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The Role of Early Childhood Education and Community Participation in Fostering Waste Management Awareness Among Young Children in Palembang City

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Abstract
Regulations and policies of Law of the Republic of Indonesia Number 18 of 2008 and its derivatives on Waste Management have ushered in a more comprehensive and integrated waste management system in Palembang City from upstream to downstream which includes waste reduction and processing activities. However, there are problems in maintaining the environment sustainably. Sustainable environmental development needs to optimize waste management from upstream (reduce, reuse, recycle) to downstream. This study aims to evaluate the extent and quality of waste management awareness among early childhood education students in Palembang City, and to assess the role of school-based curricula and parental participation in shaping that awareness. Specifically, it asks: (1) To what degree do students in Palembang understand core waste management concepts (sorting, reduction, recycling, composting)? (2) How do institutional and parental factors mediate or constrain that understanding? (3) What does the Paulo Freire's empowerment framework reveal about the transformative potential and limitations of current pedagogical practices? The research method used is a mix method, namely by combining quantitative and qualitative approaches. Data sources are from the results of interviews, observations and documentation studies. The results of the study revealed that waste management activities that have been taught by early childhood education teachers cannot all be understood by each student due to the age limitation to understand waste materials and their management, so it is necessary to invite parents to be involved in children's waste management activities and provide education related to practices that can be done at home.

Keywords
early childhood, environment, sustainable development, participation, waste management

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Introduction

Waste management is a systematic, comprehensive and sustainable activity that includes the reduction and handling of waste. Waste bank is one of the strategies to implement 3R in waste management at the community level (Pradiko et al., 2021). Waste has been reused or recycled for agricultural and farming purposes for centuries. The modern lifestyles and mass consuming patterns have shorten the material life cycle and made daily collection a necessary routine. The practices of recycling have been transformed together with the waste recovery industry to catch up with the consumption process. At the same time, it developed an exchange value in the market economy realm despite of its repulsive nature (Singhirunnusorn et al., 2011). Sustainable solid waste management

of household is a challenging task. It needs a change in public behavior to minimize the volume of their waste and the same time will increase the recycling rate. According to the United States‟ Environmental Protection Agency, recycling can be defined as "the series of activities by which materials that are no longer useful to the generator are collected, sorted, processed, and converted into raw materials and used in the production of new products." The success of any recycling program depends highly on people participation actively and sorting activities. An individual behavior changes occur when the individual is aware of the problem or need that gives individuals an initial reason or incentive to follow a particular course of action. Normally the awareness is raised by external factors such as experience of peers (Direktorat Riset dan Inovasi Institut Teknologi Bandung, 2020).

The change of waste management paradigm becomes an important thing to do, as a step adaptation to the increasing rate of waste generation every year in Indonesia. 100% management target has been divided into two parts, namely the reduction (30%) and waste handling (70%). Reductions focus on source limitation and 3R program optimization, whereas handling involves collecting and final processing activities. However, the current level of waste reduction is still very low (11%), the government made various efforts to increase it, one of its with the waste bank program (Putra et al., 2013).

Regulations and policies of the City of Palembang related to the waste management system continue to improve comprehensively and integrated from upstream to downstream. Various efforts continue to be made, including waste reduction and processing activities that are able to provide benefits to the community and are safe for the environment. This situation has proven to be able to lead the City of Palembang to get the *Adipura* award in 2023 for the 13th time. Various efforts have been made, one of which is the establishment of a waste bank, but it has not been fully implemented due to low public awareness, so there is a need for environmental education from an early age (Rahmayanti et al., 2024). Today, many people are less concerned about their surroundings, by still often littering, which results in the accumulation of garbage on roads, rivers, and other places (Fariz et al., 2023). Sustainable waste management requires a form of sustainability through increasing public awareness and new initiatives (Nizar et al., 2018), so that the progress of improving the quality of the waste system in Palembang City can continue to increase.

Education about waste management is part of the cognitive aspect, which includes the thinking process, related to the child's ability to associate, assess, and consider various events or occurrences. One of the important cognitive abilities that can be related to development is science skills in early childhood (Wulandari & Yaswinda, 2023). The existence of waste management education and environmental awareness can play a role in improving cognitive abilities and relating children's science skills. Another issue is the inconsistent implementation of policies at the local level. Despite the existence of national regulations on waste management, many local governments lack the capacity or resources to enforce them. In addition, the absence of a clear regulatory framework for the informal sector creates challenges for policy coordination. Informal workers operate outside the formal system, making it difficult to monitor and regulate their activities.

Strengthening the capacity of local governments is essential to ensure effective policy implementation. Community participation is a key factor attaining the goal of solid waste management (SWM). In developing countries, community participation plays an important role in achieving SW management. In developing countries with large population, the human resource is the potential resource for development. Human resources play the key role in management in developing countries (Dhokhikah et al., 2015). One of the real ways to improve environmental sustainability and prevent

environmental damage is to instil the values of character education in early childhood (Atthar et al., 2022), So that there will be efforts to repair existing damage and continuously preserve the environment (Maskuroh et al., 2023).

Awareness and love for the environment must be formed in children from an early age, because children are autonomous individuals who have the potential to form a character (Farahdiba et al., 2023). It is important to develop sensitivity to the importance of caring, managing, and utilizing the environment in their daily lives (Ramdani, 2022). Early childhood can easily receive learning, so understanding the negative impact or danger of environmental damage (Borman & Purwanto, 2019) can be easily understood by children. Early childhood is in a unique stage of growth and development (Rahmayanti et al., 2020). The existence of early childhood education in Palembang City is a necessity to realize public awareness in the future.

