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A Community-Based Approach Promoting Household Plastic Waste Upcycling Through Craft-Making in Labis, Johor

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Abstract

The study addresses plastic waste mismanagement in Malaysia, particularly in Labis, Johor, and aims to promote practical interventions through hands-on recycling education. It has three main objectives: to assess knowledge and recycling behaviors regarding plastic waste, to evaluate the effectiveness of craft-making workshops in promoting upcycling, and to determine respondents' willingness to adopt recycling and upcycling in their daily lives. The research involved a three-phase intervention, and data analysis was conducted using SPSS and Microsoft Excel. The study found no significant difference in awareness levels based on student status ($p>0.05$); however, a notable difference was observed in willingness to engage in plastic craft production. Evaluation of the demonstration program revealed that participants primarily valued its contribution to global environmental sustainability and personal enjoyment, though limited participation and time constraints were identified as primary weaknesses. To enhance future initiatives, respondents recommended broader advertisement strategies and the implementation of follow-up programs to sustain community engagement. These results suggest that targeted community initiatives can effectively enhance participation in waste management. Future research should adopt a longitudinal design and compare rural and urban areas to examine the influence of social cohesion on the success of such initiatives.

1. Introduction

The growing production of plastic waste in Malaysia, driven by the rapid expansion of the manufacturing sector, poses complex environmental and health challenges. Although legislative measures, such as the Separation at Source Initiative launched in 2015 [1], and various public awareness campaigns, like "No Plastic Bag Day," have been implemented [2], domestic recycling rates remain limited. Globally, less than 10% of plastic waste is effectively recycled [3], while mismanaged plastic waste, which can take around 450 years to biodegrade, poses a substantial threat to ecosystems by generating microplastics and releasing chemicals [4]. Despite Malaysia achieving a national recycling rate of 35.38% in 2023, existing approaches remain largely awareness-driven, highlighting the urgent need to shift from theoretical understanding toward practical, experience-based learning to promote lasting behavioral change [1]. Accordingly, this study investigates the extent to which hands-on

knowledge and craft-making workshops can motivate communities in Labis, Johor, to adopt sustainable practices in plastic waste recycling and upcycling.

1.1 Role of Practical Knowledge in Environmental Management and Education

Research increasingly underscores that while general awareness of environmental issues is valuable, it is specific practical knowledge that effectively drives sustainable behavior. Recent studies highlight a persistent "knowledge-action gap," indicating that awareness of environmental challenges does not necessarily translate into green action. For example, in the context of food waste management, possessing "procedural knowledge", understanding the precise steps to minimise waste, is a far stronger predictor of actual behaviour than general environmental concern [5]. This underscores the need for environmental education to evolve from mere "nature promotion" to a focus on action-oriented problem-solving [6].

Moreover, developing practical skills through hands-on workshops enables individuals to cultivate green self-efficacy, which is the belief in their ability to carry out pro-environmental tasks. This "sense of mastery" is crucial for young adults seeking to convert abstract values into consistent habits [7]. Interestingly, while knowing how to act (Action Knowledge) is advantageous, an excess of abstract ecological theory (System Knowledge) may overwhelm individuals, inducing cognitive dissonance [8]. As a result, modern environmental management programs are transitioning toward Problem-Based Learning (PBL), emphasizing practical, step-by-step instructional content over purely theoretical models to facilitate more effective public engagement and the retention of sustainable behaviors [9].

1.2 Attitude and Behavioral Changes

Hands-on learning and direct demonstration play essential roles in bridging the gap between theoretical understanding and practical application in waste management. Engaging in the physical transformation of waste, often referred to as "social upcycling", enables participants to simplify intricate recycling processes by converting plastic polymers into functional items. Research shows that this tangible engagement results in a notable 67.5% improvement in behavioral performance compared to relying solely on theoretical instruction [10]. Moreover, these activities cultivate "reflective awareness," transforming the perception of everyday waste from mere refuse into a valuable resource [11].

This cognitive shift enhances the "perceived ease of use," serving as a psychological driver for sustained, environmentally friendly behavior. When these practices are presented through community-based demonstrations, they create a "multiplier effect" and foster a sense of collective ownership, which has been shown to boost household waste segregation rates from 35% to 85% [12]. Ultimately, when the acquisition of practical skills is linked to economic empowerment and creativity, such as through the creation of marketable upcycled products, the sustainability of these pro-environmental habits is significantly strengthened.

