Influence of Rewards and Gamified Experience in Waste Management Among School Students in Jaffna College Sri Lanka

Sripathmanathan Anurakavan
I*dea Factory The Social Innovations Lab (Pvt) Ltd*
Jaffna, Sri Lanka
Anurakavan@gmail.com

Velu Aeneas Jerron
I*dea Factory The Social Innovations Lab (Pvt) Ltd*
Jaffna, Sri Lanka
Jerronva@gmail.com

***Abstract*— This research presents a pilot study exploring the use of rewards and gamification to enhance plastic waste management participation among school students. Conducted at Jaffna College (Vaddukoddai, Sri Lanka), the study introduced a competitive "Waste Bank" program where classes (525 students from 18 classes Grades 6–11) competed to collect polyethylene terephthalate (PET) and high-density polyethylene (HDPE) plastic bottles over a one-week period. The initiative featured gamified elements, such as a points-based competition and tangible rewards for the top-performing classes. Student engagement was enthusiastic, with thousands of plastic bottles collected, surpassing expectations. The top 10 winning classes received prizes like sports gear, snacks, and school supplies, providing immediate incentives to reinforce positive behavior. This aligns with broader research showing that gamified challenges and rewards significantly increase student involvement in sustainability efforts. Students collected a total of 13,933 plastic bottles, with the top-performing class collecting 4,241 bottles (114.6 bottles per student). The study reveals how a competitive, fun atmosphere can foster environmental awareness, while also highlighting practical challenges like storage and manpower limitations. Although the study was limited to one week of data, the results suggest that gamification can be an effective tool for cultivating recycling habits in schools. The research concludes with recommendations for scaling up such programs in other educational settings, alongside strategies for overcoming logistical challenges. This research aims to demonstrate the potential for gamified approaches to instill long-term sustainable practices in young people, offering valuable insights for future waste management initiatives in schools.**

I. INTRODUCTION

Plastic waste mismanagement has become one of the most pressing environmental challenges of our time, and addressing this issue requires widespread community involvement in recycling efforts. Improper disposal of plastic waste contributes significantly to environmental degradation, impacting ecosystems, wildlife, and human health. In Sri Lanka, the situation is particularly urgent, with a significant portion of plastic waste accumulating in landfills, rivers, and oceans, contributing to environmental pollution. The lack of an efficient waste management system has made recycling challenging, despite the growing awareness of plastic's harmful effects on the environment. Studies have suggested that plastic waste management remains underdeveloped in Sri Lanka compared to other countries, with a large percentage of waste being improperly disposed of or left uncollected [1][2]. This emphasizes the need for improved infrastructure and educational initiatives to address plastic pollution. Schools, as institutions that shape the minds and behaviors of young people, play a crucial role in fostering sustainable practices. Research shows that the environmental habits students form early in life often persist into adulthood, influencing their long-term behavior and commitment to sustainability [3][4]. As such, schools provide a valuable opportunity to instill eco-friendly habits that can help mitigate plastic pollution in the future.

However, motivating students to engage in waste collection and recycling can be challenging, as tasks like sorting trash are often perceived as tedious and uninteresting. Traditional recycling programs can fail to capture students' attention, resulting in low participation rates. To overcome this barrier, innovative educational strategies are necessary to make recycling both engaging and rewarding. One such strategy that has gained significant attention in recent years is gamification—the integration of game elements such as points, competition, and rewards into non-game contexts. Gamification has proven to be a powerful tool for increasing engagement in both educational and environmental initiatives by transforming mundane tasks into enjoyable and rewarding experiences [5][6]. For instance, recycling programs that incorporate play and competition have been shown to boost participation significantly. Previous studies indicate that school programs with challenges, point systems, or rewards have resulted in up to a 60% increase in student involvement compared to traditional methods. Furthermore, approximately 85% of children are more motivated to participate in activities when they are framed as games or challenges, highlighting the effectiveness of gamification in motivating young people to adopt sustainable behaviors [7][8][9].

The effectiveness of gamified systems lies in their ability to leverage key psychological factors, such as social norms, peer competition, and positive reinforcement, all of which are known to influence behavior change [10][11]. In the context of environmental education, this means that students are more likely to engage in activities like recycling when

they are presented as enjoyable challenges rather than mundane chores. By introducing elements of play into recycling efforts, schools can turn eco-friendly behaviors into fun and rewarding experiences, ultimately fostering long-term sustainability. Previous research has shown that gamified systems can effectively tap into students' natural competitive spirit and their desire for recognition, both of which can significantly increase participation in sustainability programs [12][13].

