

Recycling roads: A teacher's journey in Malaysian preschools' eco-education



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ABSTRACT

Recycling is not yet a common practice for everyone, but it is crucial for protecting the environment. According to the National Solid Waste Management Department (NSWMD), only 31.52% of Malaysians participate in recycling, which falls short of expectations. This figure is notably lower than the rates of other developed countries, which typically exceed 60%. These statistics indicate that Malaysia still has significant progress to make in recycling efforts. However, the nation aims to reach a 60% recycling rate by 2025. Although achieving this goal may seem challenging, there is a strong commitment to making it happen. This study focuses on educating young children about the benefits, challenges, and innovations of recycling. The study involved six children from a government preschool as the primary participants. To make learning more engaging, traffic road play was used as a tool to promote recycling. Data was collected through a qualitative approach within an action research framework, gathering both pre- and post-study information. The results were noteworthy, demonstrating how these children changed their understanding, habits, and creative approaches to recycling. Consequently, this study has contributed to greater societal awareness and improved recycling practices. Future research should consider expanding this approach by involving young children in public areas, such as parks, to deepen their recycling knowledge and foster a greater sense of environmental responsibility.

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1. Introduction

Most countries have implemented sustainable development initiatives to promote recycling and protect the environment, as it is closely linked to human health. Sustainable development is commonly defined as the implementation of the "3Rs": Reduction, reuse, and recycling (Faridy and Rohendi, 2020). Recycling practices in society have generally fostered a positive attitude towards the environment (Izham et al., 2023). In Malaysia, two recycling programs were launched in 1993 and 2000. However, Malaysia still lags behind other countries in terms of recycling rates. Several studies have identified a lack of knowledge, awareness, engagement, and responsibility as key factors

contributing to this issue. Herdiansyah et al. (2021), Faridy and Rohendi (2020), Galarpe and Heyasa (2017), and Jereme et al. (2016) all agreed that insufficient public awareness and participation in '3R' practices hinder their widespread adoption as societal habits. Consequently, they advocate for various efforts to address this issue, as it poses significant risks to public health and can lead to disastrous consequences.

Without recycling infrastructure, facilities, or programs, individuals often become less proactive and may neglect or disregard recycling (Ferronato and Torretta, 2019). According to a recent study by Herdiansyah et al. (2021), low-income families require support in terms of disposal facilities and formal education, while high-income families need awareness-raising initiatives on recycling. The lack of knowledge, as emphasized once again, can lead to improper waste management. In this context, the Bruntland Report of the World Commission on Environment and Development in Kono (2023) stresses the need for a balance between environmental requirements and human needs,

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highlighting the importance of global discussions on sustainable development.

When the concept of sustainable development was introduced, the topic of education for sustainable development also came into focus. It was believed that education would play a central role in achieving sustainable development goals, starting with early childhood education. [Ahmad et al. \(2021\)](#) supported this idea, emphasizing the importance of instilling recycling awareness as a social responsibility in young children. However, early childhood education has been slower than primary and secondary education in adopting the principles and practices of sustainable education. [Seth and Daud \(2022\)](#) found that there is insufficient evidence of recycling awareness among young children. Therefore, it is crucial for responsible adults to provide guidance and serve as role models for young children. This aligns with the findings of [Herdiansyah et al. \(2021\)](#), who suggested that children's ability to develop recycling habits is influenced by their surroundings, including parents, the community, and schools. In Malaysia, the National Standard Preschool Curriculum (NSPC) incorporates the concept of sustainability into preschool education. The curriculum includes two strands, namely humanities and science, and technology, which guide teachers in their classroom teaching. This study aims to explore preschool teachers' perspectives on recycling activities for children, using the Recycling Traffic Mini Park as a mediator in teaching and encouraging recycling. The study is based on the recommendations of [Vasalou and Gauthier \(2023\)](#), who proposed a collaborative effort among policymakers, activists, researchers, and the education community to redesign children's environmental education.