2. Methodology

The study was conducted within the community surrounding Sekolah Kebangsaan Labis (SK Labis) in Labis, Johor. SK Labis was selected as the study site because of its established environmental initiatives and its role as a central hub for community engagement. The respondents comprised students, teachers, and members of the Pusat Aktiviti Warga Emas (PAWE), representing key stakeholders who influence household and community waste management practices. A total of 100 respondents were targeted, comprising 50 participants from the PAWE community and 50 members of the SK Labis school community, including staff and students. This sampling strategy was adopted to capture perspectives from both educational and community settings and to allow for comparative analysis. The research methodology was structured into three phases: Phase 1 (Pre-Implementation), Phase 2 (Implementation) and Phase 3 (Post-Implementation).

Phase 1 (Pre-Implementation Stage) focused on preparation and skill development. This phase involved a Training-of-Trainers (TOT) session, during which the researcher participated in experiential workshops led by an expert in plastic craft-making. From an engineering perspective, this stage involved material characterization using Resin Identification Codes (RICs). The researcher studied the mechanical properties of PET (Code 1) and HDPE (Code 2) to understand their structural suitability for household items. Training activities included the fabrication of simple functional items such as containers, storage pots, and laminated textiles using thermal fusion techniques. In parallel, coordination with community leaders and the principal of SK Labis was carried out to finalize participant selection and program scheduling.

Phase 2 (Implementation Stage) involved community-level intervention through structured demonstration activities. Participants were trained to reconfigure rigid plastics into functional household organizers and to apply thermal fusion techniques to bond layers of LDPE plastic bags into durable and water-resistant materials. Simple braiding and knotting methods were also introduced to enhance the strength and usability of flexible plastic films for products such as mats and coasters. Following the demonstrations, a three-month monitoring period was

conducted, combining digital communication and household visits to assess skill retention and participants' confidence in applying 3R practices.

Phase 3 (Post-Implementation Stage) evaluated the effectiveness of the intervention in promoting 3R-related behavioral change. Data were collected using a structured questionnaire distributed in both hard-copy and digital formats to maximize participation. This phase was critical for determining if the technical skills introduced, such as the ability to process and bond different polymer types, successfully translated into sustained household recycling habits. Follow-up measures, including weekly reminders through community WhatsApp groups, were implemented to ensure a satisfactory response rate. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel to evaluate the impact of the intervention.

3. Results and Discussion

The data were analysed using descriptive statistical methods, including frequency distribution, mean score analysis, reliability test and Mann-Whitney U test, which was employed to examine differences in awareness levels and 3R behaviors across respondents with different background characteristics related to plastic waste management.

3.1 Background of Respondents

This study collected responses from 70 participants. While [13] recommends a minimum sample size of 100 for basic surveys, [14] argues that a sample of 40 respondents is adequate to effectively represent population behavior. Therefore, the sample size for this study is considered both representative and suitable for analysis using SPSS. Respondents provided demographic information, including student status, age, gender, employment status, and household size. These findings are detailed in Table 1.

Table 1 *Demographic profile of respondents (n=70)*

Item		Frequency (n)	Percentage (%)
Are you a primary school student?	Yes	49	70.0
	No	21	30.0
Age	30 years old and below	53	75.7
	31-40 years old	3	4.3
	41-50 years old	4	5.7
	51-60 years old	2	2.9
	61 years old and above	8	11.4
Gender	Male	28	40.0
	Female	42	60.0
Employment status	Not working / Retired	60	85.7
	Housewife	2	2.9
	Private sector	5	7.1
	Self-employed	3	4.3
Household size	Less than 3 people	11	15.7
	3 – 5 people	34	48.6
	6 – 8 people	24	34.3
	9 – 10 people	1	1.4
Have you previously participated in the demonstration program to create craft items from plastic waste?	Yes	36	51.4
	No	34	48.6

Based on Table 1, the survey predominantly included primary school students, comprising 70% of the respondents (49 respondents), while non-school students made up the remaining 30% (21 respondents). In terms

of age distribution, a significant majority, 75.7% (53 respondents), were 30 years old or younger, indicating limited participation from older age groups. Regarding employment status, the "Not working / Retired" category accounted for 85.7% of the sample (n = 60). However, this distribution was largely influenced by the high proportion of student respondents. After accounting for students, only 15.7% of participants (n = 11) fell within non-student, non-working categories, such as retirees or unemployed adults. The working-age population was small, with only 7.1% employed in the private sector, 4.3% self-employed, and 2.9% identified as housewives.

