years, with a mean age of 23.13 years (SD = 1.29). Of the respondents, 62% (n=109) resided on the campus, while 38% (n=67) lived off-campus. A statistically significant association was observed between residency status and recycling practices (p = 0.01).

In terms of academic programs, the largest group was from Environmental Health and Safety (34%, n=60), followed by Medical Laboratory Technology (14%, n=25), Nursing (12%, n=21), Physiotherapy (9%, n=15), Nutrition and Dietetics (9%, n=15), Occupational Therapy (8%, n=14), Medical Imaging (7%, n=13), and Optometry (7%, n=13). However, no statistically significant association was found between academic discipline and recycling practices (p = 0.12).

Geographically, 51% (n=89) of participants were from urban areas, while 49% (n=87) were from rural areas. No significant association was identified between area of origin and recycling behaviors (p = 0.24) (Table 1).

Table 1 Demographic Characteristics of Study Sample, (N=176)

Variable	N	(%)	*P* value
Gender			-
Male	57	(32)	
Female	119	(68)	
Age in Year, M(SD)	23.13	1.29	-
Campus Resident Status			0.01*
Resident	109	(62)	
Non-Resident	67	(38)	
Degree Course			0.12
Nursing	21	(12)	

Physiotherapy	15	(9)
Nutritional and Dietetic	15	(9)
Environment Health and Safety	60	(34)
Medical Imaging	13	(7)
Optometry	13	(7)
Medical Lab Technology	25	(14)
Occupational Therapy	14	(8)
Originality Area		0.24
Mostly Rural	87	(49)
Mostly Urban	89	(51)

*P <0.05

The demographic profile of the study participants provides valuable insights into recycling behaviors within the university setting. Of the respondents, 68% were female, reflecting the current gender distribution in higher education, where women represent a substantial majority (Frenette et al., 2007; Rodon et al., 2021). However, no direct association between gender and recycling practices was observed, suggesting that other factors may play a more critical role in shaping recycling behaviors. The average age of participants was 23.13 years, aligning with the typical age range of undergraduate students (Krug, 2023), though there is a growing demographic of older students, with 22% now exceeding 30 years of age.

Residency status was found to significantly influence recycling behaviors. On-campus residents exhibited better recycling practices, likely due to improved access to recycling facilities, campus-led initiatives, or heightened environmental awareness (Shipley, 2021). Despite this, no significant association was found between academic programs and recycling behaviors, even though Environmental Health and Safety students were most represented. Similarly, while participants came from both urban and rural areas in roughly equal numbers, no significant differences in recycling behaviors were noted based on geographic origin. This suggests that while urban residents may benefit from better facilities, other factors also significantly influence recycling practices (Cai et al., 2021).

3.2 Student recycling practices in the campus

Out of the participants, 76% (n=134) affirmed their engagement in recycling practices on campus, while 24% (n=42) did not. Among those who recycled, 29% (n=51) did so whenever possible, 18% (n=32) once a week, 17% (n=29) once a month, 7% (n=12) once a year, and 6% (n=10) daily. Plastic bottles were the most commonly recycled material (32%, n=57), followed by paper (20%, n=35), cans (11%, n=20), and glass (9%, n=16). For those who did not recycle, reasons included the lack of available recycling bins (8%, n=15), the time-consuming nature of recycling (6%, n=11), absence of signage for recycling bins (6%, n=11), and the observation that important others do not recycle on campus (4%, n=7). Regarding parental recycling habits, 56% (n=99) reported that their parents/guardians recycle, while 44% (n=77) indicated they do not. Suggestions to enhance on-campus recycling included more accessible recycling bins (30%, n=52), establishing a recycling norm on campus (23%, n=40), increased signage (18%, n=32), and providing more incentives for recycling (18%, n=32) (Table 2).

Table 2 Students Recycling Indicator in Campus, (N=176)

Recycling indicator	N	(%)
Do you recycle on campus		
Recycling in campus	134	(76)
Not recycling in campus	42	(24)
If "Yes", what degree you recycled on campus?		
Not recycle in campus	42	(24)
Everyday	10	(6)
Once a week	32	(18)
Once a month	29	(17)
Once every year	12	(7)
When possible	51	(29)
If "Yes", what types of materials do you recycle on campus?		
Cans	20	(11)
Cardboard	6	(3)
Glass	16	(9)
Paper	35	(20)
Plastic	57	(32)
If "No", why do you not recycle?		
It takes too much time to recycle on campus	11	(6)
Lack of recycling bin available	14	(8)
Lack of signage for recycling bins	10	(6)
Others important to them do not recycle on campus	7	(4)

Do your parents or guardians recycle at home?