Teaching to early childhood can be carried out through various stages. The first stage starts from the prevention of waste production, so that the waste produced can be reduced and will be simpler (Rahim, 2020), Because of the lack of harmful substances in the garbage. Waste reduction also teaches children about the impact of waste hoarding on health and environmental consequences (Nurseptaji & Prasetio, 2021). Children need to have knowledge of how to keep the environment clean (Lando et al., 2022). Teaching children to sort and dispose of garbage in its place can be an effective first step in forming the habit (Kurniati et al., 2020).

Effective waste management requires community involvement, so it is important to introduce the concept of waste management from an early age. Thus, when they grow up, they will understand the importance of good and correct waste management (Hansen & Yuliawati, 2019). Through an approach that listens to children's aspirations, so that it can create an educational environment that is more productive (Ärlemalm-Hagsér & Sandberg, 2011). Although currently, early childhood education teachers still find several problems such as the amount of plastic waste in the environment has not been properly utilized, lack of knowledge on how to process and utilize plastic waste as an environmentally friendly learning medium, and the character of loving the environment in children cannot develop independently (Palupi et al., 2020). The existence of waste management education can start from the scope of schools, as a learning medium that is easily understood by early childhood, as well as answering waste problems at the school and household levels.

Despite the growing body of literature on environmental education and community participation in waste management, empirical evidence on how early childhood education institutions in Indonesian secondary cities shape waste-related attitudes and behaviors among children under six remains limited. Most existing studies focus on adult or school-age populations, and few systematically examine the interaction between school-based pedagogy and parental reinforcement in forming waste awareness at the preschool stage. The present study addresses this gap by investigating the current state of waste management awareness across 11 Early childhood education institutions in Palembang City, analysing the role of curriculum design and parental participation, and drawing on Paulo Freire’s empowerment theory to evaluate whether current practices constitute surface-level instruction or the beginnings of transformative environmental consciousness.

Literature Review

The developmental trajectory of environmental awareness in early childhood can be understood through Vygotsky’s (1978) sociocultural theory and the concept of the Zone of Proximal Development (ZPD). In the context of waste education, the ZPD implies that a child’s current level of independent waste-management behavior disposing of waste in

any available bin can be extended, through guided interaction with teachers and parents, to more cognitively demanding practices such as sorting by category or estimating decomposition time. The scaffolding role of teachers (through structured modules) and parents (through reinforcement at home) is therefore not merely supportive but constitutive: it is through these interactions that higher-order environmental competencies are constructed. This theoretical lens is consistent with empirical findings from environmental education research showing that young children who receive co-guided waste-sorting activities demonstrate significantly better sorting accuracy than those who receive only verbal instruction (Samuelsson & Carlsson, 2008). Importantly, Vygotskian theory also explains why composting an abstract, temporally distant process is harder to teach than bin disposal, which provides immediate sensory feedback: the ZPD for composting is wider, requiring more intensive scaffolding and concrete experience to bridge.

Findings from previous studies illustrate the interconnections between community involvement, participatory methods, waste banks, and their success and challenges. Community involvement constitutes a form of public participation that supports circular economy activities, delivering tangible benefits to society. Public participation in waste management represents both social innovation and a form of green technology. Waste banks exemplify an institutional arrangement that actively involves communities in waste management, particularly in Indonesia. Nevertheless, waste bank operations still face challenges related to environmental policies, stakeholder collaboration, and the integration of technology (Sufianti et al., 2025).

Data collection was guided by the Empowerment Theory, the Empowerment Theory was developed by Paulo Freire (Valoura, 2017). This theory states that the key to participation lies in critical consciousness, dialogue, and critical reflection that are embedded in the community. The explanation related to the theory of community empowerment will be illustrated in table 1 below:

Tabel 1.
Framework The Empowerment Theory by Paulo Freire

Component	Operational Indicator
Dialogue	Teacher–child two-way discussions about waste in the classroom; HIMPAUDI sessions involving both educators and parents; children's verbal responses to waste-sorting activities.
Critical reflection	Children's ability to articulate why littering is harmful (questionnaire Q: 'dangers of waste'); teachers' self-assessment of whether module content produces conceptual change; parental recognition of limits in children's understanding at home.
Collective action	Participation in 'Ant Operation' (Friday waste collection); parent–school collaboration in home waste sorting; HIMPAUDI advocacy for government facility provision; school–Environmental Agency socialization partnerships.

