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Assessing Students' Municipal Solid Waste Recycling Behavior in Putrajaya Malaysia

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ABSTRACT

It is necessary to instill concern about the environment, particularly the management of solid waste among youngsters as habits are easily inculcated at a young age. This study assesses municipal solid waste (MSW) recycling behavior among students in Putrajaya, Malaysia. The data were analyzed using descriptive and inferential analyses. There is a moderate positive correlation between the Theory of Planned Behavior (TPB) and Other Determinant Factor (ODF) with students' recycling behavior, r=.638. The findings indicate that attitude and subjective norms of the TPB influenced student recycling behavior. In addition, awareness, recycling practices, and situational factors of the ODF influenced students' recycling behavior. In conclusion, formal education and outsource programs could educate students concerning environmental issues.

Contribution/Originality: This study contributes to the existing literature on recycling practice after years of promotion among secondary school students. This study explores and in unison look at the newly introduced variables cooperated together with Theory of Planned Behaviour.

1. Introduction

The lack of management in resources and environmental problems are reflected in environmental conditions (Debrah, Vidal, & Dinis, 2021a; Ampofo, 2020). Among the common approach that global countries have been promoting to protect the environment is Municipal Solid Waste (MSW) recycling (Yeh, Chang, & Liu, 2016). Some countries introduce monetary rewards such as exchanging recyclable items with money

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while some use enforcement of laws such as Singapore that enforce fine law towards those littering. For example, Malaysian government has been promoting 3Rs (*Reduce, Reuse and Recycle*) program since the official launch in October 1991 (Agamuthu & Fauziah, 2006). Consequently, it can be observed that formal education has been utilized to promote solid waste behavior among students (Debrah, Vidal, & Dinis, 2021b).

As the federal administrative center of Malaysia, Putrajaya pioneers promotes sustainable solid waste management (SWM) 3R. The municipality of Putrajaya, Putrajaya Cooperation (PPJ), in collaboration with Alam Flora, the concessionary company, has been managing the 3R program since 2001. Other parties involved in the recycling program include federal authorities, collectors and manufacturers, non-governmental organizations (NGOs), households, and educational institutions. Focusing on MSW recycling awareness, PPJ and Alam Flora organize outreach programs with students as the main aim. The Recycle Team visit schools to educate, increase student awareness, and improve behavior concerning MSW recycling. Therefore, this study focuses on the MSW recycling behavior of students in Putrajaya using the TPB and the ODF. Hence, this study would be able to reflect on the strategy of integrating concern towards environment into formal education and outsource programs towards the actual behavior of students in recycling.

2. Literature Review

One of the theories in considering one's behavior is the Theory of Planned Behavior (TPB). The TPB, modified by Ajzen (1991), suggests that behavior is the consequence of student's intention, which could be influenced by three factors: (1) attitude, (2) subjective norms, and (3) perceived behavioral control. Attitude can be described as students' favorable and unfavorable evaluation of performing the solid waste recycling behavior (Kanada, Norman, Kaida, & Carver, 2022). A students' attitude affects the behaviors through the pattern of people, or a social group attached (Shaw, 2008). In other words, attitude is an element that describe students' desire to recycle (Nighbur, Lyons, & Uzzell, 2010). Tucker (1999) stated that subjective norms are beliefs that students either accept or reject while carrying out behavior. Subjective norm is students' perception of social pressure to recycle household waste (Tonglet, Phillips, & Read, 2004). It has been postulated that subjective norms or social norms have the strongest positive effect on recycling participation (Vicente & Reis, 2008). Meanwhile, perceived behavioral control explains students' perception of their ability to perform the behavior. Although they have a good attitude towards recycling, they will only try to perform such behavior if they are confident in their ability to perform it with success (Tonglet et al., 2004).