Regarding gender distribution, female respondents accounted for 60% of the sample (42 respondents), while males accounted for 40% (28 respondents). A cross-tabulation was carried out between respondents' status and gender, categorizing respondents as students (primary school students) and non-students (including teachers and community members). Results showed that of the 42 female respondents who answered the questionnaire, 28 were primary school students, while the remaining 14 were non-school students, as presented in Table 2.

Table 2 *Cross Tabulation of Respondents' Status and Gender*

Are you a primary school student? * Gender Cross tabulation				
Count				
		Gender		Total
		Male	Female	
Are you a primary school student?	Yes	21	28	49
	No	7	14	21
Total		28	42	70

Regarding household size, nearly half of the participants (48.6%, 34 respondents) came from households of 3 to 5 people. Larger households, including 6 to 8 individuals, accounted for 34.3% (24 respondents), while smaller households with fewer than 3 members accounted for 15.7% (11 respondents). Rarely, very large households of nine to ten individuals were represented by only 1.4% (1 respondent). Regarding program participation, 51.4% (36 respondents) reported participation, while 48.6% (34 respondents) did not.

The demographic profile also focused on household waste generation and disposal practices. The assessment of plastic waste generation uses a binary response format, in which participants indicate 'yes' or 'no' to the question of whether they generate plastic waste in their households. Table 3 lists the types of plastic waste generated by the respondents.

Table 3 *Types of Plastic Waste Generated by the Respondents*

Plastic Waste		Frequency (n)	Percentage (%)
Plastic Bag	Yes	58	82.9
	No	12	17.1
Plastic bottles (e.g., mineral water bottles, soft drink bottles, and shampoo bottles)	Yes	54	77.1
	No	16	22.9
Plastic food containers	Yes	40	57.1
	No	30	42.9
Plastic drinking straws	Yes	38	54.3
	No	32	45.7
Plastic food wrappers (e.g., bread wrappers and snack packaging)	Yes	41	58.6
	No	29	41.4
Plastic product wraps (e.g., bubble wrap and packaging wrap)	Yes	44	62.9
	No	26	37.1
Plastic cups and cutlery (spoons and forks)	Yes	39	55.7
	No	31	44.3

Progress in Engineering Application and Technology Vol. 7 No. 1 (2026) p. 55-63

Plastic refill packs (e.g., liquid soap, oil and detergent)	Yes	44	62.9
	No	26	37.1

Based on Table 3, the study reveals that plastic bags are the most common form of plastic waste, used by 82.9% of respondents. Plastic bottles follow, with 77.1% reporting their use. More than half (58.6%) of participants generate plastic food wrappers, while 62.9% use plastic product wraps and refill packs. Additionally, 57.1% utilize plastic food containers, and 55.7% rely on plastic cups and cutlery. Plastic drinking straws are the least frequently reported, with 54% usage. The slightly lower incidence may indicate recent public awareness campaigns or a societal shift away from single-use straws. This pattern is consistent with the 'Plastic Free' movement delineated by [15], who contend that ongoing public engagement initiatives have effectively contributed to the denormalization of single-use plastics.

In addition to the types of plastic waste generated, the respondents were also asked how they dispose of the plastic waste they produce. The results of this assessment are shown in Table 4.

