

# A Study on the Role of the KITARecycle App in Enhancing Waste Separation and 3R Practice in Higher Educational Institutions in Malaysia

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## Abstract

The municipal solid waste generation rate in Malaysia has risen over the years. This situation must be controlled to prevent impacts on human health and the environment. One of the many ways to address this issue is by practising waste separation and 3R as a daily routine. This research investigates the role of the KITARecycle app in promoting waste management practices among tertiary education staff and students in Malaysia. A questionnaire survey is distributed to the respondents via the KITARecycle app. The questionnaire consisted of 4 parts, which include i) demographic profile, ii) knowledge, attitude and behaviour towards waste segregation and 3R, and iii) the feedback on the KITARecycle app. The results obtained from the questionnaire were analysed using the Statistical Package for the Social Sciences (SPSS), employing descriptive statistics, cross-tabulation analysis and correlation tests. When correlating gender and overall satisfaction on the app, no significant relationship is found between the two variables. However, a cross-tabulation analysis has shown that female has higher overall satisfaction than male. The findings show that the KITARecycle app has improved the knowledge of users in separation at source and 3R. This could be related to the app providing a list of the materials accepted for recycling, which has indirectly instilled knowledge on the recyclability of the materials. Furthermore, the app has also positively influenced the attitude and behaviour of users. This could be the outcome of providing monetary incentives to the users when they separate their waste, which can be a strong influence in shaping positive attitudes and behaviours of users. Overall, it can be concluded that KITARecycle app can help in controlling the impact of solid waste on the environment by providing information on proper waste disposal, recycling, and composting, along with interactive features such as quizzes and videos to engage users. Additionally, push notifications remind users to practise waste reduction regularly, promoting consistent and responsible waste management behaviour.

## 1. Introduction

The growing generation of municipal solid waste in Malaysia poses environmental and health challenges. Despite efforts like the waste separation and 3R campaign, enforcement of mandatory waste separation, and establishment of buy-back centers and recycling vending machines, the recycling rates in Malaysia remain unsatisfactory [1]. Apart from this, landfills in Malaysia are nearing their capacity limits. Currently, Malaysia operates 137 landfills, including 21 sanitary landfills, distributed nationwide. Previously, 174 landfills have already been closed because it has maximized their utilisation [2]. In 2018, SWM Environment Sdn. Bhd. (SWM Environment) developed an app as one of the measures to address issues related to improper waste management. The KITAREcycle app is an application that incentivises waste segregation by awarding points that can be redeemed for cash. Therefore, this study aims to investigate the extent to which the KITAREcycle app plays a role in improving knowledge, attitudes, and behaviours regarding separation at source and 3R (Reduce, Reuse, and Recycle) practices among users in higher education institutions.

Over the years, many studies have been carried out to determine the factors influencing the separation at source and 3R practice of individuals. Among the factors that influence and hinder an individual from practicing 3R habits are: i) knowledge and the individual's awareness level, and ii) attitude and behavioural changes.

### 1.1 Knowledge

Research highlights the critical role of environmental knowledge in shaping waste management behaviours. Households with higher education levels are more likely to participate in waste separation at the source, emphasising education's influence on waste management practices [3]. On the other hand, it was found that individuals with poor knowledge of solid waste management were almost five times more likely to practice improper waste disposal [4]. Furthermore, studies also noted that knowledge of proper waste disposal and the consequences of improper practices fosters positive attitudes toward waste segregation [5].

However, challenges remain. Research reported that a lack of awareness about waste segregation benefits serves as a major barrier to adopting the practice [6]. Some also found that despite understanding the importance of segregation, many individuals still lack practical knowledge of identifying recyclable and non-recyclable materials [3]. Enhanced education and awareness campaigns are crucial to bridging these gaps.