Source: Rad (2020)

Next, the process of the community empowerment process using the empowerment theory can be seen in Figure 2:

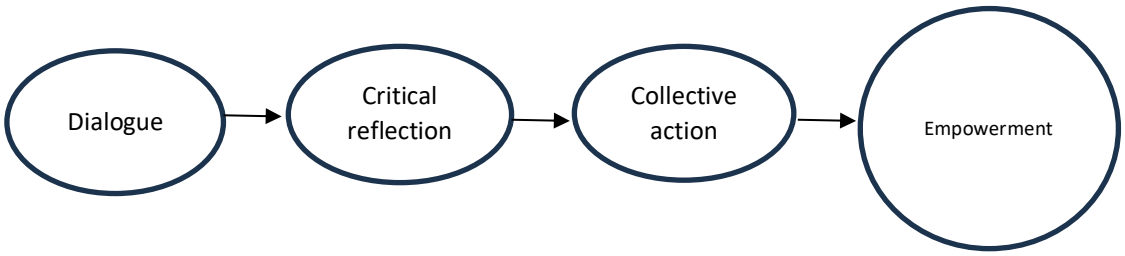

Figure 1.
Framework The Empowerment Theory by Paulo Freire
Source: Rad (2020)

Complementing the Freirean framework at the community level, Bronfenbrenner's (1979) ecological systems theory offers a developmental architecture for understanding how environmental awareness is formed within and across the multiple contexts that surround young children. At the microsystem level, the school and the home are the primary sites in which waste management behaviors are modelled, practiced, and reinforced. The mesosystem the quality of interaction between these two microsystems is therefore critical: where home practices align with school teaching, children receive consistent environmental cues that consolidate habit formation. At the ecosystem level, government provision of waste infrastructure (bins, waste banks, environmental education policy) and HIMPAUDI's institutional advocacy shape the material and normative conditions within which school and home microsystems operate. The macrosystem, encompassing community values about cleanliness, responsibility, and environmental care, determines whether waste management is culturally framed as a collective obligation or an individual burden. This multi-level model helps explain why improving only the school curriculum a microsystem intervention is unlikely to produce sustained behavioral change without corresponding support from family practices (mesosystem), government infrastructure (ecosystem), and community norms (macrosystem).

When these three components can be optimized, the outcome will be community empowerment that can produce significant and tangible impacts. According to Paulo Freire, empowerment is a process of liberating education, where individuals and communities develop critical consciousness through a process of dialogue, reflection, and concrete action (praxis). Empowerment is not merely a transfer of knowledge, but a process of social transformation that positions the community as the subject of development.

Method

This study employs a convergent parallel mixed-methods design (Creswell & Zhou, 2016), in which quantitative and qualitative data are collected simultaneously, analyzed separately, and then merged at the interpretation stage to produce a more complete understanding of waste management awareness among Early Childhood Education students in Palembang City. A mixed-methods approach is warranted here because the research questions require both the systematic measurement of awareness levels across institutions (addressed through structured questionnaires) and the contextual explanation of the factors that shape those levels (addressed through semi-structured interviews and observation). The quantitative strand generates breadth across 11 schools; the qualitative strand generates depth through purposive engagement with teachers, school principals,

and HIMPAUDI representatives. Findings are integrated by using the qualitative data to explain patterns, outliers, and unexpected results emerging from the quantitative data. 11 Early Childhood Education institutions (Kindergartens) in Palembang City were selected through purposive sampling, using the official registry of the Palembang City Education Office (Dinas Pendidikan Kota Palembang) as the sampling frame.

Selection criteria included: (1) institutional status as a formally registered Kindergarten; (2) geographic distribution across urban sub-districts to capture variation in socioeconomic context; and (3) availability of a functioning waste management curriculum or related environmental education initiative. This approach was chosen to ensure that sampled schools had sufficient curricular engagement with waste education to generate meaningful data, while maintaining geographic representation across the city. School selection for the quantitative strand was conducted through purposive sampling from the Palembang City Education Office registry. For the qualitative informant strand, snowball sampling was applied to identify individuals with specialist knowledge of Early Childhood Education waste education beyond the school level specifically HIMPAUDI representatives, local government officers, and NGO practitioners. This two-stage sampling strategy recognizes that while schools are easily enumerable, expert practitioners in environmental education networks are a less visible population for whom snowball referral is appropriate. The initial participant, namely the authorities in Palembang City, provided recommendations for other individuals or groups that could be contacted by researchers to be asked for information about early childhood education and their concern for waste in Palembang City. Thus, the network of participants develops like a rolling snowball, resulting in a larger sample.

Data were collected using three instruments. First, a structured teacher or principal questionnaire consisting of items assessed each school's curriculum content, pedagogical activities, physical waste infrastructure, and teachers' observations of student understanding. Items used a binary response format (yes/no) supplemented by open-ended elaboration prompts. Second, a parent questionnaire of items assessed household waste management practices and parental involvement patterns, also using binary and frequency-scale response formats. Both instruments were reviewed by two Early Childhood Education specialists for content validity and piloted at one school not included in the main sample. Third, semi-structured interviews were conducted with school principals, HIMPAUDI representatives, and Palembang City Environmental Agency officers. An interview guide of open-ended questions was used; interviews were conducted in Bahasa Indonesia, audio-recorded with participant consent, and transcribed verbatim. Bin condition data (Table 2) were classified according to a three-level rubric (Good/Moderate/Poor) developed by the research team based on three observable criteria: physical condition of bin, separation of waste types, and cleanliness of the surrounding area. Classifications were verified by two researchers independently, with discrepancies resolved through discussion.

Quantitative data from teacher/principal and parent questionnaires were analyzed using descriptive statistics (frequencies and percentages), disaggregated by school to enable school-level comparisons. No inferential statistics were applied given the non-probability sampling design and the exploratory nature of the study. Qualitative interview data were analyzed using directed content analysis, in which a priori codes corresponding to the three Freirean components: Dialogue, Critical Reflection, and Collective Action were applied to the transcripts. Additional inductive codes were generated where data did not fit the a priori framework. Coding was conducted by two researchers independently, with a Cohen's Kappa inter-rater reliability coefficient calculated to assess coding consistency. Integration of the two strands was achieved through a convergent joint display (Creswell & Zhou, 2016), in which quantitative findings for each thematic domain

were placed alongside corresponding qualitative excerpts to identify areas of convergence, divergence, and complementarity.