In determining recycling behavior, other determinant factors (ODF) such as (1) awareness, (2) knowledge of issues, (3) situational factors, (4) motivation, (5) preferences scheme, and (6) recycling practice are included (Debrah et al., 2021a). This additional factor influences students' recycling behavior and contributes to the explanation regarding recycling behavior by the TPB model (Ajzen, 1991). It was believed that there is a relationship between awareness and recycling behavior (Islam, Dias, & Huda, 2021). Apart from that, students' knowledge reflects the outcome or consequence in performing said behavior. Students in Malaysia reported a lack in knowledge and understanding in regard to recycling, which resulted in low recycling participation (Nurzairin, 2012). Situational factor refers to student's perception of the ease or difficulty in performing such behavior (Ajzen, 1991). Kanada et al. (2022)

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indicate that situational variables are a significant predictor of recycling behavior and factors such as cost, time, and facilities condition restrict environmental behavior. Motivation also contributes to students' recycling behavior (Kowasch, Oettel, Bauer, & Lapin, 2022). It was found that external incentives such as monetary rewards able to initiate and promote recycling, but it is not sustainable as it is expensive (Haak et al., 2022). Meanwhile, the preferences scheme refers to well-designed collection system of recyclable items and influenced recycling behavior (Kanada et al., 2022).

Recycling practices refer to students' actual implementation of the act. Accordingly, it can be assumed that the efforts are not just exerted by the schools involved but also the municipal authority in terms of educating the students towards municipal solid waste recycling. Therefore, it is essential to evaluate the effort played by the education sector through integrating the elements concerning on environment and the municipality towards recycling behavior in students.

3. Methods

3.1. Population and Samples

The random sampling approach of the probability sampling strategy was applied in this study (Noraini, 2013). The chosen population was students from Putrajaya at the age of 15 years old and went through almost three years of lower secondary school with population of N = 1,467. The sample size was determined using Krejcie and Morgan (1970) table with S = 302.

3.2. Research Instrument

The instrument used in this study was a set of questionnaires comprises of two sections: (1) Part A: Demographics, served as demographic profiling (2) Part B: Behavioral, comprises thirty items of TPB and ODF with 4-point Likert scale of which the items were adapted from Tonglet et al. (2004) and Bezzina and Dimech (2011). Scores were 1=Strongly disagree, 2=Disagree, 3=Agree, 4=Strongly agree.

3.3. Validity and Reliability of the Instrument

Experts reviewed on the questionnaire was conducted for the content and language validation. Content validity was conducted via the content validity index analysis both for s-CVi and i-CVi. Five items have been removed has it achieved <0.80 for i-CVI and completely removed from the questionnaire. As a result, both i-CVi and s-CVi of the questionnaire with value 1.00 were then suitable to proceed for further analysis. Amendments of sentences were made based on experts' suggestion before proceeding with pilot study to check for reliability. A pilot study was conducted with thirty-five samples from randomly selected school. The pilot school was excluded from the actual study. Cronbach's alpha (r = .802) indicated that the questionnaire function as intended and suitable to be used in the current study. Table 1 illustrates the details of questionnaire.

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Table 1: Questionnaire

Construct	Items
Demographic data (5 items)	Gender
	Race
	Methods used for recycling
	Time duration student has been exposed to Recycle Team
	Involvement in recycling
TPB: Attitude (3 items)	I feel a responsibility to sort solid waste.
	I do not have any problems with recycling solid waste because recycling has become routine.
	Recycling does not contribute to any benefits or advantages.
TPB: Subjective norm (3 items)	My friends are always mocking when I recycle.
	My parents provide appropriate containers to use to separate our waste at home.
	The general public is not doing its part to address the issue of recycling.
TPB: Perceived behavioral control (2 items)	I only practice recycling as recycling has been taught in school.
	It would be wrong of me not to recycle my used material waste.
ODF: Awareness (5 items)	Recycling helps to maintain the cleanliness of my school.
	Recycling helps to maintain the cleanliness of my home.
	Recycling cannot reduce the amount of solid waste in landfills.
	Briefing by the Recycle Team (PPJ-Alam Flora) did not improve my awareness of recycling.
	Because of teaching and learning activities at school, I recycle more.
ODF: Knowledge of issue (4 items)	I have grown accustomed to having recycling facilities available at my school such as recycle bins, and a place to store recyclable items.
	I have come to know which materials can be recycled.
	I do not know how to separate recyclable items.
	I have grown accustomed to the recycling centre at my residence, where I can send my recyclable items.
ODF: Motivation (2 items)	I am more likely to recycle if recycling plans come with rewards and incentives.
	I recycle although I have to separate my solid waste for the sake of the environment.
ODF: Scheme Preferences (2 items)	I am happier if my school provides collection schedules for recyclable items.
	I am happier if recycling containers are available on every floor at my school because collection areas are far away from my classroom.
ODF: Recycling practice (6 items)	I wash all recyclable items before recycling.
	I separate recyclable items based on the official guidelines.
	I send recyclable items for collection according to the schedules.
	I send recyclable items to the collection area at my school as instructed.
	I also send my recyclable items to the recycling center, the local recycle bin, or I donate them.
	I also send my recyclable items to the recycling center or the local recycling bin in my neighborhood.
ODF: Situational factors (3 items)	Waste separation is too complicated.
	I do not have enough time to sort materials for recycling.
	The recyclables that I store attract pests.

