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The Use of Gamification Strategies to Encourage User Engagement and Cloth Recycling Behaviour

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ABSTRACT

This research investigates how gamification strategies can enhance user engagement and encourage cloth recycling behaviour in Malaysia. With textile waste reaching alarming levels at 432,901 metric tonnes recorded in 2021, there is an urgent need for creative and sustainable solutions. Employing a mixed-methods approach, the research integrates a systematic literature review with a quantitative survey conducted with 50 participants aged between 18 to 65. The results indicate a high level of awareness and previous involvement in cloth recycling, with significant barriers including limited access to recycling facilities and a lack of information about recycling activities. Respondents expressed a strong interest in gamified recycling initiatives, particularly in features such as points, rewards and community engagement. Incentives were identified as the most effective motivator, with 72% of participants saying they would be more inclined to recycle when rewards are offered. The research finding indicates that user-centric gamification systems that are well-designed can turn recycling into an engaging activity, bridging the gap between awareness and consistent action. These insights provide valuable guidance for policymakers, app developers, educators and advocates of sustainability who seek to encourage long-term recycling behaviours and support environmental goals.

Keywords: *Gamification, Cloth Recycling, User Engagement, Eco-Gamification, Behavioural Change*

1 INTRODUCTION

1.1 Research Background

The textile industry is the second most polluting industry in the world and Malaysia is one of the contributors to this issue. A report by the Ellen MacArthur Foundation in 2017 stated that clothing accounts for more than 60% of the total fabrics used worldwide. An estimated 18.6 million tonnes of clothing end up in landfills and if this trend continues, over 150 million tonnes of textile waste will fill and clog landfills by 2050 (Ellen MacArthur Foundation, 2017).

In 2018, Malaysians dumped 195,300 tonnes of fabrics into landfills. Solid Waste and Public

Cleansing Management Corporation also known as SWCorp Malaysia reported that the amount of textile waste in landfills doubled from 2.8% in 2012 to 6.3% in 2018. About 2,000 tonnes of textile waste ends up in landfills every day and this indicates a low recycling rate for textile materials (Syed Abdul Khalid, 2021). The latest report by SWCorp Malaysia revealed that Malaysians disposed of 432,901 metric tonnes of textile waste in 2021. This figure has doubled compared to 195,300 metric tonnes in 2018. (Manap, A. H. A., 2024). This sharp increase signals a critical need to find more effective waste management andrecycling strategies.

1.2 Research Purpose

The purpose of this study is to investigate the use of gamification strategies to increase user engagement and encourage cloth recycling behaviour. Seeing the significant impact of the textile industry on the environment emphasise the urgency of raising awareness and the importance of finding innovative solutions to promote sustainable habits among consumers.

Gamification, the application of game design elements in non-gaming contexts has shown possibilities in influencing people's behaviour and increasing engagement in various industries. Gamifying cloth recycling offers a promising opportunity to transform typical disposal behaviours into more engaging and environmentally responsible actions.

1.3 Problem Statement

This research aims to address the problem of insufficient cloth recycling practices among the public which has contributed to the accumulation of textile waste and environmental degradation. According to the journal article "Waste Management" titled "Assessment of Carbon Footprint Emissions and Environmental Concerns of Solid Waste Treatment and Disposal Techniques: Case Study of Malaysia," about 8% of solid waste in the country comes from textile waste (Malakahmad, A., Abualqumboz, M. S., Kutty, S. R. M., & Abunama, T. J., 2017).

Although people are aware of the environmental problems related to textile waste, there is still a great need to find practical ways to encourage and maintain cloth recycling habits among consumers. In 2018, Malaysians were recorded to have disposed of 195,300 tonnes of textile waste which is equivalent to the weight of 19 Eiffel Towers. SWCorp Malaysia also noted that the amount of textile waste enteringlandfills has doubled from 2.8% in 2012 to 6.3% in 2018 (Chu, M. M., 2019).

Traditional approaches have shown limited success in encouraging individuals to recycle textiles regularly where this expresses the need for more creative and sustainable solutions. The latest report from SWCorp Malaysia revealed that Malaysians disposed of 432,901 metric tonnes of textile waste in 2021, which is a double figure compared to 195,300 metric tonnes in 2018 (Manap, A. H. A., 2024).