Table 4 *Plastic Waste Disposal Methods among the Respondents*

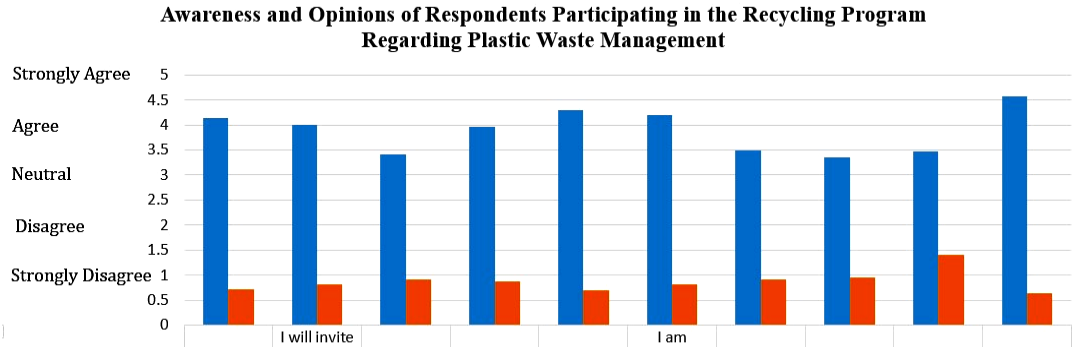
Plastic Waste	Throw directly into the trash can with other domestic waste		Burn with other trash		Dispose into The drain/river		Bury with other trash		Separate for use/recycling	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Plastic Bag	17	24.3	6	8.6	1	1.4	3	4.3	43	61.4
Plastic bottles (e.g., mineral water bottles, soft drink bottles, and shampoo bottles)	20	28.6	5	7.1	0	0	3	4.3	42	60.0
Plastic food containers	41	58.6	11	15.7	0	0	3	4.3	15	21.4
Plastic drinking straws	41	58.6	9	12.9	1	1.4	0	0	19	27.1
Plastic food wrappers (e.g., bread wrappers and snack packaging)	40	57.1	10	14.3	1	1.4	2	2.9	17	24.3
Plastic product wraps (e.g., bubble wrap and packaging wrap)	33	47.1	0	0	0	0	8	11.4	29	41.4
Plastic cups and cutlery (spoons and forks)	36	51.4	4	5.7	1	1.4	0	0	29	41.4
Plastic refill packs (e.g., liquid soap, oil, and detergent)	31	44.3	6	8.6	2	2.9	5	7.1	26	37.1

Table 4 indicates that plastic bags (61.4%) and bottles (60.0%) have the highest rates of proper disposal, suggesting the effectiveness of initiatives for reuse and recycling. Other items, such as plastic wraps, cups, and cutlery, show moderate recycling rates (41.4%). In contrast, single-use food-related plastics are often improperly disposed of, with plastic food containers and drinking straws having the highest rates of improper disposal (58.6% disposed of as trash). Only 21.4% of food containers and 27.1% of straws are recycled. Convenience and perceived lack of value contribute to the improper disposal of plastic food wrappers in the trash (57.1%). Environmentally harmful methods, such as burning (15.7% for food containers) and burying (11.4% for wraps), are also noted, while disposal in public waterways is rare (2.9% for refill packs). The data highlights the need to maintain good recycling practices for bags and bottles while addressing the significant issue of food-related single-use plastics being discarded.

3.2 Awareness Level on Plastic Waste Management and 3R Behavior

This section examines participants' awareness and attitudes toward plastic waste management through recycling activities. The survey used 10 statements to gauge participants' awareness and opinions, with responses measured on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). Descriptive statistical

analyses were performed to evaluate participants' awareness, ensuring that four negatively phrased items were reverse-coded for consistency. The findings, including comprehensive descriptive statistics, are summarized in Fig. 1.



	I believe that turning plastic waste into craft products can generate extra income.	I will invite people around me to attend recycling craft training and workshops together as an effort to preserve the environment and...	I am willing to pay for products made from waste materials if they are of good quality.	I believe that society still lacks awareness of the potential of plastic waste in producing craft products.	I believe that recycling craft training and workshops should be made available to all levels of society.	I am confident that recycling craft training and workshops can help reduce problems related to plastic waste generation.	I am willing to join recycling craft training and workshops if the fees are reasonable.	I believe that recycling plastic waste into craft products is a challenging task.	I believe that unplanned plastic waste management does not significantly impact the environment or human health.	I think that recycling craft training and activities are a waste of time and do not provide any benefits.
Mean	4.14	4.01	3.41	3.96	4.3	4.2	3.49	3.36	3.47	4.57
Standard Deviation	0.728	0.825	0.925	0.882	0.709	0.809	0.913	0.948	1.401	0.65

Fig. 1 *Respondents' Awareness Level and Opinions Regarding Plastic Waste Management*

Fig. 1 analyzes respondents' views on a plastic-waste craft training program, indicating overall positive perceptions, with mean scores between 3.36 and 4.57. The highest mean score (M = 4.30, SD = 0.709) reflects strong support for expanding training and recycling workshops across society. Respondents also agreed that transforming plastic waste can provide additional income (M = 4.14, SD = 0.728) and help address plastic waste issues (M = 4.20, SD = 0.809). However, there was moderate agreement regarding willingness to purchase recycled products (M = 3.41, SD = 0.925) and to pay training fees (M = 3.49, SD = 0.913). Negative perceptions about recycling activities were generally disagreed with, as indicated by reverse-coded items reflecting low support for the ideas that these activities are difficult (reversed M = 3.36, SD=0.948) or a waste of time (reversed M = 4.57, SD=0.65). Overall, the findings highlight a constructive attitude towards recycling initiatives.