Recycling is an effective approach to reducing the amount of solid waste that is disposed of. Many studies ([Fadhullah et al., 2022](#); [Chea et al., 2021](#); [Faridy and Rohendi, 2020](#)) have shown that mismanaged waste can have negative effects on health (disease vectors), the environment (odors, pollution) and even lead to disasters (such as floods). However, the percentage of people practicing recycling in Malaysia is low compared to neighboring countries like Singapore, Korea, and Thailand ([Zulkarnain et al., 2023](#)). Consequently, the rate of solid waste generation is increasing, posing a significant challenge for local authorities. Experts predict that if Malaysia does not take action to address this issue, there will be no space for waste disposal by 2050.

Every day, Malaysians dispose of 1.17kg of waste. [Mamat and Mohd Najib \(2020\)](#) stated in their studies that the amount of solid waste generated in Malaysia is increasing due to population growth, economic development, and industrial processes. The latest report by the Intergovernmental Panel on Climate Change demonstrates a significant rise in greenhouse gases, including carbon dioxide and methane, over a span of 800,000 years. Waste disposal sites are major contributors to these

greenhouse gas emissions. In March 2022, Malaysians lost RM 476 million in the recycling resources industry. This industry is considered high-value, but recycling practices have not yet become the norm. In addition, inefficient and unsystematic solid waste management also contributes to these issues ([Zulkarnain et al., 2023](#)).

Without proactive efforts to address the problem, numerous issues will arise, particularly in the areas of the environment, pollution, disasters, and social and environmental problems ([Herdiansyah et al., 2021](#)). Therefore, it is recommended that awareness of the "3R" principles—reduce, reuse, and recycle—be instilled from an early age, encompassing knowledge, understanding, and practical application. Nazar Abdul Raof, the Chief Operating Officer of Alam Flora Environment Solutions (AFES), has called upon Malaysians to take swift action and advocate for the younger generation to be educated about sustainability and recycling, as they are quick learners and represent our future. Children should be exposed to proper waste management practices and taught the dos and don'ts of their daily lives. [Chea et al. \(2021\)](#) have suggested in their research that the government should consider incorporating environmental issues into the academic curriculum from a young age.

In preschool education, it is crucial to emphasize recycling education and sustainable development among children ([Sihvonen et al., 2024](#)). However, a study conducted by [Otitoju et al. \(2022\)](#) found that preschool teachers have low and unsatisfactory practices of environmental sustainability. Therefore, recycling education should be given more attention and emphasis, especially at the preschool level. Investing in preschool education is vital because it can shape a sustainable society in the future.

2. Literature review

2.1. The concept of recycling

The practice of recycling serves to prevent the wastage of resources, facilitating the recycling and repurposing of waste materials and mitigating the accumulation of garbage by segregating waste from its original source ([Awogbemi et al., 2022](#)). Recycling not only helps conserve natural resources in the surrounding area but also reduces waste. It is an effective technique for resource recovery, offering significant economic and environmental benefits. Recycling and waste recovery processes involve reprocessing and reusability of items. Reuse, on the other hand, involves repeatedly using resources or goods. By enhancing products and reselling them, reuse brings societal benefits while reducing waste and protecting the environment. Thus, recycling and reuse are part of the "3Rs" practices that [Supardi \(2023\)](#) and [Nadzir and Seowfuddin \(2019\)](#) also referred to in sustainable development education.

As recycling is a vital part of sustainable education, it should start in preschool. Even at a young age, children can show responsibility and

concern for others' well-being. Achieving sustainable development requires attention to social, economic, and environmental aspects. Educational institutions, like schools, have a role in promoting continuity by teaching children about sustainability. Alongside raising environmental awareness, schools should also address social and economic considerations. Studies by Gill (2014) and Fyfe-Johnson et al. (2021) have found that children who engage in nature-based play activities experience better balance and overall health. Incorporating environmental education into the curriculum has shown positive effects on academic performance, with improved test scores and increased motivation to learn (Brink et al., 2021). Encouraging children to explore and connect with the natural world lays a foundation for them to develop an understanding and appreciation for the environment, leading to responsible behavior in adulthood.