Gamification provides a promising and user-centred approach to address this issue. Element such as points, incentives, challenges and leaderboards motivate users to participate, create good habits and remain involved with environmentally beneficial behaviour. Gamification has the potential to close the gap between awareness and consistent action by making something as basic as cloth recycling into a fun and significant event that engages, rewards and connects people.

1.4 Significance of the Study

1.4.1 Contribution to the Eco-Gamification Sector

The findings of this research will contribute to the field of eco-gamification by providing empirical evidence on the effectiveness of gamification strategies in encouraging sustainable behaviour. By analysing the implementation of game design elements such as points, badges,

leaderboards and challenges in cloth recycling, this research will offer valuable insights into the strategic use of gamification to increase user engagement and promote eco-friendly behaviours. These findings have the potential to be applied in other sustainable fields and could serve as a foundation for future eco- gamification research.

1.4.2 Greater Impact on Society

This study can also have a greater impact on society. It has the potential to encourage governments, educators and business leaders to incorporate gamification elements into environmental initiatives and increase cloth recycling rates. Effective gamification techniques in cloth recycling can provide benefits to the environment such as lower greenhouse gas emissions, less textile waste in landfills and improved resource conservation. From an economic perspective, it can help reduce waste management expenses and creating new opportunities in the recycling and sustainable fashion industries. Socially, it can drive change by increasing awareness and acceptance of sustainable behaviours, promoting a culture of environmental responsibility and conscious consumption. Additionally, gamification adds educational value by offering engaging and interactive experiences that enhance learning about environmental issues.

1.5 Research Questions

1. How effective are gamified strategies in encouraging user engagement and cloth recycling behaviour?
2. What specific gamification elements are most effective in promoting cloth recycling behaviour?
3. How does the use of gamified strategies influence users' long-term commitment to cloth recycling compared to traditional recycling methods?

2 LITERATURE REVIEW

2.1 Gamification and Behavioural Change

Gamification is now gaining more attention as a method to promote behavioural change through the application of psychological and motivational principles. According to Deterding et al., (2011), gamification uses game design elements in a non-game context to engage users and influence their actions. The Self-Determination Theory (SDT), (Deci, E. L., & Ryan, R. M., 1985) emphasise the importance of intrinsic motivation, which is fostered by gamification by satisfying psychological needs for autonomy, competence and relevance.

Empirical evidence supports the effectiveness of gamification in encouraging positive behaviours. For example, Mekler et al., (2017) showed that gamification improves user engagement and task performance by providing feedback and a sense of accomplishment. Hamari et al., (2014) found that gamification can drive consumer motivation in areas such as education, health and waste management. These findings create a foundation for exploring the potential of gamification in sustainability initiatives including cloth recycling.

2.2 Gamification in Recycling and Environmental Sustainability

Gamification has been successfully used to promote environmental behaviour, especially in recycling initiatives. Helmefalk and Rosenlund (2018) examined the effects of gamified waste sorting systems, finding that participants were more likely to engage with recycling programs when interactive elements such as points and rewards were included. Santti et al. (2020) reported a significant increase in recyclingrates when gamification is integrated into household waste management systems.

A recent study by Venturi (2022) explored the impact of gamification on recycling behaviour in

the Italian city of Pistoia using the GreenApes gamification app. This quasi-experimental design compared three groups: one using a gamified app, another receiving non-gamified information and a control group without intervention. The study found that gamified apps significantly improved participants' recycling accuracy rates and long-term engagement compared to other groups. The research emphasises the importance of real behaviour change and addressing gaps in previous studies that focused primarily onintentions rather than real-world actions.

In 2022, Mulyanto and Soerojo designed a zero-waste application using a player-centred design (PCD) approach. The study emphasises the adaptation of gamification elements such as badges, leaderboards and challenges to specific types of users based on their motivations. The study emphasises that PCDs combined with gamification, can effectively address user needs and foster sustainable behaviours, demonstrating the potential to design interventions that increase user engagement in recycling initiatives.

In the context of cloth recycling, research is more limited. However, research on broader recycling behaviour suggests promising results. Gibovic and Bikfalvi (2021) conducted a systematic review of gamified recycling programs, highlighting key elements such as leaderboards, challenges and real-time feedback as essential for maintaining user engagement. The findings highlight the potential of gamified systems in tackling the growing issue of textile waste.