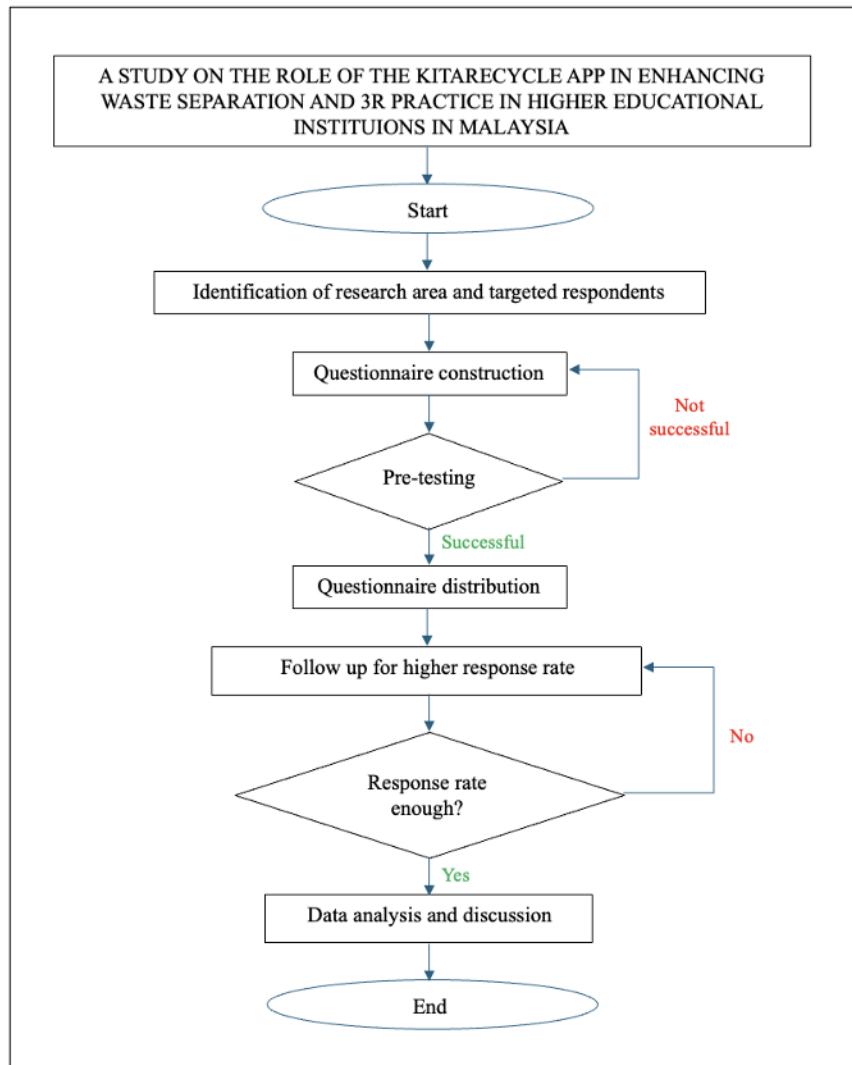
### 1.2 Attitude and Behavioural Changes

Attitude plays a significant mediating role between knowledge and practice. Past research demonstrated that a positive attitude toward waste management enhances the likelihood of translating knowledge into practice [7]. Social norms and personal values, such as a sense of environmental responsibility, further influence behaviour [3]. In addition to that, group norms and peer influence are critical, and individuals are more likely to participate in waste segregation if it is socially encouraged within their community or workplace [8].

External motivators, such as monetary incentives, also drive behavioural changes. Studies found that financial rewards increase participation in waste segregation [9][10]. However, the impact of economic incentives varies; some research has observed that recyclers are less sensitive to financial benefits than non-recyclers, suggesting that intrinsic motivations, such as environmental values, may have a stronger influence in some cases [11].

## 2. Methodology

This study is designed for the users of the KITAREcycle app from higher education institutions in Melaka, Negeri Sembilan and Johor. A questionnaire is prepared for the targeted respondents. The questionnaire comprises four parts. The first part focuses on gathering the demographic information of the respondents. The second part is designed to test the knowledge and awareness level of respondents on separation at source and 3R practices. Conversely, the third part examines the attitude and behaviour change of respondents on separation at source and 3R practices. The user's feedback on the KITAREcycle app was collected in the fourth part. The survey was conducted online, with respondents provided access via a Google Form link in a pop-up window once the users opened the app. An overview of the methodology applied in this study is presented in Fig. 1.