A reliability test was conducted using SPSS to assess the internal consistency of survey questions measuring a common construct. The aim is to ensure the reliability of measurement instruments, such as Likert-scale questionnaires. The analysis was conducted on a 10-item scale, yielding a Cronbach's alpha coefficient of $\alpha = 0.646$. According to [16], Cronbach's alpha values exceeding 0.6 are deemed acceptable, demonstrating satisfactory internal consistency. Consequently, the findings indicate that all questionnaire items consistently measure the intended construct and are appropriate for inclusion in subsequent analyses.

A Mann-Whitney U test showed a significant difference in awareness levels between respondents willing to engage in plastic craft production from plastic waste and those who were not (Z-score = -2.042, p = 0.041). The null hypothesis was rejected, indicating that higher awareness is associated with a willingness to participate in plastic craft production. This aligns with the findings of [17], which highlight that individuals with greater awareness are more involved in waste management programs. The detailed results are shown in Table 5.

Table 5 *Comparison of Awareness Level by Willingness to Participate in Plastic Craft-Making using the Mann-Whitney U test*

Ranks				
Grouping Variable		Mean likert scale awareness		
		N	Mean Rank	Sum of Ranks
Are you a primary school student?	Yes	58	37.75	2189.50
	No	12	24.63	295.50
Test Statistics				

Progress in Engineering Application and Technology Vol. 7 No. 1 (2026) p. 55-63

	Mean likert scale awareness
Mann-Whitney U	217.500
Wilcoxon W	295.500
Z	-2.042
Asymp. Sig. (2-tailed)	0.041

3.3 Feedback on the Program

In this section, only respondents who participated in the demonstration program were included in the feedback analysis. Of a total sample of 70 individuals, 36 participants attended the demonstration program and were therefore retained for this analysis. Respondents were first asked to identify the perceived benefits of the demonstration program, and the results are shown in Fig. 2.

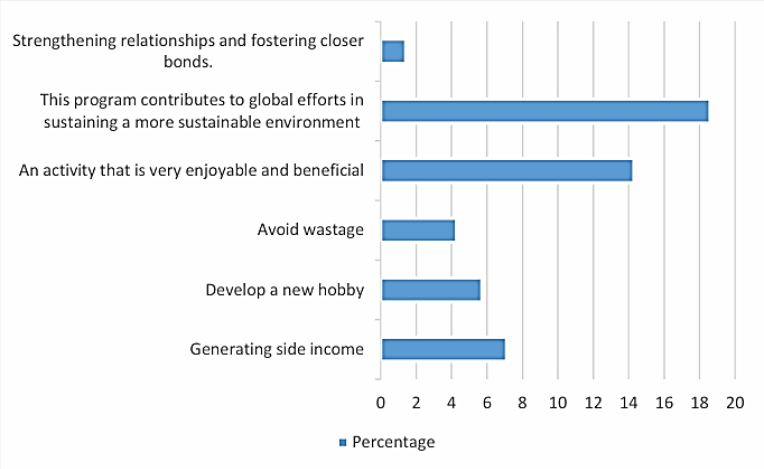


Fig. 2 *Benefits Gained by Respondents from Participating in the Demonstration Program*

The analysis of the demonstration program reveals several key benefits reported by participants. The primary advantage identified was the program's contribution to global environmental sustainability, with 18.6% of respondents highlighting this outcome. Additionally, 14.3% found the program enjoyable and rewarding, indicating the importance of personal satisfaction in participation. Economic benefits included supplemental income (7.1%) and hobby development (5.7%), while 4.3% noted its role in minimizing waste. The least mentioned benefit was strengthening social relationships, mentioned by only 1.4% of respondents, suggesting a focus on individual activities rather than community engagement. Fig 3 illustrates these benefits further.

Subsequently, the participants were asked to identify the shortcomings of the demonstration program, enabling the researchers to gather insights for future improvements. The findings are presented in Fig. 3.