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3.4. Data Collection and Analysis

Data were collected from nine schools and analyzed using statistical descriptive using SPSS Version 20.0.0.0.155 © IBM Corp. 2011. Students' behavior level towards recycling were categorized into three corresponding behavior scales (Erin, Hui, & Lori, 2012; Ugulu, 2015). Samples scoring (1) 1-40 points showed poor MSW recycling behavior, (2) 41-80 points showed good MSW recycling behavior, and (3) 81-120 points showed excellent MSW recycling behavior. The relation between students' MSW recycling behavior and the TPB and ODF was determined based on the correlation coefficient, *r*. The strength of the correlation was determined according to Chua (2006). Standard multiple regressions were employed to determine which independent variables showed high credibility in influencing dependent variables.

4. Results

4.1. Demographic Analysis

As many as 302 of 315 students in Putrajaya participated in this study, with 95.9% survey return percentage. Male and female students involved were 153 and 149 respectively. 98.3% of the respondents were Malays, and 1.7% were Indians. Respondents were also asked about the type of sources that influence them in practicing MSW recycling. Table 2 indicate that the strongest influence on MSW recycling was mass media, with the percentage of 32.8%.

Table 2: Demographic Analysis

Items	Criteria	Frequency	Percentage (%)
1. Gender	Male	153	50.7
	Female	149	49.3
2. Race	Malay	297	98.3
	Chinese	0	.0
	Indian	5	1.7
	Other	0	0.0
3. Education on recycling received from	Mass media	202	32.8
	Teaching and learning activities	162	26.3
	Briefing from Recycle Team	68	11.0
	Peers	80	13.0
	Parents	104	16.9
4. Involvement with the Recycle Team's recycling program	Less than a year	182	60.3
	1-2 years	63	20.9
	3-4 years	39	12.9
	More than 5 years	18	6.0
5.Practicing recycling	Yes	254	84.1
	No	48	15.9

The next influence on performing MSW recycling were teaching and learning activities in school with the rate 26.3%. Parents and peer influence accounted for 16.9% and 13% respectively. However, despite all the effort by the Recycling Team by Alam Flora, only 11% reported that this effort had a strong influence on MSW recycling. Although this program had been in place for more than a decade, students ranked the program as the

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least effective influence on recycling. The result showed that most of the respondents (60.3%) reported being exposed to the Recycle Team within the previous year, 20.9% of the respondents reported on being exposed within 1-2 years, and 12.9% reported on being exposed for 3-4 years. Only 6% reported being exposed for longer than five years. This study also observed that 84.1% of the respondents claimed to be recycling MSW in their lives. Only 15.9% reported on not performing MSW recycling.

Subsequently, this study also showed in Table 3 that 77.5% of the respondents exhibited excellent and 22.5% exhibited good MSW recycling behavior level.

Table 3: Student Behavior Level towards Recycling

Behavior level	Frequency	Percent (%)
Poor	0	.0
Good	68	22.5
Excellent	234	77.5
Total	302	100.0

Table 4 show the results of descriptive analysis obtained from this study. Awareness, the first construct of the ODF, has a mean of 3.16. The mean of the second construct of the ODF, Knowledge of Issue, was 3.07. The third construct of the ODF is Motivation (mean = 2.55). The fourth construct of the ODF is Scheme Preferences (mean = 3.18), which attempt to evoke the preferred plans by respondents to recycle effectively. The fifth construct of the ODF, Recycling Practice, examined how respondents were currently practicing recycling (mean = 2.41). The final construct of the ODF is Situational Factors (mean = 2.52).