**Fig. 1:** Flowchart of the research methodology

### 3. Results and Discussion

The data were analysed using descriptive statistical methods, including frequency distribution, cross-tabulation, and a correlation test, which was employed to evaluate the relationship between two variables.

#### 3.1 Background of Respondents

This study gathered responses from a total of 54 participants. According to Memon et al. (2022), there is no universal guideline for determining an ideal sample size [12]. However, there is a suggestion that a minimum of 40 respondents is adequate to reasonably represent population behaviour [13]. Consequently, the sample size for this study is deemed sufficient for analysis.

Respondents were asked to provide their demographic details, including their role in higher education institutions, name of higher education institutions, location, age, gender, ethnicity, educational background, and overall satisfaction with the KITAREcycle app. The findings are presented in Table 1.

**Table 1:** Demographic profile of respondents (n=54)

Item		Frequency (n)	Percentage (%)
Description of respondents	Student	34	63.0
	Academic staff	2	3.7
	Non-academic staff	18	33.3
Name of higher	Universiti Tun Hussein Onn Malaysia	40	74.1

education institution	(UTHM)		
	Universiti Teknologi MARA (UiTM)	6	11.1
	Universiti Teknologi Malaysia (UTM)	4	7.4
	Politeknik Tun Syed Nasir Syed Ismail	1	1.9
	Kolej Universiti Agrosains Malaysia (RISDA)	1	1.9
	Politeknik Tun Syed Nasir Syed Ismail (USIM)	2	3.7
	Universiti Teknikal Malaysia Melaka (UTeM)	1	1.9
Location of working/ studying	Batu Pahat, Johor	29	53.7
	Segamat, Johor	2	3.7
	Skudai, Johor	4	7.4
	Melaka	3	5.6
	Muar, Johor	7	13.0
	Nilai, Negeri Sembilan	2	3.7
	Parit Raja, Johor	7	13.0
Age	Less than 25 years old	23	42.6
	25- 35 years old	21	38.9
	36- 44 years old	7	13.0
	45- 55 years old	3	5.6
Gender	Male	20	37.0
	Female	34	63.0
Ethnicity	Malay	51	94.4
	Chinese	2	3.7
	Others: Indonesian	1	1.9
Educational background	Diploma	7	13.0
	Bachelor's Degree	34	63.0
	Master's Degree	7	13.0
	Doctorate Degree	3	5.6
	Others	3	5.6
Overall satisfaction on the KITAREcycle app	Not satisfied	16	29.6
	Satisfied	38	70.4

Based on Table 1, most respondents (n=34) are students, followed by non-academic staff (n=18) and academic staff (n=2) from higher education institutions. A significant proportion of the respondents (40) are affiliated with Universiti Tun Hussein Onn Malaysia (UTHM), followed by Universiti Teknologi MARA (UiTM) with 6 respondents, Universiti Teknologi Malaysia (UTM) with 4 respondents, and Politeknik Tun Syed Nasir Syed Ismail (PTSNI) with 2 respondents. Additionally, Politeknik Tun Syed Nasir Syed Ismail, Kolej Universiti Agrosains Malaysia (RISDA), and Universiti Teknikal Malaysia Melaka (UTeM) are represented by 1 respondent each.

Geographically, the majority of respondents are located in Batu Pahat, Johor (29 respondents), followed by Muar, Johor and Parit Raja, Johor 7 respondents each, Skudai, Johor (4 respondents), and Melaka account for 3 respondents, while Segamat, Johor and Nilai, Negeri Sembilan have 2 respondents each.

When analysed by gender, females constitute the majority, with 34 respondents (63.0%), while males account for 20 respondents (37.0%). A correlation test was conducted to assess the relationship between gender and overall satisfaction with the KITARecycle app, as presented in Table 2.