Encouraged by these insights, a pilot "Waste Bank" program was implemented at Jaffna College, Sri Lanka, to investigate the influence of rewards and gamified experiences on students' waste management practices. The term "Waste Bank" refers to an initiative where students "deposit" recyclable waste (in this case, plastic bottles) in exchange for collective rewards, analogous to saving in a bank and earning interest. This pilot initiative aimed to provide practical evidence on how gamification and incentives can foster better waste management behavior in school environments. By incorporating elements of gamification, the program aimed to engage students in a sustainable and long-term approach to recycling. This research complements existing studies on gamified recycling, offering valuable insights into how gamification can be used effectively to promote sustainability in schools and beyond [14][15].

II. METHODOLOGY

The pilot study was carried out over the course of one school week at Jaffna College, Vaddukoddai, Sri Lanka and aimed to engage the entire student body, spanning multiple grade levels (Grade 6 to 11), in a collective effort to address plastic waste management. The central concept behind the study was to transform the usually mundane task of plastic waste collection into an exciting and competitive school-wide activity, encouraging participation by integrating elements of gamification, including competition and rewards. The procedure for the pilot study was as follows:

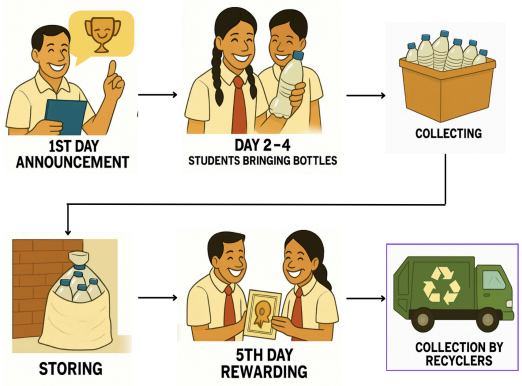

Fig. 1. Pilot process of waste bank program.

Announcement (Day 1 - Monday)
The program was officially introduced to all students and teachers during the Monday morning assembly, where the organizers explained the details of the initiative and outlined what was expected from everyone. They informed the students that for the next three days, they were encouraged to collect polyethylene terephthalate (PET) and high-density polyethylene (HDPE) plastic bottles, which could be sourced from home or the local community, ensuring that all students could participate regardless of whether they had access to recycling materials at home. Each class was tasked with collecting and submitting as many plastic bottles as possible, with the goal of gathering the largest amount of plastic waste. The competition was designed to motivate students to fully engage, and the organizers highlighted the gamified aspect of the program, framing it as a friendly contest between classes, where each class's progress would be tracked and compared. This approach helped create excitement and fostered teamwork within each class. The announcement also previewed the rewards for the top-performing classes, such as sports equipment, snacks, and school supplies, to encourage students to give their best efforts. To ensure the program ran smoothly, teachers were briefed on their roles and were encouraged to support and remind their students throughout the week, motivating them to continue collecting bottles and maintaining enthusiasm for the competition.

The reward scheme announced was as follows.

Reward for the Children as a classroom (10 classroom winners. First pick based on rank hierarchy)

1. Cricket Bat and Ball
2. Football
3. Badminton
4. Volleyball
5. Chess Board
6. Cake
7. Box of Chocolates
8. Basketball
9. Ice Cream
10. Yoghurt

Reward for the Classroom provided to the class teachers (Rank 1 or 10 classroom winners based on per capita plastic collected. First pick based on rank hierarchy)

1. 3 Dust bins
2. Broom
3. Clock
4. White Board Markers
5. Inspirational posters
6. Sri Lanka Map
7. World Map
8. Notice Board
9. Door Mat
10. School Song Poster