Results and Discussions

Fragmented policies and weak interagency coordination continue to hinder waste management efforts in Indonesia. The findings on low community participation in waste recycling align with previous studies that highlight the importance of awareness and infrastructure in promoting recycling behavior. The awareness of waste management among early childhood education children in Palembang City was obtained from the results of interviews and questionnaires conducted with Early childhood education teachers and school principals in Palembang City. The early childhood education schools used as samples in this study consisted of 11 schools, including: early childhood education Aisyah, Early childhood education Al-Kautsar, TK Arimibi, TK Dewi Sartika, TK Handayani, TK Pembina 1, TK Pembina 2, TK Pembina 3, TK Pembina 4, TK Pembina 5, TK Pembina 6, dan TK Pembina 7.

One form of curriculum and character building has been implemented by several early childhood education Early childhood education schools. Environmental education is an essential element that needs to be applied and taught in schools, with the main goal of shaping students into individuals who are sensitive and caring toward nature and their surrounding environment (Handayani et al., 2021). This is exemplified in the teaching module (project-based learning) at TK Negeri Pembina 2 in Palembang City with the theme "I Love the Earth." The topic raised in this project-based learning is "Making a Trash Bin from an Ice Cream Container." The goal of this project activity is to introduce children to the concept of reusing materials and disposing of waste properly. This material is part of a socialization effort to continually enhance public understanding of waste management (Mardhanita et al., 2021).

The module was conducted over 4 days through several stages: the first stage involved explaining trash disposal and the benefits of recycled materials. The second stage provided information and introduced the tools that would be used. The third stage involved watching educational videos or images on how to paint and color correctly using recycled materials. The final stage was a hands-on practice of painting used ice cream containers with markers (Figure 1). The use of visual media, role-playing activities, and practical experiences can encourage behavior change in children regarding proper waste disposal, raising awareness about its importance, and fostering environmental cleanliness (Moerad, 2009).

Based on these conditions, it shows that several Early childhood education schools have implemented education through modules that teach students to love the environment. This condition serves as a good first step in introducing Early childhood education students to the basic understanding of sustainable waste management. Although the material about waste management has been delivered, it has not had a significant impact on the students' knowledge of how to manage waste (Manyullei et al., 2022), therefore, consistent practical activities are needed.

Waste Awareness in Practice: Survey Findings Across 11 Early Childhood Education Institutions

The manifestation of the role of waste management education can be observed through the daily activities of early childhood education students in Palembang City. Shaping children's character cannot be achieved through just one or two activities, but must be instilled continuously and consistently (Hariadi, 2015). The results obtained from the questionnaire show that there are still 4 out of 11 Early childhood education schools in Palembang City, or about 33.3% of the schools, where the majority of children are

unaware of the difference between natural waste and human-made waste. Natural waste includes vegetable scraps, fruit peels, leaves, and fallen branches. On the other hand, human-made waste includes ash, plastic, paper, cans, and others. This indicates that children's knowledge about the difference between natural waste and human-made waste is not yet widespread across all Early childhood education schools in Palembang City, making it difficult to implement waste management practices based on waste sorting into designated waste bins.

Based on the questionnaire that was conducted, 100% of children in all Early childhood education schools are aware of the correct waste disposal bins. This indicates that all Early childhood education children in Palembang City understand that when they dispose of waste, it must not be thrown carelessly but placed in the designated trash bins. This shows that Early childhood education children in Palembang City have developed a sense of waste awareness and are able to dispose of waste in the provided bins. Knowledge of proper waste disposal is reinforced through activities like the "Ant Operation," where on Fridays, children collect trash and dispose of it in the bins provided. Five of the eleven schools (41.7%) had students who could not identify the correct bin by waste type (organic, inorganic, or B3). Notably, three of these five schools are classified in the 'Poor' infrastructure category in Table 2, where bins are unseparated and the surrounding areas are unclean. This pattern suggests that the physical waste environment mediates children's ability to practice sorting: without differentiated bins present in the school setting, sorting behavior cannot be reinforced regardless of curriculum content. This finding is consistent with the environmental affordance literature, which holds that children's prosocial behaviors are facilitated or constrained by the physical environments in which they are embedded. It also echoes Freire's insistence that genuine learning arises from praxis the interaction of reflection and material action rather than verbal instruction alone. Where the material infrastructure for waste sorting is absent, the dialogic conditions for critical consciousness cannot be met. The existence of waste sorting is crucial, as this process is the starting point for sustainable waste management (Putra et al., 2023).

Of the 11 total Early childhood education research samples, 100% of the Early childhood education samples have trash bins. However, their conditions vary. These conditions are divided into three classifications: Good (25%), Moderate (41.7%), and Poor (33.3%)

Actually, all the teachers in Early childhood education have already taught these concepts, but due to the young age of the children, not everything conveyed by the teacher can be fully understood and applied by all the students. Based on the questionnaire conducted, 8 out of 11 schools, or about 66.7%, of Early childhood education students are unaware of the types of waste that cannot decompose. In this case, the waste that cannot decompose refers to inorganic waste. This could increase the tendency of children to dispose of waste improperly, without considering the type of waste bin available.