The "3Rs" should be introduced to preschoolers from the beginning in order to instill in them the value of knowledge preservation. According to Ting et al. (2020), exposing and practicing the "3Rs" at a young age will develop positive habits that will benefit children in the future. Faridy and Rohendi (2020) and Mahat et al. (2016) also supported this idea, noting that children are highly receptive to practices demonstrated by educators and caregivers, whom they see as authoritative figures to imitate. Herdiansyah et al. (2021) conducted a study that suggests children's learning in school can influence their parents' lifestyle if the children practice what they have learned at home. This finding aligns with Faridy and Rohendi's (2020) belief that children learn through imitation.

Teaching and learning approaches aim to engage more children in activities related to the "3Rs." By participating in these activities within the school environment, children can develop greater enjoyment from practicing the principles of reduce, reuse, and recycle. This, in turn, fosters enthusiasm among young individuals to integrate sustainable practices into their everyday routines. It is important for children to be exposed to an environmental curriculum, as their understanding of concepts and environmental issues often correlates with the ability of older individuals to learn and receive guidance (Herdiansyah et al., 2021). When children voice their concerns and actively participate in studies, it provides a fresh perspective. As a result, explaining and promoting children's understanding of their actions can encourage additional responsibilities among adults.

2.2. Recycling activity in preschool education

Preschool education plays a crucial role in helping children understand how to address environmental issues and come up with original, innovative, and effective solutions to pressing challenges. It serves as the first formal educational experience for children and sets the foundation for their future learning. Preschool education is also

significant in facilitating substantial learning, fostering the development of fundamental behaviors, and supporting children's rapid growth in terms of social, cognitive, and linguistic development (Bulut, 2020). Moreover, preschool education provides children with opportunities to develop essential habits through hands-on experience. In a classroom environment, children naturally exhibit curiosity and a desire to discover. It is within this space that children can explore and learn based on their developmental stage. Problem-solving skills, decision-making abilities, and conceptual understanding are given priority in preschool education (Khani et al., 2021; Yalçın and Erden, 2021). However, since children cannot develop these abilities independently, it is necessary to provide them with a natural and artificially prepared environment, as well as professionals trained in this area, to help them acquire exploration and discovery skills.

Herdiansyah et al. (2021) provided evidence suggesting that preschool-aged children are in the process of developing the ability to identify the correct cues for recycling and properly dispose of items with recycling symbols. To promote sustainability practices among preschoolers, it is feasible to incorporate lessons on water conservation, utilization of alternative energy sources, waste reduction, and fostering environmental awareness into the primary school curriculum on a daily basis. Additionally, students at this educational institution receive instruction on solid waste management, which includes proper techniques for composting banana peels and yogurt containers. When other children observe these activities, they incorporate them into their daily lives.

In Malaysia, there is a recognized lack of awareness of recycled education activities integrated into the existing preschool education curriculum (Law et al., 2023; Mahat et al., 2016). Conversely, it has been found that preschool education programs that promote children's cognitive, social, and emotional development include recycling-related activities and skills. As part of this educational effort, children are provided with posters about recycling various materials such as glass, plastic, and paper. They are also given cards with the universally recognized recycling symbol, as well as photographs showing recycling bins specifically for glass, plastic bottles, and paper (Mahat et al., 2016). These activities demonstrate that recycling in preschool education promotes environmental consciousness. Additionally, studies suggest the need for teaching and learning to be more creative and innovative (Shermukhammadov, 2022).

It is crucial for individuals to effectively utilize the world's natural and economic resources. To achieve this, it is important to prioritize the promotion of cultural awareness in early childhood education. A key aspect of creating and maintaining a more sustainable environment is ensuring that children's understanding of sustainable practices

grows as they progress through their preschool years. Preschool teachers have a vital role to play in fostering environmental consciousness and awareness among young children. By placing greater emphasis on recycling education, preschool teachers provide children with valuable hands-on experiences that help develop their early environmental awareness (Bulut, 2020). Additionally, early childhood educators have the potential to help young children comprehend sustainability challenges, concepts, and practices. Given their influence on young children, it is crucial to examine their behaviors regarding a sustainable future and the factors that influence those behaviors.