2.3 Elements of Gamification and Their Effectiveness

Various game design elements have different impacts on user engagement and behavioural outcomes. Mekler et al. (2017) categorised these elements into extrinsic and intrinsic motivators. Extrinsic elements such as points, badges and rewards provide significant incentives that encourage early participation. On the other hand, intrinsic elements such as challenge, social interaction and feedback, foster deeper engagement by appealing to the user's internal motivation.

Leaderboards and competitions have been shown to encourage participation by tapping into consumers' desire for recognition and achievement. For example, Helmefalk and Rosenlund (2018) found that the leaderboard significantly increased recycling rates in gamified waste management systems. Venturi (2022) reinforces these findings by showing that elements such as missions, challenges and rewards in the GreenApes app increase user engagement and continuous recycling behaviour.

Mulyanto and Soerojo (2022) also found that gamification elements tailored to user types can improve usability and motivation, with metrics showing high success rates in fostering zero-waste behaviours. However, Mekler et al. (2017) warn that overreliance on extrinsic rewards may affect long-term motivation, suggesting the need for a balanced approach that incorporates intrinsic motivators.

2.4 Challenges and Ethical Considerations in Gamification

While gamification has great potential, its implementation can be a challenge. According to Nicholson (2012), user disengagement can occur if the gamified system becomes repetitive or fails to provide meaningful rewards. Ethical concerns such as psychological manipulation and data privacy must also be addressed.

Designing an ethical gamification system requires a user-centric approach that prioritises transparency and aligns with participant values. Nicholson (2012) advocates "meaningful gamification" that emphasises intrinsic motivators and provides users with opportunities for self-expression and learning.

Venturi (2022) emphasises the importance of combining extrinsic motivators such as rewards with intrinsic elements such as community engagement, to foster continuous user participation in recycling initiatives. Mulyanto and Soerojo (2022) also emphasised that gamification, customisation and adjusting game elements based on user behaviour, can increase the engagement of different types of players and potentially address user disengagement issues.

2.5 Gaps in the Literature

Despite the growing interest in gamification, there is a significant gap in its application to cloth recycling initiatives. Previous research has mostly concentrated on general recycling behaviours or other sustainability activities, therefore leaving unresolved issues about the specific mechanisms and challenges related with cloth recycling. Furthermore, few research looked at the long-term effectiveness of gamified interventions or their scalability in different demographic and cultural settings.

3 METHODOLOGY

This study employs a mixed-methods approach with a convergent parallel design, where both qualitative and quantitative data are collected simultaneously, evaluated independently and then combined for interpretation. For qualitative data, a literature review was conducted on gamification strategies to encourage user engagement and clothing recycling behaviour. For quantitative data, an online survey was conducted to investigate the potential use of gamification to increase engagement and participation in clothing recycling behaviour in Malaysia.

3.1 Quantitative Methods (Online Surveys)

For the quantitative method, an online survey was conducted using Google Forms on July 13, 2024. The survey took a sample of 50 respondents aged between 18-65 years old who were willing to participate. Respondents were gathered via personal networks and social media sites to guarantee diverse participation.

The survey consisted of 20 questions divided into five main sections: Demographics and Background, Awareness of Cloth Recycling, Barriers to Cloth Recycling, Gamification and Behaviour and Attitudes and Perceptions. The questions were structured to identify user awareness, motivation and behaviouralintentions about cloth recycling.

4 DATA ANALYSIS AND RESULTS

4.1 Demographics and Background

The survey revealed that women dominated the group of respondents, who made up 74% of the sample. The majority of respondents, who accounted for 72%, were between the ages of 25 and 44. In this age range, 30% fall into the 25 to 34 category, while 42% are between the ages of 35 and 44. Educational backgrounds vary, with the largest group holding a high school diploma at 32%, followed by those with a bachelor's degree at 26%. This demographic profile highlights a technologically savvy population with a strong potential to engage in gamified recycling initiatives. The large representation of women further emphasises the importance of targeting this group, as women often make important decisions about household recycling practices.