According to the survey, only 1 out of 11 Early childhood education schools, or 8%, of students were unaware of the dangers of waste to the environment if it is disposed of carelessly. Therefore, it can be said that nearly all Early childhood education schools' students are aware of the dangers of waste when disposed of improperly. This understanding helps increase the Early childhood education children's awareness of waste, encouraging them to always keep the environment clean by not littering. Based on the questionnaire, 16.7% or 2 out of 11 Early childhood education schools still have students who do not understand the benefits of reducing plastic waste. However, 83.3% of Early childhood education schools in Palembang city have students who are already aware of the benefits of reducing plastic waste. With the high level of understanding of

Early childhood education children regarding the benefits of reducing plastic waste, it can also improve their awareness of waste management.

Tabel 2.
Table of Early childhood education Grouping Based on Waste Bin Availability

No	Tittle	Classification
1	TK Pembina 1	Good Category (Waste is separated into organic and inorganic)
2	TK Pembina 2	Good Category (Waste is separated into organic and inorganic)
3	TK Al- Kautsar	Good Category (Waste is separated into organic and inorganic)
4	TK Pembina 4	Moderate Category (The area around the trash bin is clean, but the waste has not been separated according to its type)
5	TK Pembina 5	Moderate Category (The area around the trash bin is clean, but the waste has not been separated according to its type)
6	TK Pembina 6	Moderate Category (The area around the trash bin is clean, but the waste has not been separated according to its type)
7	TK Aisyah	Moderate Category (The area around the trash bin is clean, but the waste has not been separated according to its type)
8	TK Dewi Sartika	Moderate Category (The area around the trash bin is clean, but the waste has not been separated according to its type)
9	TK Pembina 3	Poor Category (Poor facilities, waste not separated according to type, the area around the trash bin is dirty)
10	TK Pembina 7	Poor Category (Poor facilities, waste not separated according to type, the area around the trash bin is dirty)
11	TK Arimbi	Poor Category (Poor facilities, waste not separated according to type, the area around the trash bin is dirty)

Sources: Analysis 2025

Based on the questionnaires conducted, 50% of Early childhood education schools in Palembang City have children who already understand the concept of recycling or reusing plastic waste. This understanding of recycling mostly starts with using waste as teaching aids, such as using Yakult bottles filled with various objects (sand, rice, etc.) to produce different sounds. This approach helps increase young children's awareness about waste, showing that not all waste needs to be immediately discarded; instead, it can be repurposed through recycling

Based on the questionnaire, 75% of ECE schools have children who are not yet aware of how to reduce plastic waste through waste bank programs. From a Freirean perspective, this finding is not simply a knowledge deficit; it reflects the absence of meaningful dialogue between the institutional waste economy and children lived experience. Without concrete, tangible interactions with waste bank activities what Freire would term praxis children cannot develop the critical consciousness necessary to connect their individual waste behaviors to wider community and economic systems (Paul & Quiggin, 2020). This is due to the difficulty young children have in understanding this concept, as there are no direct examples of it. The presence of waste banks can support and foster entrepreneurial values, allowing children to learn the value of recyclable waste (Kristanto et al., 2013).

This result can serve as a reference that there is still a need for education on this matter to increase the environmental awareness of young children, so that they can understand that waste also has economic value if they save the waste they have. This will prevent

them from indiscriminately throwing away trash and encourage them to participate in reducing waste that is not reused. Based on the questionnaire conducted, many children are still unaware of composting, with about 83.3% of Early childhood education schools in Palembang City not knowing about it. The compost referred to here is made from dry leaves or organic waste. With this result, the knowledge of children about the benefits of organic waste, such as its use as compost fertilizer, can be improved, enabling young children in Early childhood education to engage in organic waste processing in the future and avoid burning or throwing away dry leaves.

Non-governmental organizations (NGOs) and community leaders emphasized the importance of grassroots initiatives in promoting recycling. Many NGOs are already working to educate communities and support informal workers, but they face resource limitations. Youth organizations are institutions that gather all the potential of young people, both students and school children who are included in the youth category, even those who are not educated become educated children. This youth organization stands together with a vision and leadership structure, culture and a model for actualizing its ideas and ideas (Praja et al., 2021). In addition to conducting interviews with teachers and headmasters of Early childhood education schools in Palembang City, interviews were also conducted with HIMPAUDI (Indonesian Association of Early Childhood Educators and Education Personnel) in Palembang City as part of the effort to foster waste awareness among young children in Palembang. The key points from the interviews are as follows:

1. HIMPAUDI strongly supports the plan for early childhood waste awareness education in Palembang City, seeing that waste significantly impacts environmental sustainability. HIMPAUDI Early childhood education aims to collaboratively instill waste awareness in children, which can be supported through activities such as socialization with teachers, parents, and children. This socialization can also be carried out in collaboration with the Palembang City Environmental Agency, with a minimum of twice per semester.
2. According to HIMPAUDI Early childhood education, at the very least, young children in Palembang City should first learn about the basic 5M concept to be applied, which includes reducing waste, sorting waste, reusing waste, recycling, and saving waste.
3. The appropriate method to increase early childhood awareness in waste management is through watching animated videos about the consequences of littering, or by taking them to waste disposal sites while also teaching them about the dangers of improper waste disposal.