3. Method

3.1. Research design and samples

This research employed a checklist, observation, and interviews to fully understand the results. Thus, the study utilized a qualitative approach within the framework of action research. Purposive sampling was employed, focusing on young children from a government preschool in the Hulu Selangor district of Malaysia. Six children were selected based on their lower-grade pre-test results. Additionally, the research involved young children who required constant supervision, guidance, and attention from the teacher. Therefore, a small sample was utilized, which yielded saturated results. According to Islam and Aldaihani (2022), qualitative research does not seek to generalize results but rather to explore, explain, and describe what is occurring within a small group.

3.2. Instrument

This research utilized recycling checklists that were created by a team member, who based them on a Preschool Recycling Module published by the Malaysian Department of Environment (DOE). This module was distributed to all Malaysian government preschools, and the preschool teachers who attended the courses are familiar with its use. The instruments were validated by experts with diverse backgrounds relevant to the research topic, including Department of Environment officers, preschool teachers, and early childhood education lecturers. A pilot study was conducted, and the checklists demonstrated a high level of reliability, with an Alpha Cronbach α coefficient of 0.86.

3.3. Preschool recycling module

Researchers and the teacher had discussed and agreed to use the Preschool Recycling Module by the DOE to instruct the children. Through mutual discussions and agreement, seven topics were identified to teach children, which are embedded in other subjects learned in class. The topics are as follows:

1. Introduction to solid waste;
2. Introduction to solid waste at home;
3. Introduction to solid waste at school;
4. Introduction to Recycle, Reduce and Reuse;
5. Reuse of solid waste at home and home;
6. Reduce solid waste at school and home and;
7. Recycle solid waste at school and home.

3.4. Data collection procedure

Before starting the lessons, the teacher conducted a test with the children using a checklist prepared by the researchers. This checklist evaluated their knowledge, understanding, and recycling practices. The lessons, based on the module, were completed over six weeks, during which the children learned about recycling. At the same time, the researchers built a Recycling Traffic Mini Park, intended for the children's future play activities. The recycled items created by the children were displayed in this park. During the data collection phase, the children had four opportunities to play at the Recycling Traffic Mini Park. Researchers visited the park twice a month to observe the children's activities and the items they brought. After the data collection period ended, the children were retested to evaluate their progress in knowledge, understanding, and recycling practices. The results of the initial and final tests were then analyzed. The research flow is illustrated in Fig. 1.

3.5. Procedure to play at recycling traffic mini-park

The teacher will inform the children when they have a day to play at Recycling Traffic Mini Park. The teacher asks the children to bring any recycled items from home or school, as they had previously learned in the lessons based on the Preschool Recycling module.

Before they begin playing, children need to show their teacher the items they brought and place them in the appropriate colored recycling bin. After that, they can participate in the barter system, which allows them to play at the recycling traffic mini park using a scooter.

Children who brought incorrect items were asked to find recycled items around the school compound. This was done to reinforce the lesson on identifying the correct recycled items. Afterward, the children were given 30 minutes of free time to play at the recycling traffic mini park, allowing them to explore and socialize.

4. Results

4.1. Pre and post result

Data was collected four times within a span of two months. Teachers instructed the children to bring the recycled items and place them in the appropriate colored recycle bin before they were

given permission to play at the recycling traffic mini park. The distinction between children's knowledge, understanding, and practice of recycling is clearly evident in Table 1. It is evident that children who

have received education and have had direct practice with the Recycling Traffic Mini Park are performing better in terms of recycling.