Table 1 Gender, Age and Education

Characteristic		Frequency	Percentage %
Gender	Male Female	11	22.0
	Prefer not to say	37	74.0
		2	4.0
Age	18-24	2	4.0
	25-34	15	30.0
	35-44	21	42.0
	45-54	4	8.0
	55-64	4	8.0
	65 <	4	8.0
Education	Less than High SchoolHigh	6	12.0
	School Diploma	16	32.0
	College and Foundation Studies	10	20.0
	Bachelor's Degree	13	26.0
	Graduate Degree	5	10.0
	Total	50	100.0

4.2 Awareness of Cloth Recycling

Table 2 Experience, Familiarity, Recycling Pattern, Method of Disposal and Reasons

Characteristic		Frequency	Percentage %
Experience withCloth	Yes	40	80.0
Recycling	No	10	20.0
Familiarity withCloth	Very familiar	31	62.0
Recycling	Somewhat familiar	11	22.0
	Not very familiar	8	16.0
	Not familiar at all	0	0.0
Cloth Recycling	Always	6	12.0
Pattern	Often	7	14.0
	Sometimes	24	48.0
	Rarely	8	16.0
	Never	5	10.0
Method ofDisposal	Donation centres	21	42.0
	Recycling bins	19	38.0
	Trash	2	4.0
	Resale	5	10.0
	Give to family and friends	3	6.0
Reasons	Space saving	21	42.0
	Social responsibility	16	32.0
	Environmental concerns	10	20.0
	Financial incentives	3	6.0
Total		50	100.0

The data showed a high level of familiarity with cloth recycling among participants, with 62% reporting that they were very familiar with the concept and an additional 22% quite common. Most respondents, about 80%, have recycled clothing items in the past, with 48% engaging in occasional recycling and 14% doing so regularly. Donation centres emerged as the most popular method of disposal, used by 42% of respondents, followed by recycling bins at 38%. The main reasons for recycling include a desire to save space, cited by 42%, and a sense of social responsibility, expressed by 32%. This demonstrates well-established awareness and recycling practices among participants, providing a strong foundation for gamification initiatives to build on.

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4.3 Barriers to Cloth Recycling

Table 3 Barriers to Cloth Recycling, Access to Recycling Facilities andMotivation to Recycle

	Characteristic	Frequency	Percentage %
Barriers to Cloth Recycling	Lack of information on how to recycle	10	20.0
	Inconvenience	5	10.0
	Lack of access to recycling facilitiesDon't	32	64.0
	believe it's effective Don't see the need to	1	2.0
	recycle	2	4.0
Access toRecycling Facilities	Very easy	5	10.0
	Easy	14	28.0
	Neutral	16	32.0
	Difficult	10	20.0
	Very difficult	5	10.0
Motivation to Recycle	More information on how to recycleCloser	19	38.0
	recycling locations Incentives or rewards	8	16.0
	for recycling Social or community events	11	22.0
	A need to make space in wardrobe	11	22.0
		1	2.0
	Total	50	100.0

The most significant barrier to cloth recycling is the lack of access to recycling facilities, as identified by 64% of participants. Perceptions of the ease of finding such facilities are mixed, with 38% finding them easy or very easy and 30% finding them difficult or very difficult. 38% of respondents suggested that more information on how to recycle, followed by 22% each citing the introduction of incentives and community events would encourage greater participation in recycling activities. Interestingly, only 2% of respondents were driven by the need to clear space in their wardrobe, suggesting that practical or social factors exceed personal organisation.

4.4 Gamification and Behaviour

Only 36% of respondents stated that they are familiar with the concept of gamification. This shows a significant knowledge gap that can be addressed through awareness campaigns and educational outreach. Furthermore, only 30% of respondents reported having used gamified apps before, suggestinga limited exposure with gamified systems.

However, users' interest in engaging with gamified recycling apps is positive. A total of 62% of respondents stated either very interested (22%) or interested (40%). While only 8% said that they were not interested and none expressed very not interested. In general, this shows the openness to the concept of gamification, even among those who are not familiar with it.

72% of participants stated that they would recycle more often if incentives and rewards were involved, 26% answered with "maybe", while 2% said "no". These findings support the potential effectiveness of gamification especially through reward mechanisms in encouraging long-term behaviours.

Regarding the likelihood of recommending a gamified recycling app to friends and family, 70% of respondents said they were either "likely" (36%) or "very likely" (34%). Only one respondent (2%) said they would be "very unlikely" to do so, and none of them selected "unlikely". Considering the limited exposure that most users have to gamification, the results strongly suggest the potential for social influence. High level of willingness to recommend shows that users not only find personal value in gamified applications but also view them as beneficial and interesting enough to share with their social circles.