Several critical supporting factors enable the capacity for joint action among stakeholders. One of the foremost is the commitment from government agencies and community groups, which manifests in active participation and resource allocation. The presence of clear leadership roles and responsibilities further strengthens collaborative efforts. The availability of institutional frameworks that encourage stakeholder engagement also plays a vital role. These frameworks facilitate communication channels and set mechanisms for cooperation, enabling stakeholders to align their goals and coordinate actions effectively (Gede et al., 2025).

Collective Action

The role of local leaders and community organizations is also critical in promoting participation. However, the study found that many community leaders lack the resources and training to effectively advocate for recycling. Finally, cultural attitudes toward waste management also play a role in low participation rates. In some communities, waste is seen as a low-priority issue, and recycling is not considered a social norm. Changing these

attitudes will require long-term efforts, including public awareness campaigns and the involvement of religious and community leaders to promote recycling as a collective responsibility (Sihaloho & Rusliadi, 2025).

Parental involvement in household waste management was reported at high levels: all respondents (100%) indicated that they had introduced waste management practices to their children, and 85.7% reported that their children engage in such practices 'very frequently'. These figures suggest a strong base of social capital for waste education in the domestic sphere (Mukaromah & Kusumastuti, 2021). However, the data do not distinguish between surface-level behavioral compliance (e.g., placing waste in a bin when prompted) and deeper attitudinal formation (e.g., independently initiating waste sorting or articulating reasons for doing so). (Dhokhikah et al., 2015) distinguish between 'passive' participation (following instructions) and 'active' participation (initiating, advocating, problem-solving) in household solid waste management a distinction this study's parent data cannot currently resolve but which future research should address through longitudinal or observational designs. The finding that all parents (100%) are willing to involve their children in school waste activities is a strong indicator of social readiness for deeper program integration, but willingness alone does not constitute participation. A follow-up study tracking actual school–home activity linkages over time is warranted. Therefore, data collection was conducted through questionnaires distributed to the parents of students at early childhood education centers in Palembang City. The results of the questionnaire show that all the children have been practicing waste management, but with varying frequencies. Some children occasionally manage waste (14.3%), while others have developed the habit and do so very frequently (85.7%). This is certainly a positive sign that children have shown awareness through the habit of throwing their waste in the designated bins at home, with no children reported as never participating in waste management by disposing of waste in the provided trash bins.

Based on the interview results, children have already been practicing waste management at home, starting from disposing of waste in the designated bins according to its type, where leaf waste is not mixed with plastic, rubber, and paper waste. According to the questionnaire conducted, all parents (100%) have instilled the habit of waste management in their children. Parents have been teaching practices such as separating organic and non-organic waste at home, teaching children to use the correct waste bins, and recycling items that can be recycled. In addition, parents have also involved their children in activities to clean the home environment from waste such as dry leaves and others. Based on these results, it can be concluded that parents have been actively involved in fostering waste awareness in their young children. The presence of parents is expected to help address the main issues related to waste, including incorrect paradigms, inappropriate behaviors, and low levels of awareness (Simatupang et al., 2021).

Based on the questionnaire conducted, all parents (100%) are willing to have their children involved in waste management activities at school. Parents are supportive of waste management activities at their children's schools because they recognize the positive benefits. They believe that involving children in waste management will foster environmental awareness from an early age, teach values of responsibility, and encourage care for sustainability. Taken together, the parental questionnaire data and HIMPAUDI interview findings suggest that Palembang's Early childhood education waste education ecosystem has begun to cultivate the first stage of Freirean collective action: stakeholders are aware of the problem and are engaging in coordinated, if not yet critically reflective, responses. The 'Ant Operation' and module-based hands-on activities represent embryonic forms of praxis the unity of reflection and action Freire identifies as essential to genuine empowerment. However, the persistence of low awareness in areas such as composting (83.3% unaware) and waste bank participation (75% unaware) signals that

current practices have not yet crossed the threshold into transformative critical consciousness. Deepening these activities through structured dialogue, community problem-posing, and increased family involvement could help bridge this gap.

Conclusion

Based on the results of identification and analysis of several Early childhood education schools, it shows the schools' readiness in fostering sustainable waste management awareness among young children as follows:

In the curriculum and character building, several schools have introduced waste management and environmental love. Several stages have been carried out, starting from the delivery of the material to the colouring practice, as an effort to provide students with the experience of learning about waste management.

Besides through the curriculum, a consistent form of enhancing children's understanding is realized through daily practical activities. Based on the survey results, it shows that there are still some limitations in the children's understanding of waste management. Children's understanding of waste processing, especially products like compost, is still very limited. This condition is due to the limitations of early childhood education children in comprehensively understanding waste management. In addition to the role of education and practices at school, the presence of parents as the closest community is crucial. All parents have provided education at home for their children in waste management practices. The presence of parents and children who consciously engage in sustainable waste management becomes a positive social capital in supporting sustainable development (Mukaromah & Kusumastuti, 2021).