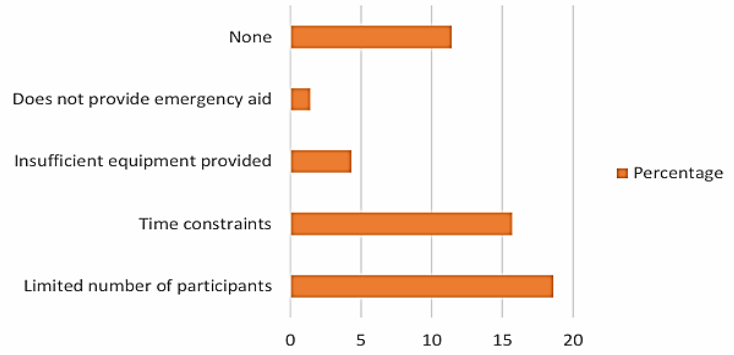


Fig. 3 *Perceived Weaknesses of the Demonstration Program*

The majority of respondents identified a limited number of participants as the main weakness of the program (18.6%, 13 respondents). Time management constraints were noted by 15.7% (11 respondents), and 4.3% (3 respondents) mentioned insufficient equipment. One respondent (1.4%) expressed concerns about the lack of emergency aid. Despite these weaknesses, 11.5% (8 respondents) reported satisfaction with the program, suggesting that some participants found it effectively catered to their learning styles. This phenomenon occurs when the pedagogical approach aligns so closely with the learner's preferred learning style that the individual becomes impervious to external deficiencies within the educational program, such as time or resource limitations [18].

Lastly, respondents were asked to provide suggestions for improving the demonstration program in the future. The findings are presented in Fig. 4.

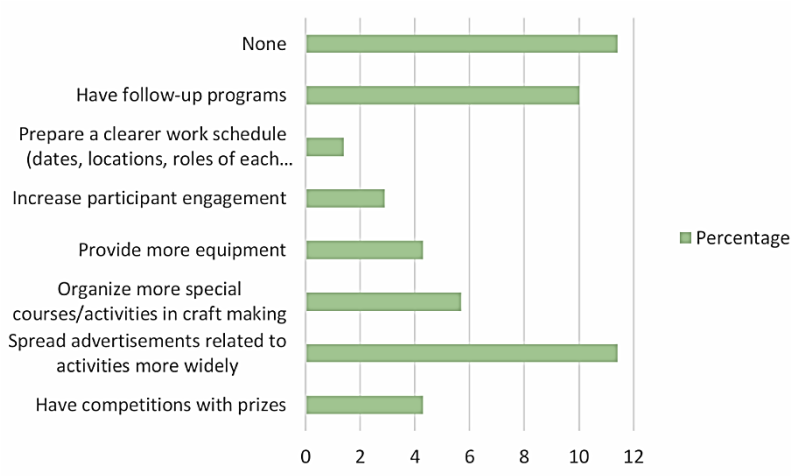


Fig. 4 *Suggestions for Improving the Demonstration Program*

Fig. 4 highlights key areas for strategic improvement in a program, with a focus on increasing visibility and sustaining participant engagement. The primary suggestion, made by 11.4% of respondents, is to broaden advertisements for activities, indicating a need for enhanced outreach strategies. Follow-up programs were recommended by 10.0% of participants, while 5.7% suggested offering more specialized craft courses and 4.3% advocated for competitions with prizes to diversify engagement. Additionally, calls for more equipment (4.3%) and clearer scheduling (1.4%) were noted, alongside a small percentage (2.9%) emphasizing participant engagement efforts. Interestingly, 11.4% of respondents expressed satisfaction with the current program, suggesting that no changes are needed.

4. Conclusion

In summary, the study examined community-based craft-making initiatives implemented in Labis, Johor, with a focus on enhancing the upcycling of household plastic waste. The findings showed that these programs effectively raised awareness of 3R (Reduce, Reuse, Recycle) practices, primarily engaging younger participants. Overall, demographic characteristics did not appear to significantly affect awareness levels, suggesting a shared understanding of recycling and practices among participants. This finding suggests that hands-on, community-oriented programs are effective in bridging demographic differences in environmental awareness. The study further revealed a statistically significant difference in respondents' willingness to engage in plastic craft activities ($p=0.041$, $p < 0.05$), indicating that while general awareness levels are relatively consistent across groups, individuals with higher levels of specific awareness are significantly more inclined to adopt and sustain plastic craft production in their daily activities. To strengthen future research, larger and more diverse samples are recommended to improve representativeness. Additionally, incorporating qualitative approaches, such as in-depth interviews, could provide deeper insights into community motivations and perceptions. Longitudinal studies are also suggested to assess the long-term sustainability of behavioral changes resulting from upcycling-based environmental interventions.

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Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this paper.

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