Table 4 Gamification Familiarity, Gamification Experience, Interest Level in Using Gamified App, Impact of Incentives and Rewards on Cloth Recycling Behaviour and Recommendation Likelihood of a Gamified Recycling App to Friends and Family

Characteristic		Frequency	Percentage %
Familiarity withGamification	Yes	18	36.0
	No	32	64.0
Experience with Gamification App	Yes	15	30.0
	No	35	70.0
Interest Level inUsing a Gamified App	Very interested	11	22.0
	Interested	20	40.0
	Neutral	15	30.0
	Not interested	4	8.0
	Very not interested	0	0.0
Impact of Incentives and Rewards on Cloth Recycling Behaviour	Yes	36	72.0
	No	1	2.0
	Maybe	13	26.0
RecommendationLikelihood of a Gamified Recycling App to Friends and Family	Very likely	17	34.0
	Likely	18	36.0
	Neutral	14	28.0
	Unlikely	0	0.0
	Very unlikely	1	2.0
Total		50	100.0

Points and rewards were chosen by 66% of respondents as the most influential gamification elements, highlighting the potency of incentives in promoting recycling behaviour. Social sharing and community engagement followed, selected by 44% of respondents, suggesting that users are also driven by a feeling of community and the chance showcase their environmentally conscious behaviours. Moderate interest was shown in features like badges and achievements with 28% and challenges and missions at 26%. These indicate that goal-oriented tasks and personal development can increase user engagement for some individuals. However, leaderboards and competitions were the least popular option among the respondents, reflecting a lower preference for competitive elements in cloth recycling activity.

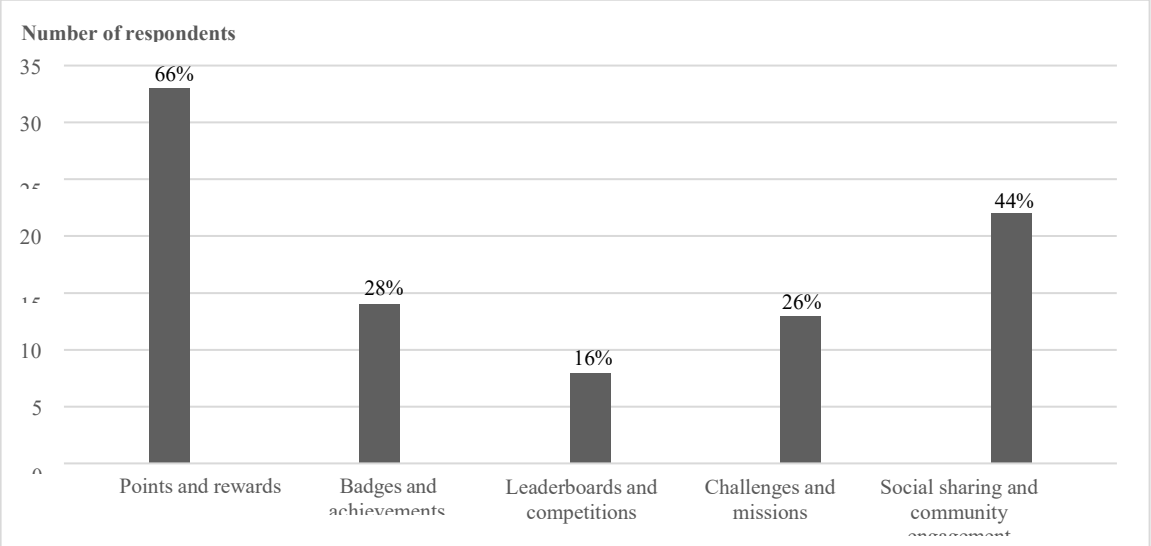

Chart 1 Preferred Gamification Elements to Encourage Cloth Recycling Behaviour

4.5 Attitudes and Perceptions

Table 5 Attitudes and Perceptions toward Cloth Recycling

Characteristic		Frequency	Percentage %
Perceived Effectivenessof Gamification in Promoting Sustainable Behaviour	Strongly agree	14	28.0
	Agree	30	60.0
	Neutral	6	12.0
	Disagree	0	0.0
	Strongly disagree	0	0.0
Role of Sustainability in Personal LifestyleChoices	Very important	13	26.0
	Important	29	58.0
	Neutral	7	14.0
	Not important	1	2.0
	Very not important	0	0.0
Total		50	100.0

The majority of respondents expressed positive views toward the role of gamification in promoting sustainable behaviour. 60% of the respondents agreed and 28% strongly agreed that gamification is an effective tool for encouraging sustainability, while 4% remained neutral and none disagreed. When asked about the role of sustainability in their personal lifestyle choices, 58% of the respondents considered it important, and 26% viewed it as very important, suggesting that environmental values are a priority for most participants. Only 2% said it was not important, and no one considered it "very not important." These findings reflect that there is strong alignment between users' values and the potential of gamified strategies to influence cloth recycling behaviour.