The role of early childhood education in fostering awareness of waste management in Palembang City has shown success based on the efforts that have been made. Although some conditions are still found that have not been fully implemented by young children, several identified aspects indicate that the children have an understand of sustainable waste management. In the development and significant improvement provided, there is a need for intensification of more engaging learning media to make it easier to understand. The role of early childhood education in fostering awareness of waste management in Palembang City has demonstrated success based on the efforts that have been made. Although there are still some conditions that have not been fully implemented by early childhood children, several identified aspects indicate that the children understand sustainable waste management. Viewed through Freire’s empowerment framework, this study’s findings reveal a system in early formation. Evidence of dialogue is present in teacher–student interactions and parental reinforcement at home, though it remains largely one-directional (teacher to child) rather than genuinely dialogic. Critical reflection the capacity to understand the structural causes of waste problems and one’s role within them is nascent at best: children demonstrate awareness of consequences (nearly all understand the dangers of littering) but lack conceptual depth in areas like waste categorization and circular economy practices. Collective action is most visibly present in community-level partnerships between schools, parents, and HIMPAUDI. To advance from compliance to conscientization, future initiatives should prioritize problem-posing pedagogy, iterative dialogue with families, and experiential encounters with waste recovery systems such as waste banks. The local government’s continued investment in infrastructure particularly in improving trash bin quality and availability is a necessary, if not sufficient, precondition for this transformation. The recommendation given to foster waste awareness among early childhood in Palembang is that the local government should consider providing facilities in the form of trash bins to address the limited availability of trash bins and prevent improper waste disposal. Additionally, there is a need to enhance

waste education for parents, with the aim of encouraging them to focus more on teaching children to dispose of waste properly and maintain cleanliness.

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Declaration of conflicting interests

There is no conflict of interest in this research.

References

Adak, P., Sahu, R., & Elumalai, S. P. (2016). Development of emission factors for motorcycles and shared auto-rickshaws using real-world driving cycle for a typical Indian City. *Science of the Total Environment*, 544, 299–308. https://doi.org/10.1016/j.scitotenv.2015.11.099

Atthar, A., Sari, M., Suryawan, I. W. K., Septiariva, I., Suhardono, S., & Sianipar, I. (2022). Repercussions of the COVID-19 pandemic on medical waste management. *International Journal of Public Health Science (IJPHS)*, *11*, 949. https://doi.org/10.11591/ijphs.v11i3.21517

Dhokhikah, Y., Trihadiningrum, Y., & Sunaryo, S. (2015). Community participation in household solid waste reduction in Surabaya, Indonesia. *Resources, Conservation and Recycling*, *102*, 153–162. https://doi.org/10.1016/j.resconrec.2015.06.013

Direktorat Riset dan Inovasi Institut Teknologi Bandung. (2020, February 27). *Seminar Nasional Teknologi Industri Hijau 3 Tahun 2020*. https://dri.itb.ac.id/seminar-nasional-teknologi-industri-hijau-3-tahun-2020/

Farahdiba, A. U., Warmadewanthi, I. D. A. A., Fransiscus, Y., Rosyidah, E., Hermana, J., & Yuniarto, A. (2023). The present and proposed sustainable food waste treatment technology in Indonesia: A review. *Environmental Technology & Innovation*, *32*, 103256. https://doi.org/10.1016/j.eti.2023.103256

Fariz, R., Rachman, I., & Matsumoto, T. (2023). Municipal solid waste management in regency area in Indonesia: a review of Deli Serdang. *IOP Conference Series: Earth and Environmental Science*, *1263*, 12065. https://doi.org/10.1088/1755-1315/1263/1/012065

Sentanu, G. E. P. S., Yustiari, S. H., Nirmalasandy, M., Ferdiansyah, R., & Aulia, R. S. (2025). Collaboration as a capacity for joint action in community-based cultural heritage tourism management. *Kolaborasi: Jurnal Administrasi Publik*, *2025*(2), 120–140. https://doi.org/10.26618/xpncbf02

Handayani, P. H., Eza, G. N., Damanik, S. H., Zati, V. D. A., & Listia, W. N. (2021). Pendampingan guru paud dalam menyelenggarakan sekolah ramah lingkungan. *Jurnal Bunga Rampai Usia Emas*, *7*(2), 63. https://doi.org/10.24114/jbrue.v7i2.30519

Hariadi, H. (2015). Pengembangan pendidikan karakter dalam pendidikan jasmani dan olahragapada pendidikan anak usia dini. *PARAMETER: Jurnal Pendidikan Universitas Negeri Jakarta*, *27*(II), 93. https://doi.org/10.21009/parameter.272.01

John W Creswell, & Yuchun Zhou. (2016). What is mixed methods research? In Aleidine J Moeller, John W Creswell, & Nick Saville (Eds.), *Second language assessment and mixed methods research* (p. 350). Cambridge University Press.

Kristanto, M., Prasetiyawati, D., & Purwadi, D. H. (2013). Implementasi pendidikan kewirausahaan sebagai media pembelajaran melalui pemanfaatan limbah kdp (kertas, daun, dan plastik) paud di Kota Semarang. *Jurnal Penelitian PAUDIA*, *2*(1), 43–63.

Manyullei, S., Saleh, L. M., Arsyi, N. I., Azzima, A. P., & Fadhilah, N. (2022). Penyuluhan pengelolaan sampah dan phbs di sekolah dasar 82 barangmamase Kecamatan Galesong Selatan Kab. Takalar. *Jurnal Altifani Penelitian Dan Pengabdian Kepada Masyarakat*, *2*(2), 169– 175. https://doi.org/10.25008/altifani.v2i2.210

Mardhanita, D. C., Hilman, F. A., AS, M. F., & Fath, N. F. Al. (2021). Sosialisasi pengelolaan sampah plastik sebagai upaya mengurangi kebiasaan membuang sampah ke sungai di Kampung Cilaku. *Proceedings UIN Sunan Gunung Djati Bandung*, *1*(Desember), 93–101.