Table 4: Descriptive Analysis Obtained

Construct	Mean	Std. Dev.
Attitude	3.28	1.30
Subjective norm	2.68	1.73
Perceived behavioral control	2.81	1.35
Awareness	3.16	2.44
Knowledge of issue	3.07	3.15
Motivation	2.55	1.17
Scheme Preferences	3.18	1.35
Recycling practice	2.41	3.08
Situational factors	2.52	2.20

4.2. Correlation between the TPB, ODF and Students' Behavior towards MSW Recycling

Table 5 summarizes the relation among the variables in the TPB and ODF with students' MSW recycling behavior. The correlation coefficient showed that all nine predictors correlate with the recycling behavior of r = .638 (n = 302, p = .000). Although there was a weak positive correlation between students' attitudes towards MSW recycling behavior of r = .387 (n = 302, p = .000), people possessing good attitude will likely practice good behavior in recycling programs. The subjective norm shows a weak positive correlation with behavior among the variables in the TPB by r = .379 (n = 302, p = .000), indicating that people in their surroundings exerted pressure on the students' behavior to recycle. Perceived behavior control shows the weakest relation among the

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variables in the TPB, although weak-positive correlation with recycling behavior by r = .285 (n = 302, p = .000).

The awareness construct showed the strongest, although moderate, correlation with MSW recycling behavior at r = .479, p = .000. Knowledge of the issue also showed moderate positive correlation with students' behavior in MSW recycling with r = .429 at p = .000. Recycling practices show weak positive correlation with MSW recycling behavior at r = .383, p= .000. Situational factors show r = .317 at p = .000, reflecting a weak-positive correlation. Thus, the waste separation process, time for sorting materials and pest attraction weakly correlated to the recycling behavior. There is a weak positive correlation between Scheme Preferences and MSW recycling behavior at r = .244 and p = .000. Motivation shows the weakest positive correlation among the six independent variables in the realm of the ODF with r = .209, p = .000.

Table 5: Correlation between Variables in the TPB and ODF with Students' MSW Recycling Behavior

Independent variables	*r* value obtained	Correlation condition	*p*-value
TPB			
Attitude	.387	Weak relationship	.000*
Subjective norm	.379	Weak relationship	.000*
Perceived behavior control	.285	Weak relationship	.000*
ODF			
Awareness	.479	Weak relationship	.000*
Knowledge of issue	.429	Weak relationship	.000*
Motivation	.209	Weak relationship	.000*
Scheme preferences	.244	Weak relationship	.000*
Recycling practice	.383	Weak relationship	.000*
Situational factors	.317	Weak relationship	.000*

* Significance at $p < .05$, $r = .638$, $r^2 = .407$

4.3. Variables of the TPB and ODF that influence students' MSW Recycling Behavior

Table 6 represents the students' recycling behavior under TPB and ODF variables. The results showed that 40.7% of the total variation in recycling behavior is explained by the TPB and ODF while 59.3% by other factors (r^2 = .407). The probability of the F statistic (22.78) for the overall regression relation is $p < .05$.

Based on the results, attitude, and subjective norms of the independent TPB variables show a significant relation with student behavior when $p < .05$ and support that there is a statistically significant explanation in MSW recycling behavior. Attitude influenced the students' MSW recycling behavior in several manners; (1) responsibility to segregate solid waste, (2) recycling becoming routine rather than an issue, and (3) their opinions towards recycling. Attitude has a greater influence than other factors of TPB (β = .107, t = 2.196). The subjective norm was the second most important predictor of recycling behavior at β = .090 and t = .146. Students consider social pressure from peers, family, and the public, as factors that could influence their behavior. The third predictor of the TPB, perceived behavioral control, is insignificant ($p > .05$) and does not influence students' recycling behavior.