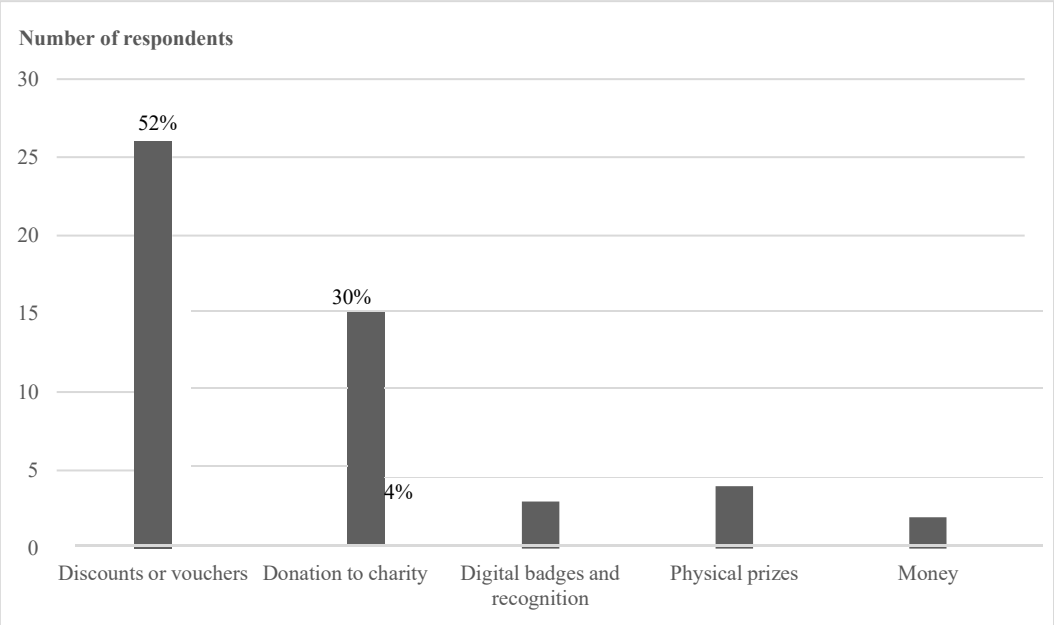

Chart 2 User Preferences for Incentives and Rewards in Recycling Apps

52% of respondents chose discounts or vouchers as their most preferred reward, indicating a significant preference for useful and tangible benefits. Donation to charity was the second most popular option, selected by 30% of users, suggesting that social and altruistic incentives also serve as a source of motivation for many people. On the other hand, money (4%), physical prizes (8%) and digital badges and recognition (6%) were much less popular. This implies that although users enjoy rewards, they place a higher priority on social impact and real-world savings than on monetary or

symbolic rewards. These results demonstrate how adding practical benefits and opportunities for social contribution to a gamified recycling app may greatly increase user engagement and motivation.

5 DISCUSSION

This section discusses the results in accordance with the three research questions that were presented inthe study using information from the survey data and supporting literature.

5.1 Effectiveness of Gamified Strategies in Encouraging User Engagement and Cloth Recycling Behaviour

These results clearly indicate that gamification strategies can successfully encourage user engagement and cloth recycling behaviour. The majority show a great interest in gamification recycling solutions, even though just 36% of respondents are familiar with gamification and 30% had previously used gamification apps. 62% respondents were very interested or interested in using the app. Furthermore, 72% said that incentives and rewards will have a positive impact on their recycling behaviour.

These results are consistent with studies like Hamari et al. (2014) and Venturi (2022), which emphasise how gamification can enhance user engagement in sustainable activities by appealing to both intrinsic and extrinsic motivations. Therefore, strategic design has the ability to significantly increase cloth recycling engagement even in people that have had little experience to gamification.