Collection Drive (Days 2–4: Tuesday to Thursday)
During the next three days, students enthusiastically participated in the collection of plastic bottles, actively bringing them to school each day. The collection process took place at the end of each school day, where students from each class handed over the bottles they had gathered to their respective class teacher or a designated coordinator. Once collected, the bottles were manually counted, and the totals for each class were carefully recorded. To simplify the tracking process, teachers used counting the individual bottles as a practical method. The collected plastic bottles were then stored in designated bags on college to ensure proper organization. Each class's daily totals were noted and documented, allowing for the creation of a running tally that could be easily monitored. This approach provided transparency and allowed both students and teachers to track progress over the course of the competition, though it required considerable effort from the staff to maintain accuracy. In terms of reward and gamification mechanics, no digital platform was used; instead, a simple leaderboard concept was employed, communicated to students verbally. Teachers and organizers regularly updated the students on the performance of high-performing classes, such as announcing interim leaders, which fueled the competitive spirit and kept the students engaged. The gamified experience revolved around the competition between classes, with a straightforward points system where each bottle contributed to the class's overall score. This method mirrored common gamification strategies, such as point accumulation and leaderboards, known to significantly enhance student engagement. The promise of tangible rewards at the end of the competition acted as a strong extrinsic motivator, encouraging students to participate and do their best. The rewards were thoughtfully chosen to appeal to the students, ensuring they would be both meaningful and enjoyable. These rewards included sports items, such as balls and jump ropes, snacks, classroom supplies, and decorative items, all of which were intended to ensure that winning would bring a sense of pride and enjoyment to the entire class.

Final Tally and Prize Distribution (Day 5 - Friday)
On Friday, the competition came to a close, marking the end of an exciting and engaging week. Organizers collected the record sheets from each class and carefully tallied the total volume of plastic waste collected by each group over the three-day period. Once all the data was compiled, the top 10 classes that had collected the highest volumes of plastic waste were identified and designated as the winners. During the school assembly on Friday, the results were shared with the entire student body. The winning classes, ranked from first to tenth, were called up to the stage or acknowledged publicly in front of their peers. Each winning class was then presented with their well-deserved rewards as a recognition of their hard work and dedication. This moment of celebration in front of the whole school was an integral part of the gamified experience, offering public recognition and reinforcing positive behavior. The public acknowledgment of their efforts, coupled with tangible rewards, served to further motivate the students and provided a sense of accomplishment. It is widely recognized that such public recognition in a social setting can significantly strengthen students' motivation, boost their self-esteem, and encourage them to continue participating in future initiatives. The involvement of the entire school community in applauding the winners also helped underscore the importance and value of the activity, demonstrating that the collective effort towards environmental sustainability was highly valued. To complete the cycle, all of the collected plastic waste was handed over to Eco Spindles, the designated recycling partner, for proper processing and recycling. This final step was crucial as it ensured that the students' efforts directly contributed to actual recycling, closing the loop and allowing the students to see the real-world impact of their participation.

Throughout the week, the initiative was carefully monitored by the teachers, who made qualitative observations about the students' engagement and the overall process. Teachers recorded details such as the level of enthusiasm shown by the students, any challenges faced during the collection, and how the students organized their efforts. For example, some classes formed small teams to help gather plastic bottles from their neighborhoods, fostering a sense of teamwork and cooperation. These observations were invaluable as they would later contribute to the discussion about the motivational impact of the program and any unexpected challenges that arose during the initiative. Although the study was based on just one week of data, which was primarily focused on tracking the total plastic bottles collected by each class, it provided useful insights. Given the small scale of the project, no sophisticated analysis tools or complex statistical methods were employed. Instead, the results were simply tallied as straightforward counts of the plastics collected by each class. While this approach may have lacked the depth of a more elaborate study, it was still effective for addressing the central question: does introducing competition and rewards lead to a significant increase in student participation in recycling activities? This simplified method allowed for a clear and direct measure of the impact of gamification on student involvement in the recycling effort.

III. Results and Discussion

The gamified approach led to a significant increase in participation throughout the school, with nearly every class actively joining the competition. Students from various grade levels enthusiastically engaged in collecting plastic bottles, sourcing them not only from their homes but also from their neighbors and the surrounding community. This widespread involvement reflected the success of the gamified system in motivating students across different age groups. By the end of the third collection day, a large quantity of recyclable plastic had been gathered. In total, several hundred PET and HDPE

plastic bottles, ranging from small water bottles to larger containers, were collected. These bottles filled dozens of large garbage bags, representing a substantial volume of material. This amount of plastic far exceeded the organizers' initial expectations for a one-week pilot program. The collection effort was so successful that organizers noted the school managed to accumulate more plastic in just three days than it would typically gather in several weeks through standard recycling efforts. Remarkably, the top-performing class alone collected tens of liters of plastic waste. Equation (1) is the Per Capita which is the total bottles collected in a class divided by the total number of students in a class. This will enable to understand the individual contribution, that is the contribution by an average student in the pilot study