**Table 2:** Correlation test between gender and the overall satisfaction of the KITARecycle app

<b>Correlation test between gender and overall satisfaction of the KITARecycle app</b>		Gender	Overall satisfaction
Gender	Pearson Correlation	1	0.258
	Sig. (2-tailed)		0.059
	N	54	54
Overall satisfaction	Pearson Correlation	0.258	1
	Sig. (2-tailed)	0.059	
	N	54	54

The findings indicate no significant correlation ( $\rho = 0.258$ ) between gender and overall satisfaction. This contrasts with the findings of Palyama and Tomasila (2022), which identified a significant relationship between these variables [14].

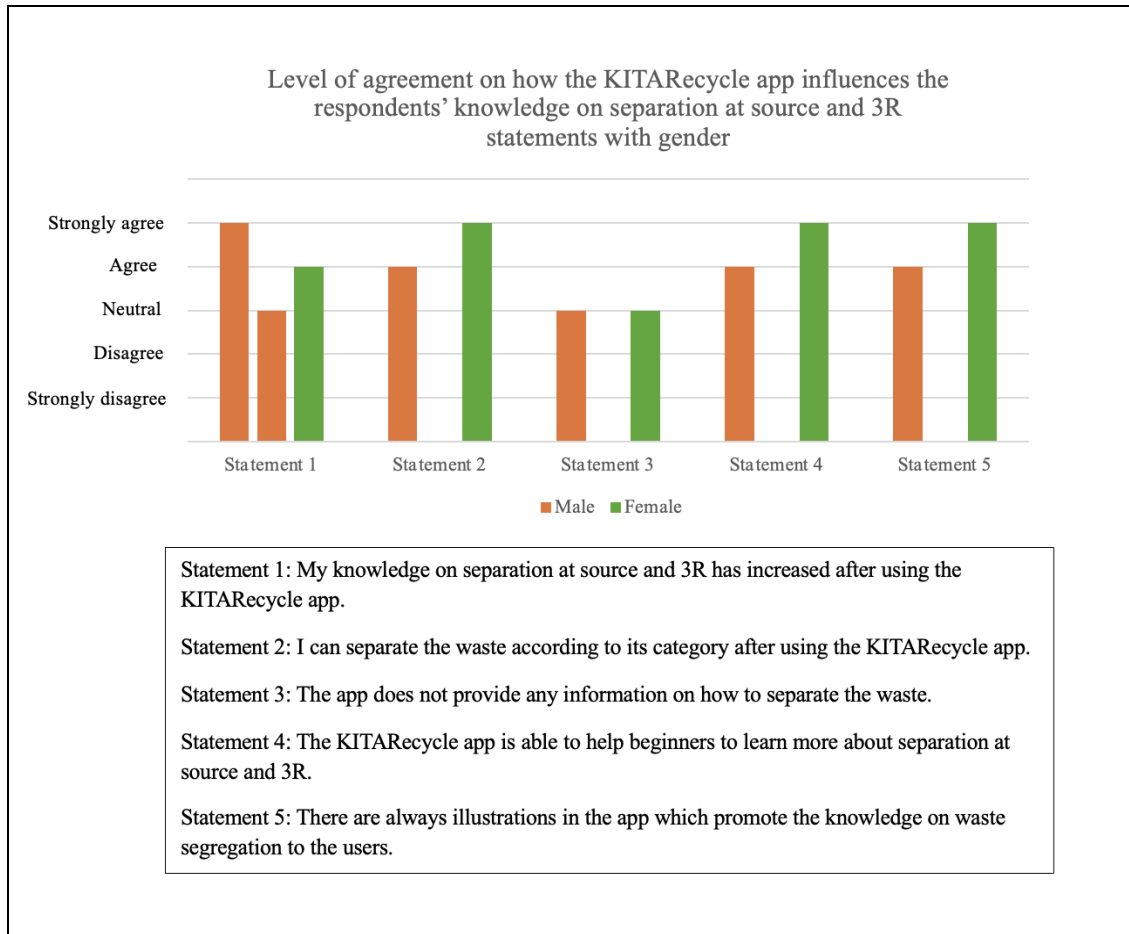
**Table 3:** Crosstabulation between gender and the overall satisfaction of the KITARecycle app