5.2 Most Effective Gamification Elements in EncouragingCloth Recycling

A total of 66% of survey respondents identified points and rewards as the most influential features of gamification. This is followed by social sharing and community engagement of 44%. A total of 28% showed less interest in badges and achievements and 26% in challenges and missions. While leaderboards and competitions were the least favoured with 16%. This suggests that consumers are more driven by significant incentives and community engagement than competition.

This supports the findings of Mulyanto and Soerojo (2022), who emphasise adapting game elements to the type of user. Further literature emphasises the importance of combining extrinsic motivators with intrinsic motivators such as social interaction and autonomy (Mekler et al., 2017; Nicholson, 2012). Overall, the most effective gamification elements for cloth recycling activities are those that provide practical rewards and promote social value, rather than competitive elements.

5.3 Influence of Gamification on Long-Term Commitmentto Recycling

The survey data reveals a promising prospect for the long-term effects of gamification on recycling behaviour. A total of 88% of respondents agree or strongly agree that gamification is effective in encouraging sustainable behaviour. Furthermore, 84% consider sustainability important or very important in their personal lifestyle choices. This indicates an alignment of fundamental values that a gamification system can reinforce.

However, a review of the literature warns that excessive reliance on external rewards can reduce intrinsic motivation over time (Mekler et al., 2017). Therefore, while initial engagement can be driven by incentives such as vouchers or donations (prioritised by 52% and 30% of respondents, respectively), long-term commitment requires a balanced system that integrates elements of education, social features and meaningful user participation.

Apps like GreenApes (Venturi, 2022) have demonstrated how community-building features and gamification can sustain long-term engagement. This supports the idea that a thoughtfully designed gamification strategy can sustain and strengthen consumers' commitment to cloth recycling beyond short-term gains.

5.4 Broader Implications

This study contributes to the growing field of eco-gamification by providing insight into how thoughtfully designed gamification elements can bridge the gap between environmental awareness and real-world recycling behaviour. The study highlights the importance of user-preferred features such as incentives, social sharing and community engagement in encouraging cloth recycling activities. These insights have wider applications beyond textile waste that have the potential to be used in other sustainability initiatives such as waste segregation, energy-saving campaigns and water-saving efforts.

These findings also provide practical guidance for policymakers, app developers, educators and non- governmental organisations to design interventions that are not only engaging but also aligned with users' motivational preferences. By strategically utilising gamification, these stakeholders can enhance public participation in environmental programs and contribute in strengthen the sustainability culture.

5.5 Limitations and Recommended Future Directions

While this study provides meaningful insights into gamification and cloth recycling, there are some limitations that must be acknowledged. The sample size of 50 participants, while sufficient for exploratory analysis, limits the generality of the findings to a wider population. Furthermore, these surveys primarily capture short-term intentions and perceptions, which may not fully reflect long-term behavioural changes.

Future studies should consider:

5.5.1 Expanding sample sizes and ensure representation across different age groups, socioeconomicstatus and geographic regions.

5.5.2 Conducting longitudinal research to assess how gamification influences long-term engagementand behaviour over time.

5.5.3 Exploring technological advancements such as augmented reality (AR) for immersive recyclingexperiences or blockchain for transparent reward tracking and trust building.

Finally, future research should explore the ethical dimensions of gamification, ensuring that the designrespects user autonomy, privacy and avoids manipulative practices.

6 CONCLUSION

This study explores the potential of gamification strategies as a tool to enhance user engagement and encourage sustainable cloth recycling behaviours. Based on both qualitative and quantitative data, the findings suggest that gamification strategies, especially those aligned with user values and motivationalpreferences, can effectively encourage participation in recycling initiatives.

Key elements of gamification such as points and rewards, social sharing and community engagement appeared as the most influential elements in driving behaviour change. Although users have shown limited exposure to gamification apps before, but their level of interest and willingness to recycle is high when rewards are involved. This reflects a strong opportunity for gamification systems to bridge knowledge gaps and motivate action.

The study also highlights the importance of user-centred design and balancing extrinsic rewards with intrinsic motivators such as social connection and purpose. By integrating these insights into app development, education and environmental policy, gamification can serve as a powerful tool for both short-term engagement and long-term behaviour change.

Gamification offers a promising pathway for tackling the textile wastage issue. With thoughtful design and ethical implementation, it has the capacity to turn awareness into action, while encouraging a cultureof sustainability and shared environmental responsibility.

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All authors played equal contributions towards the production of this paper.

CONFLICT OF INTEREST

The author declares no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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