Notably, a diverse mix of grade levels appeared in the top ten, suggesting that the competitive spirit fostered by the program spread widely among both younger and older students. Every winning class collected well into the two digit number of plastic bottles, showcasing their dedication and effort. The friendly competition between classes clearly motivated the students to gather as much plastic as possible, emphasizing how effective the gamified approach was in encouraging active participation.

$$\text{Per Capita} = \frac{\text{Total Bottles Collected in a class}}{\text{Total Number of Students in a Class}} \quad (1)$$

TABLE I. FULL 3-DAY COLLECTION DATA OF THE NUMBER OF PLASTIC BOTTLES COLLECTED DURING THE PILOT RUN OF WASTE BANK

Class	Division	No. on Roll	Day 1	Day 2	Day 3	Total	Per Capita
6	Silver	20	20	44	514	578	28.900
6	Crimson	32	37	104	466	607	18.969
6	Gold	34	0	74	466	540	15.882
7	Silver	38	121	147	514	782	20.579
7	Crimson	37	23	271	690	984	26.595
7	Gold	36	0	0	788	788	21.889
8	Crimson	42	0	0	708	708	16.857
8	Silver	11	0	34	225	259	23.545
8	Gold	41	22	244	1871	2137	52.122
9	Silver	13	0	87	69	156	12.000
9	Crimson	29	0	0	190	190	6.552
9	Gold	35	0	0	232	232	6.629
10	Silver	18	0	93	141	234	13.000
11	Silver	23	70	451	976	1497	65.087
11	Crimson	37	162	4079	0	4241	114.622
11	Gold	22	0	0	0	0	0.000

Across all classes, totals were:

Day 1 = 455,

Day 2 = 5628,

Day 3 = 7850;

Cumulative Total = 13933

TABLE II. STUDENT REWARD RANKING BY TOTAL PLASTIC BOTTLES COLLECTED DURING THE 3 DAYS WASTE BANK PILOT PROGRAM

Rank	Class	Division	Total Bottles
1	11	Crimson	4241
2	8	Gold	2137
3	11	Silver	1497
4	7	Crimson	984
5	7	Gold	788
6	7	Silver	782
7	8	Crimson	708
8	6	Crimson	607
9	6	Silver	578
10	6	Gold	540

TABLE III. CLASSROOM REWARD RANKING BY PLASTIC BOTTLES PER STUDENT COLLECTED DURING THE 3 DAYS WASTE BANK PILOT PROGRAM

Rank	Class	Division	No. on Roll	Bottles/Student
1	11	Crimson	37	114.622
2	11	Silver	23	65.087
3	8	Gold	41	52.122
4	6	Silver	20	28.900
5	7	Crimson	37	26.595
6	8	Silver	11	23.545
7	7	Gold	36	21.889
8	7	Silver	38	20.579
9	6	Crimson	32	18.969
10	8	Crimson	42	16.857

IV. CONCLUSION

This pilot study demonstrates that integrating rewards and gamified experiences into school waste management programs can have a significant and positive influence on student behavior. The "Waste Bank" initiative at Jaffna College, Sri Lanka proved to be a successful model for encouraging students to actively engage in plastic waste collection, mobilizing them to gather an impressive amount of recyclable materials in a short period. The program primarily achieved this success by leveraging the power of competition, game mechanics, and incentives, which proved to be highly motivating for students. By introducing class-based competition and offering attractive prizes, the initiative transformed what is often seen as a mundane or dull duty recycling into an exciting and enjoyable challenge. This shift in perspective led to enthusiastic participation across various grade levels, with students eagerly engaging in the activity.

The success of this project aligns with existing research on the effectiveness of gamification in environmental education, confirming that students are particularly responsive to interactive and rewarding learning experiences. By the end of the week, the initiative not only achieved a tangible environmental benefit removing a significant volume of plastic waste that could have otherwise been improperly disposed of but also provided students with practical knowledge about recycling and its importance. Moreover, the project allowed students to experience the value of teamwork and community action, as they collaborated within their classes and competed

collectively for a shared goal. This multifaceted learning experience not only contributed to the school's sustainability efforts but also fostered a sense of responsibility, teamwork, and environmental awareness among the students.