<b>Crosstabulation between gender and overall satisfaction of the KITARecycle app</b>				
Gender	Not satisfied		Satisfied	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Male	9	45.0	11	55.0
Female	7	20.6	27	79.4

A cross-tabulation reveals that female respondents exhibit higher satisfaction levels with the app than their male counterparts in Table 3. Females generally utilize mobile apps more frequently and report greater satisfaction than males [15]. Thus, despite the lack of a direct correlation in this study, the cross-tabulation indicates that female respondents are more satisfied with the app than male respondents.

### 3.2 Level of Agreement on How the KITARecycle App Influences the Respondent's Separation at Source and 3R Knowledge According to Gender

In this section, the respondents were asked about their level of agreement on the statements designed to find out how the KITARecycle app influenced their knowledge of separation at source and 3R. There are 5 statements listed in this section. The analysis revealed that the KITARecycle app significantly enhanced respondents' knowledge of separation at source and 3R practices across all genders. Both male and female respondents showed a high level of agreement regarding the app's ability to improve their understanding, with no notable differences observed between genders. The overall results of the respondents' level of agreement with how the KITARecycle app improves the knowledge of waste separation and 3R according to gender are shown in Fig. 2 below.

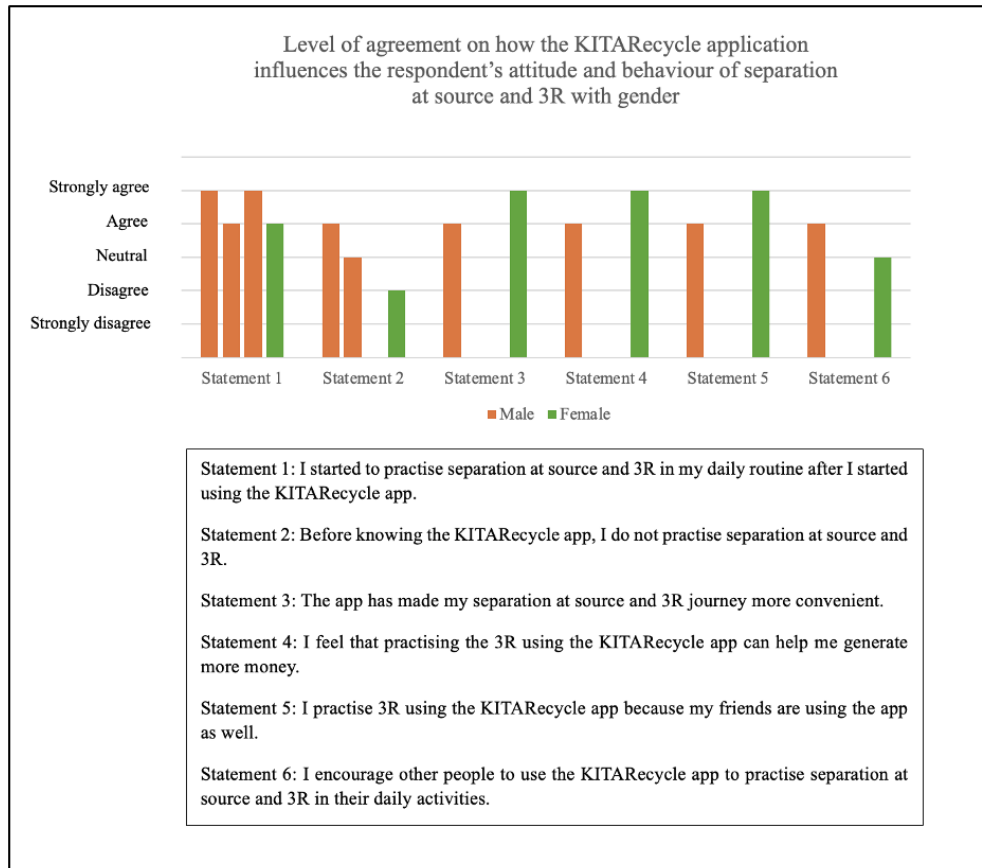


**Fig. 2:** Overall results of the respondent's level of agreement of how the KITAREcycle app improves the knowledge of waste separation and 3R according to gender