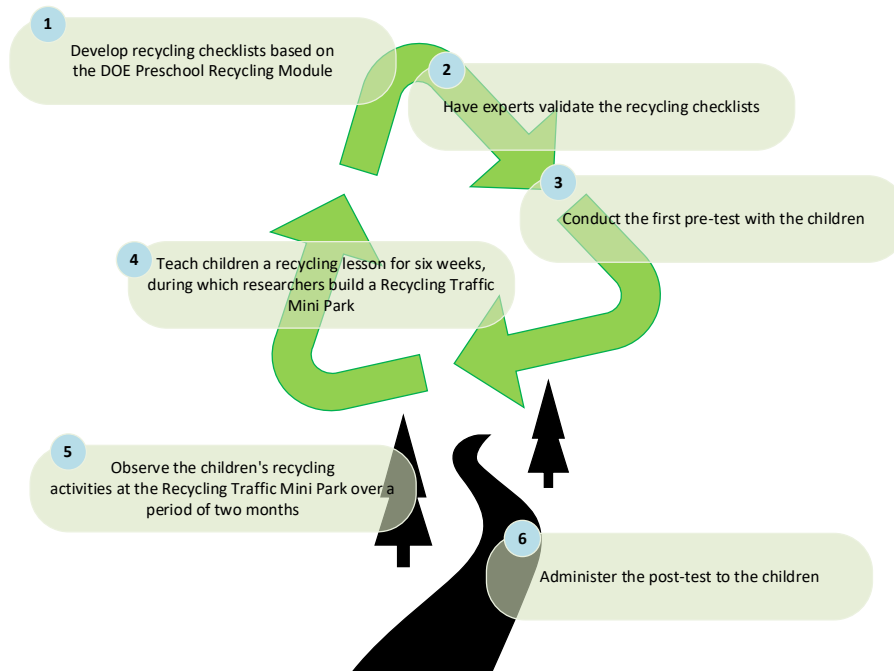


Fig. 1: Research flow

Table 1: Checklist result of pre and post

Respondent	Knowledge		Understanding		Practice	
	Pre	Post	Pre	Post	Pre	Post
Child 1	5	18	1	4	1	4
Child 2	7	18	1	4	0	5
Child 3	4	19	0	4	1	4
Child 4	7	20	1	4	0	4
Child 5	6	20	2	5	1	5
Child 6	5	19	1	5	1	5
Mean	5.666667	19	1	4.333333	0.666667	4.5
Standard deviation	1.21106	0.894427	0.632456	0.516398	0.516398	0.547723

4.2. Observation checklist result

Referring to Tables 2 and 3, it is clear that children show improvement during the second observation and continue to refine their skills by the third and fourth observations. Despite initially bringing the wrong recyclables, we actively

encourage them to locate the correct items either nearby or within the school compound. This support helps children recognize and understand which products are suitable for recycling. As a result, the next time, they will remember to bring the proper recyclable items.

Table 2: Observation checklist for first and second observation

Child	1 st observation-correct items	1 st observation-incorrect items	1 st observation-found nearby items	2 nd observation-correct items	2 nd observation-incorrect items	2 nd observation-found nearby items
Child 1	✓			✓		
Child 2		✓	✓	✓		
Child 3		✓	✓	✓		
Child 4	✓			✓		
Child 5		✓	✓		✓	✓
Child 6		✓	✓		✓	✓

Table 3: Observation checklist for third and fourth observation

Child	3 rd observation-correct items	3 rd observation-incorrect items	3 rd observation-found nearby items	4 th observation-correct items	4 th observation-incorrect items	4 th observation-found nearby items
Child 1	✓			✓		
Child 2	✓			✓		
Child 3	✓			✓		
Child 4	✓			✓		
Child 5	✓			✓		
Child 6	✓			✓		

4.3. Interview result

Results were analyzed under the two sections: roles of teachers and impacts on preschool children's development on recycling in sustainable education.

4.3.1. Roles of teachers

Recycling is a crucial practice that deserves significant attention, particularly among preschool teachers. This is because recycling education is an ongoing and interdisciplinary endeavor. Introducing children to recycling education at an early age can cultivate a generation that comprehends the link between themselves and the environment. Instilling values of concern and responsibility for the environment should begin in early childhood. This is necessary to foster awareness and nurture an affection for the environment in the children themselves. As teachers, we have a pivotal role in educating children about recycling by providing engaging and enjoyable activities.

4.3.2. Impacts on preschool children's development on recycling in sustainable education

Based on my observations, I find that recycling education has a positive impact on children's development. From a cognitive perspective, recycling education enhances their knowledge by introducing new concepts and providing meaningful experiences. These new ideas serve as a starting point for children's exploration, shaping their attitudes and behaviors toward the environment in a positive way. In terms of emotional development, children are generally happy and excited, particularly when participating in recycling activities that involve group cooperation. This collaborative environment nurtures their social development. Additionally, recycling education instills positive values in children, which is an important step in shaping their moral character and noble qualities.