Maskuroh, N., Widyanty, W., Nurhidajat, R., Wardhana, I. W., & Fahlevi, M. (2023). Green human resource management and green supply chain management on sustainable performance of nickel mining companies in Indonesia. *Uncertain Supply Chain Management*, *11*(1), 203– 212. https://doi.org/10.5267/j.uscm.2022.10.006

Moerad. (2009). *Pendampingan Pelaksanaan Program Perilaku Hidup Bersih dan Sehat (PHBS) Anak Usia Dini - Pos PAUD Terpadu Melati Kelurahan Medokan Ayu - Rungkut Surabaya*. *36*.

Mukaromah, H., & Kusumastuti, K. (2021). Modal sosial dalam upaya pengelolaan sampah berkelanjutan di Kampung Iklim Joyotakan Surakarta. *Region : Jurnal Pembangunan Wilayah Dan Perencanaan Partisipatif*, *16*(1), 83. https://doi.org/10.20961/region.v16i1.34512

Nizar, M., Munir, E., Munawar, E., & Matseh, I. (2018). Implementation of zero waste concept in waste management of Banda Aceh City. *Journal of Physics: Conference Series*, *1116*, 52045. https://doi.org/10.1088/1742-6596/1116/5/052045

Paul, L. A., & Quiggin, J. (2020). Transformative Education. In *Educational Theory* (Vol. 70, Issue 5). https://doi.org/10.1111/edth.12444

Pradiko, H., Wahyuni, S., & Ganiy, W. (2021). Knowledge-attitude-practice method analysis as a guide for Kasomalang Kulon Village waste bank planning. *IOP Conference Series: Earth and Environmental Science*, *737*, 12074. https://doi.org/10.1088/1755-1315/737/1/012074

Praja, S. E., Munir, A. R., & Irwan, L. (2021). The role of youth force muhammadiyah (amm) in developing the suprastructure and youth infrastructure in knpi south sulawesi. *Kolaborasi: Jurnal Administrasi 7*(2), 254- 261. https://journal.unismuh.ac.id/index.php/kolaborasi/article/view/4300%0Ahttps://journal.unismuh.ac.id/index.php/kolaborasi/article/viewFile/4300/3793

Putra, H., Taufiq, A., & Juliani, A. (2013). Studi hubungan antara tingkat pendidikan dan pendapatan keluarga terhadap sikap dalam pengelolaan sampah rumah tangga (studi kasus di Desa Condongcatur, Depok, Sleman, Yogyakarta). *Jurnal Sains & Teknologi Lingkungan*, *5*, 91– 101. https://doi.org/10.20885/jstl.vol5.iss2.art3

Putra, I. M. Y. D., Paramitha, D. A. R. D., Adnyanaesa, P. B., Handita, I. G. A. D., Ariwangsa, I. G. N. O., & Laksmi, P. K. W. (2023). Pengedukasian pemilahan sampah organik dan anorganik pada anak-anak paud dan tk di desa tegallinggah, penebel tabanan. *Bubungan Tinggi: Jurnal Pengabdian Masyarakat*, *5*(1), 298. https://doi.org/10.20527/btjpm.v5i1.6464

Rad, D. (2020). *Literature Review for Hate Speech Perpetuation with Regards to Empowerment Theories -Freire's Theory of Empowerment or the Pedagogy of the Oppressed*. *Journal Pl*, 403–412. https://doi.org/10.24250/JPE/1/2020/DVR

Rahmayanti, R., Uii, M., & Johan, A. (2024). Does innovative work behavior matter for performance? green talent management and green servant leadership in the healthcare industry. *JBTI : Jurnal Bisnis : Teori Dan Implementasi*, *15*, 85–100. https://doi.org/10.18196/jbti.v15i1.21346

Samuelsson, I. P., & Carlsson, M. A. (2008). The playing learning child: Towards a pedagogy of early childhood. *Scandinavian Journal of Educational Research*, *52*(6), 623–641. https://doi.org/10.1080/00313830802497265

Sihaloho, U. O., & Rusliadi, R. (2025). Collaborative governance in plastic waste recycling in Medan City: Integrating informal sector, community participation, and policy. *Kolaborasi : Jurnal Administrasi Publik*, *1*(11), 26–37. https://doi.org/10.3390/kjap.v11i1.17422

Simatupang, M. M., Veronika, E., & Irfandi, A. (2021). Edukasi pengelolaan sampah : pemilahan sampah dan 3R di SDN Pondok Cina Depok. *Prosiding Hasil Pengabdian Masyarakat*, 34–38.

Singhirunnusorn, W., Donlakorn, K., & Kaewhanin, W. (2012). Contextual factors influencing household recycling behaviours: A case of waste bank project in mahasarakham municipality. *Procedia - Social and Behavioral Sciences*, *36*, 688–697. https://doi.org/10.1016/J.SBSPRO.2012.03.075

Valoura, L. (2017). *Paulo Freire, the Brazilian Educator, Author of the Term "Empowerment" in Its Transformative Sense 1*.