Parents or guardians recycled at home	99	(56)
Parents or guardians not recycled at home	77	(44)
What would help increase on campus recycling		
Everyone recycles on campus	13	(7)
I am not going to recycle on campus	7	(4)
There was an established norm about on campus recycling	40	(23)
There were more incentives towards recycling	32	(18)
There were more recycling bins accessible	52	(30)
There were more signs influencing me to recycle	32	(18)

The study revealed that 76% of students engage in recycling on campus, indicating a generally positive attitude towards sustainability. This finding aligns with previous research showing high recycling participation among university students (Tiew et al., 2013). The majority of students recycle "when possible," with plastic bottles being the most frequently recycled material, underscoring the need for effective management of plastic waste (Jones, 2020). However, a significant barrier identified was the lack of recycling bins, highlighting the need for improved infrastructure. Moreover, a positive relationship was found between parental recycling behaviour and children recycling practices, indicating the influence of family habits (Lorina, 2023; Matthies et al., 2012). Enhancing the availability of recycling bins emerged as a key recommendation for improving recycling rates (Truelove et al., 2023)

3.3 Factor associated with intention to recycle behaviour

3.3.1 Attitude

Table 3 showing results pertaining to factor associated with intention to recycle behaviour. Regarding attitudes towards recycling, the majority of students "strongly disagreed" that "Recycling does not make a difference" (36% strongly disagree, mean = 3.86, SD = 1.13, p = 0.005). Additionally, most students "agreed" that their actions affect the environment (42% agree, mean = 2.11, SD = 0.99, p < 0.001) and "strongly agreed" that consuming environmentally friendly products has significant benefits for the environment (39% strongly agree, mean = 1.97, SD = 0.98, p < 0.001) respectively.

3.3.2 Subjective Norm

Students were neutral regarding feeling social pressure from peers to recycle on campus (35% neutral, mean = 3.21, SD = 1.11, p < 0.001) and whether important others want them to recycle (32% neutral, mean = 3.04, SD = 1.13, p < 0.001). However, most "disagreed" that they do not recycle because others on campus do not (43% disagree, mean = 3.73, SD = 1.10, p < 0.001).

3.3.3 Perceived Behavioral Control

Students generally "agreed" that recycling on campus is an easy task (42% agree, mean = 2.26, SD = 0.97, p < 0.001) and that there are ample bins for recycling (41% agree, mean = 2.53, SD = 1.08, p < 0.001). Additionally, the majority "disagreed" that recycling on campus takes too much time (46% disagree, mean = 3.59, SD = 0.99, p < 0.001).

Table 3 Individuals' Recycling Behavioural Intention (N=176)

Question	%	Mean	SD	P-Value
Attitude				
Recycling does not make a difference.	36%-strongly disagree	3.86	1.13	0.003*
I regularly think about how my actions affect the planet Earth.	42%-agree	2.11	0.99	<0.001*
Consuming environmentally friendly products have important and direct benefits to the environment.	39%-strongly agree	1.97	0.98	<0.001*
Subjective Norm				
I feel social pressure from peers on campus to recycle.	35%-neutral	3.21	1.11	<0.001*
People who are important to me want me to recycle on campus.	32%-neutral	3.04	1.13	<0.001*
I don't see others recycle so I don't recycle on campus.	43%-disagree	3.73	1.10	<0.001*
Perceived Behavioural Control				
For me to recycle on campus is an easy task.	42%-agree	2.26	0.97	<0.001*
There are ample bins for recycling on campus.	41%-agree	2.53	1.08	<0.001*
Recycling on campus takes up too much time.	46%-disagree	3.59	0.99	<0.001*

*P<0.05

Analysis of the factors affecting students' intention to recycle revealed several key determinants. Positive attitudes towards recycling were a strong predictor of recycling behaviour, with students recognizing its environmental benefits. Subjective norms, or the social pressures to recycle, played a role but were less influential, suggesting that while social expectations may impact recycling practices, individual attitudes and autonomy are more decisive. Perceived behavioural control, which reflects the ease or difficulty of recycling, was also a significant predictor. Most students found recycling on campus to be straightforward and accessible, with few perceiving it as time-consuming. These findings emphasize the importance of both perceived ease and accessibility in promoting recycling behaviours.

4. CONCLUSION

This study offers valuable insights into the determinants of recycling behaviours among university students. By examining the interplay of individual attitudes, social norms, and perceived behavioural control, universities can develop targeted interventions to enhance recycling practices. Strategies should focus on improving infrastructure, increasing awareness, and fostering a supportive social environment to encourage sustainable behaviours. Addressing these factors will contribute to broader sustainability initiatives and environmental conservation efforts.

ACKNOWLEDGEMENTS

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