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This finding showed only awareness, recycling practices, and situational factors of the ODF variables to be statistically significant predictors of student behavior when $p < .05$ with the standardized β weights of .219, .163, and .075. The findings of this study indicate that awareness has a greater influence than other factors ($\beta = .219$, $t = 4.843$). These variables elicit students' consciousness of schools' and home's cleanliness, the amount of solid waste in landfills, the effect of the Recycle Team program, and instructional activities at school. It can be deduced that those items significantly influence students' recycling behavior. Multiple regression revealed significant relations between situational factors and students' MSW recycling behavior ($\beta = .075$, $t = 3.162$).
This study also demonstrates that some factors are insignificant and have no influence on recycling behavior. Such factors include knowledge of the issue, motivation, and scheme preferences at $p < .05$. In this study, motivation insignificantly influenced students' MSW recycling behavior at $p < .05$ that monetary incentives encourage recycling. The scheme preferences variable showed that the scheduled collection system and bins near their classrooms were insignificant influence on their recycling behavior in this study.

Table 6: The Influence of the TPB and ODF on Students' Recycling Behavior

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig***
	Beta	**Standard error**	**Beta**		
Attitude	.107	.049	.116	2.196	.029*
Subjective Norms	.090	.032	.146	2.859	.005*
Perceived Behavior Control	-.006	.031	-.010	-.193	.847
Awareness	.219	.045	.263	4.843	.000*
Knowledge of issue	.077	.040	.107	1.932	.054
Motivation	-.024	.027	-.044	-.878	.381
Scheme preferences	.037	.030	.059	1.234	.218
Recycling practices	.163	.040	.217	4.104	.000*
Situational factors	.075	.024	.156	3.162	.002*

* significance at p-value < .05, $r = .638$, $r^2 = .407$, Adjusted $r^2 = .389$, $F = 22.78$

5. Discussion

Mass media has always been a popular choice as one of the means for information dissemination (Mateus et al., 2022) which reflected in the study as the respondents stated mass media as the strongest influence in practicing MSW recycling. Similarly, 99% of the samples in the previous study conducted by Aini, Nurizan, and Fakhru'l-Razi (2007) chose mass media as their source for information. It is coherent with frequent television programs such as '*Berita Nasional RTM*' and '*Astro Awani*' which have repeatedly reported news about recycling and its impact on the environment during their primetime news broadcasts. Adding to that, teaching and learning practice has great influence in persuading the students to recycle more (Kanada et al., 2022). Excellent and good MSW recycling behavior level exhibited by the students are consistent with the findings by Ugulu (2015) which having good attitudes will lead people to be more responsible. This coincides with the study done by Debrah et al. (2021b) which support these assumptions, suggesting that "*people with good attitudes are more responsible concerning environmental pollution control*". Debrah et al. (2021b), and Abbasi, Araban, Heidar, Alidosti and Zamani-Alavijeh (2020) suggested that recycling activities conducted in school may enhance student awareness. This study

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confirmed that assumption through the findings that the majority of students agree with the statement "*Through teaching and learning activities at school, I recycle more*".

Consistent with Kanada et al. (2022), student's practicing recycling and education necessary for enhancing recycling activities. Additionally, the recycling education that be conducted by the municipal is not comprehensive for all students, and students involved with recycling clubs are more knowledgeable. Recycle Team initiatives by the PPJ seems insufficient to foster all students to recycle. Nevertheless, it is arguable that one year is sufficient to educate students and expect the students to perform well in recycling.

The findings also stated that subjective norm and perceived behavior having weak positive correlation with the students' intention to recycle. These relations show that students have positive control of themselves and greater intentions to recycle solid waste (Reyes & Madrigal, 2020). Bashir, Jun, Yi, Abushammala, Amr and Pratt (2020) stated that students who had been provided with more opportunity were more likely to recycle. A weak correlation between recycling practice and behavior suggests that students who practice MSW recycling are more positive towards the program. On that account, this relation indicates that students act positively regarding the handling of recyclable item, recycling the item regularly based on schedule and instructions, and sending the item to nearby recycling facilities.