In summary, the implementation of the KITAREcycle application has significantly contributed to enhancing knowledge about separation at source and 3R practices within higher education institutions. In the modern era, technology serves as a critical enabler across various domains, including education. Its integration into educational frameworks facilitates efficient access to information and resources, thereby improving the overall learning experience. Furthermore, technology fosters interactive and collaborative learning environments while supporting personalized educational pathways. As highlighted by Akrami et al. (2024), mobile applications play a pivotal role in advancing knowledge acquisition and transforming pedagogical approaches within digital learning contexts. In promoting positive behaviors and encouraging sustainable waste management practices among its users [16].

### 3.3 Level of Agreement on How the KITAREcycle App Influences the Respondent's Attitude and Behaviour of Separation at Source and 3R According to Gender

In this section, the respondents were asked about their level of agreement with the statements designed to find out how the KITAREcycle app influenced their attitude and behaviour on separation at source and 3R. There are 6 statements listed in this section. The findings indicated that the KITAREcycle app positively influenced the attitudes and behaviors of both male and female respondents towards waste separation and 3R practices. Respondents of all genders acknowledged the app's role in fostering behavioral changes, with consistent agreement levels across gender groups. The overall results of the respondent's level of agreement with how the KITAREcycle app influences their attitude and behavior toward waste separation and 3R according to gender are shown in Fig. 3 below.



**Fig. 3:** Overall results of the respondents' level of agreement on how the KITARecycle app influences their attitude and behaviour in practising waste separation and 3R according to gender

Overall, the findings suggest that respondents from higher education institutions acknowledge the influence of the KITARecycle application on their attitudes towards practising separation at source and 3R. The results demonstrate that the application enhances awareness, simplifies recycling processes, and offers practical guidance on effective waste management. Consequently, the KITARecycle app plays a pivotal role in promoting positive behaviors and encouraging sustainable waste management practices among its users.

### 3.4 Overall Feedback on the KITARecycle App

In this section, respondents provided feedback on the KITARecycle app through open-ended questions, although not all participants responded. The analysis focuses on those who did. The feedback was quantified for analysis.

Respondents were first asked to identify problems and challenges encountered while using the app. A total of 17 respondents highlighted two primary issues: the app's slow performance and the requirement for a strong internet connection. Additionally, three respondents noted that the app is not user-friendly, indicating a need for interface improvements. Other challenges included a slow points redemption process, with some respondents mentioning difficulties with password recovery and the registration/log-in process.

For the second question, respondents were asked for suggestions to improve the KITARecycle app, with 18 providing feedback. Seven respondents recommended enhancing the app's user interface, while three suggested simplifying the points redemption process by integrating it with Touch'nGO eWallet. Other recommendations included improving app speed, collaborating with third parties for recyclable collection in rural areas, creating a game section for engaging recycling education, increasing awareness campaigns, expanding the number of recycling cages, and regularly updating information on waste separation and recycling practices.

This research highlights several challenges users face with mobile applications, particularly the necessity for a strong internet connection to effectively use the KITARecycle app. This aligns with findings by Lotan and Patil (2023), who identified connectivity as a significant factor affecting mobile app usability and adoption [17].

## 4. Conclusion

In summary, this study has successfully demonstrated the extent to which the KITARecycle app plays a role in knowledge and attitude and behaviour changes. Generally, the app contributes to reducing the impact of solid

waste on the environment by offering guidance on proper waste disposal, recycling, and composting. It is suggested that the app include engaging tools like quizzes and videos to keep users informed and motivated, while push notifications serve as reminders for practising waste reduction consistently. However, the responses received were relatively low, which limits the ability to draw general conclusions. Therefore, it is suggested that a larger sample size be utilised in future research to obtain more in-depth information on how the app influences respondents.

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## Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of the paper.

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