The findings from this pilot study suggest that gamified approaches can be a highly effective and powerful tool for schools aiming to foster environmental stewardship among students. Despite using minimal technology and simple rules, the strategy of "learning through play" demonstrated considerable success in driving positive behavior change. By transforming the act of recycling into a competitive, game-like experience, students were motivated to participate enthusiastically and contribute meaningfully to the cause. This approach not only captured students' attention but also engaged them in an enjoyable way, making learning about sustainability both fun and impactful. The effectiveness of this method indicates that it can easily be replicated in other schools or extended to other areas of environmental education, such as energy-saving initiatives or paper recycling competitions.

This pilot, while limited in duration, offers a promising evidence base for educators, program designers, and policymakers to incorporate game elements, such as competition and rewards, into environmental initiatives aimed at young people. By doing so, they can encourage more meaningful and lasting engagement in sustainability efforts, ultimately contributing to better environmental outcomes for future generations.

Acknowledgment

The authors would like to thank the administration and Jaffna College, Vaddukoddai, Jaffna, Sri Lanka for their support and collaboration in this pilot program. In particular, the enthusiastic involvement of the teachers in organizing daily collections and record-keeping was invaluable. We extend our gratitude to all the students of Jaffna College for their spirited participation. We also acknowledge Idea Factory The Social Innovations Lab (Pvt) Ltd for conceptualizing and leading the program, and our partner Eco Spindles for providing logistical support and ensuring the collected plastic was responsibly recycled.

References

[1] N. F. Pambudi, et al., "Enhancing public participation in plastic waste management: A five-dimensional sustainability approach," *Waste Management*, vol. 145, pp. 1-12, 2025.

[2] P. Gupta, "Plastic waste management, a concern for community," *Holistic Approach in Environment*, vol. 11, no. 2, pp. 49-66, 2021.

[3] M. G. Kibria, et al., "Plastic waste: Challenges and opportunities to mitigate environmental impacts," *Environmental Science and Pollution Research*, vol. 30, no. 4, pp. 1234-1245, 2023.

[4] B. P. Kamiel, "Household plastic waste recycling: A pathway to a sustainable community," *Bio-Environmental Conferences*, vol. 56, Article 03007, 2024.

[5] S. Anurakavan, B. C. L. Athapattu, and V. A. Jerron, "Gamification of plastic waste management for behavioral change," in *Proceedings of the 1st International Conference on Plastics & Environmental Sustainability*, Centre for Environmental Studies & Sustainable Development, The Open University of Sri Lanka, Nawala, Sri Lanka, 7th-8th March 2024, pp. 99.

[6] V. A. Jerron and S. Anurakavan, "Smart tracking of plastic containers for an efficient waste management future," in *Proceedings of the 1st International Conference on Plastics & Environmental Sustainability*, Centre for Environmental Studies & Sustainable Development, The Open University of Sri Lanka, Nawala, Sri Lanka, 7th-8th March 2024, pp. 102.

[7] C. Chen, P. Shahbaz, and S. ul Haq, "Transforming students' green behavior through environmental education: the impact of institutional practices and policies," *Frontiers in Psychology*, vol. 15, Article 1499781, 2024.

[8] W. Leal Filho, S. Raath, B. Lazzarini, V. R. Vargas, L. de Souza, R. Anholon, O. L. G. Quelhas, R. Haddad, M. Klavins, and V. L. Orlovic, "The role of transformation in learning and education for sustainability," *Journal of Cleaner Production*, vol. 172, pp. 4394–4401, 2018.

[9] C. Mărcuță and MoldStud Research Team, "Why gamification is essential for successful recycling programs in schools," *MoldStud*, 3 Jun. 2025.

[10] S. Venturi, "Gamification and informed recycling behavior," *Waste Management*, vol. 45, pp. 1–10, 2025.

[11] K. M. Cheng et al., "An evaluation of online Edcraft gamified learning (EGL) to understand motivation and intention of recycling among youth," *Scientific Reports*, vol. 12, Article 14843, 2022.

[12] Rosenlund, J., Helmefalk, M., Stenfelt, S. et al. Levelling up the Recycling Experience: Gamification of Recycling through an Innovative Recycling Station. Circ.Econ.Sust. 5, 1983–2007 (2025).

[13] J. Krath, "Revealing the theoretical basis of gamification," *Computers in Human Behavior*, vol. 115, p. 106605, 2021.

[14] M. S. Patel et al., "Effect of a game-based intervention designed to enhance social incentives to increase physical activity among families," *JAMA Internal Medicine*, vol. 177, no. 11, pp. 1586–1593, 2017.