5. Discussion

5.1. Roles of teachers

Teachers have pointed out the lack of emphasis on recycling awareness in preschool education. They believe that it is essential to instill environmental consciousness in children from a young age, as it not only contributes to economic well-being but also helps preserve natural ecosystems, conserve resources, and protect the welfare of all living organisms (Bulut, 2020). Studies by López-Alcarria et al. (2021) and Mohamed et al. (2017) have demonstrated that early childhood recycling education not only aligns with these broader objectives but also enhances children's problem-solving skills, sense of responsibility, and appreciation for the environment.

To improve children's understanding of recycling, teachers suggest incorporating hands-on activities into preschool curricula. Engaging children with tangible materials and real-life recycling processes makes learning more relevant and enjoyable, fostering greater recycling awareness. A study by Castellano et al. (2021) demonstrated that using real objects, such as waste items, is an effective way to teach recycling. This approach not only enhances learning outcomes but also actively involves children in the process. By aligning with the developmental stages of preschoolers, this method bridges the gap between abstract ideas and practical application, resulting in a more impactful and sustainable learning experience (Law et al., 2023; Mahat et al., 2016). Additionally, Abdul et al. (2023) found that project-based learning, which includes designated project areas, supports both academic and emotional development in children. Teachers emphasize the value of visual and hands-on learning tools, which improve children's comprehension of recycling concepts. Active learning opportunities and collaborative settings can spark creativity and deepen understanding. Teaching recycling at an early age not only equips children to contribute to a sustainable future but also cultivates a lifelong appreciation for nature and the environment (Bulut, 2020; Samuelsson, 2011).

5.2. Impacts on preschool children development on recycling in sustainable education

The teacher's perception of the impact of children's development on recycling in sustainable education aligns with The United Nations, which recognizes children as key agents of change in achieving the Sustainable Development Goals (SDGs) and building a sustainable future. This is supported by a study conducted by Melis et al. (2020), which found a positive correlation between positive childhood experiences and environmental awareness in adulthood. Other studies also support the teacher's perception of children's cognitive development, indicating that teaching recycling to children at an early age enhances their naturalist intelligence and fosters a sense of responsibility for their environment. These studies show that children not only refrain from littering themselves but also remind others to properly classify their garbage (Faridy and Rohendi, 2020).

Children learn by imitating what they see. Therefore, a recycling program was implemented at the school for a duration of six weeks. This program helped children develop the habit of recycling and become aware of the importance of recycled items. According to Herdiansyah et al. (2021), the knowledge children acquire at school can also influence their parents' knowledge. In a study by Hosany et al. (2022), it was found that children can influence their parents to become more conscious consumers. They can encourage sustainable behavior at home. Additionally, Liu and Green (2024) found that childhood experiences with nature

can affect career choices in adulthood as individuals develop emotional connections to nature. Norton et al. (2023) also conducted a study that showed that children who receive sustainable education are more likely to adopt positive behaviors in the future. Teaching sustainable development from a young age has numerous positive impacts on children, as these lessons and habits carry into adulthood. This aligns with the objective of the Sustainable Development Goals (SDGs), which is to create a sustainable future.

6. Conclusion

In conclusion, children play a crucial role in shaping a sustainable future. By educating them about sustainability, we not only teach them the values of environmental stewardship but also empower them to be proactive agents of change. Through learning about recycling, resource conservation, and sustainable living, children develop habits and mindsets that will guide their actions throughout their lives. Their involvement in sustainability efforts today lays the foundation for a more resilient and environmentally conscious society in the future. By nurturing their understanding and commitment, we invest in a generation that will lead the way toward a healthier planet for everyone. This research was conducted to examine teachers' perceptions and the impact of recycling activities and habits on children. Therefore, it is recommended that future research broaden the sample group and focus on public areas, particularly rural areas, to educate and raise awareness among children and communities.

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Compliance with ethical standards

Ethical considerations

This study was conducted in compliance with ethical guidelines for research involving minors. Informed consent was obtained from the parents or legal guardians of all participants. Anonymity and confidentiality were maintained, and activities were designed to avoid any harm.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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