The findings also reflect that parents and society involvement are among the key success of MSW recycling. However, students felt that the societies did not play their role to address the issue. Hence, it is crucial to educate the societies on the behavior of recycling, managing recyclable items, and the benefits that may be obtained, as students look up to adults as role models, in particular their parents, family, teachers, and surrounding people Thus, it is suggested that future studies should focus on the inculcation of formal and informal environmental education from infants to elderly. Their participation in MSW recycling can be strengthen via resident-centered environmental action learning. As behavior took time to retain, it is suggested that recycling education should begin in kindergarten and continue perpetually with time. Such initiatives might enhance the societies' attitudes, leading to changes in their behavior in MSW recycling.

Students' awareness of the issue makes them more alert of cleanliness and thus, leads to their recycling behavior. Nonetheless, being aware also coincides with having knowledge regarding the subject matter albeit the correlation was slightly lower than the former. This finding was similar to the studies conducted by Tiong, Lean, Ming, Abdullah, Mahalingam, Arshad, and Hock (2021), in which it was stated that knowledgeable students regarding the issue displayed more responsible behavior towards the environment. That study also proposed that the attribute observed in this current study may arise from the struggle to develop appropriate measurements for MSW recycling behavior. Kanada et al. (2022) proposed that knowledge of the issue was one of the variables that significantly influence recycling behavior. Nevertheless, this study indicates that students possess more knowledge, and many students report knowing the location of recycling bins and centers, are familiar with recyclable items and separation guidelines, and know where the recycling facilities are in their neighborhoods.

Besides, outbound motives such as situational factors should also be strengthened to encourage recycling involvement. This study observed that nearly half of the

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respondents were willing to recycle if recycling container was made available on every floor. This suggest that increasing the proximity of recycling location increases the number of students who recycled. A study by Pike, Tim, Kay, McGee, Martin, and Lamoreaux (2003) demonstrated 30% reduction in waste through determining the location of the bin. On the other hand, Damiano (2013) observed that introducing a recycling bin increased the probability that people would recycle by 40%. This shows the importance of having the right condition of situational factors could influence the behavior of the corresponding subject. However, the scheme preferences variable showed that the scheduled collection system and bins near their classrooms were insignificant influence on their recycling behavior in this study.

On another note, it is highly made known throughout the study that motivation insignificantly influenced students' MSW recycling behavior as majority of the students agreed that monetary incentives appear to maintain recycling behavior (Hornik, Cherian, Madansky, & Narayana, 1995). This is similar to the findings from Aini, Fakhru'l-Razi, Lad and Hashim (2002) which stated that personal commitment and satisfaction with being frugal were the two motivational variables that influenced recycling behavior. In contrast, Iyer and Kashyap (2007) indicated that incentives are less effective and unable to sustain recycling behavior in long-term trials. This is consistent with the study conducted by Gonzalo and Asuncion (2006) and item 19 in the findings. The findings support previous studies that indicate variables in the TPB laterally influence recycling behavior when people question their intentions (Tonglet et al., 2004; Sidique, Lupi & Joshi, 2010; Ahmad, Bazmi, Bhutto, Shahzadi, & Bukhari, 2014). This study is also consistent with the study conducted by Shaw (2008) that stated attitude influence recycling behavior through the people with whom one is surrounded.

5.1. Implications

The implications of this study suggest that to inoculate recycling practice within students, the existence of external support helps supporting the action as the education of the practice does not rely on formal education alone. Hence, it is concern now on how to integrate other parties into education activities at school as it is a must that the education must not be there just to instill the awareness but to encourage the students to walk the practice.

6. Conclusion

This study revealed that students in Putrajaya exhibit positive MSW recycling behavior after years of implementation of recycling education program. All samples demonstrated concern for protecting their environment through MSW recycling through the integrating of formal education approach and outsourced environmental programs. A proper implementation should be organized and planned well to educate the students that would fortify their attitude, awareness, and practical behavior on MSW recycling based on data obtained. suggest that both the TPB and ODF are significantly related to students' MSW recycling behavior. Attitude, subjective norms, awareness, recycling practices, and situational factors appear to be the significant predictors of students' MSW recycling behavior.

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Ethics Approval and Consent to Participate

Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interests

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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