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Trash to treasure: Integrating waste management and financial literacy for sustainable behaviors

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ABSTRACT

The "Trash to Cash: *Jago Atur Uang, Jago Rawat Bumi*" program, conducted at SDN 008 Waru, Penajam Paser Utara Regency, East Kalimantan, Indonesia, aimed to enhance sixth-grade students' understanding of waste management and financial literacy through an interactive educational intervention. Targeting 30 students aged 11–12 years, the program integrated the eco-financial concept, transforming inorganic waste, such as plastic bottles and cardboard, into economic assets via waste banks, with proceeds encouraging savings habits. Employing an action research approach, the intervention utilized presentations, the "*Tebak Sampah*" game, and a waste value calculation quiz. The results demonstrated a significant increase in waste classification knowledge (from 40% to 85% accuracy), with 95% of students recognizing the economic value of recyclables and 80% accurately calculating waste-derived income. Qualitative findings indicated high engagement and intention to collect recyclables, suggesting potential behavioral changes toward sustainability. Challenges, including time constraints and classroom management, did not diminish the program's success in achieving its goals. This study contributes a novel framework for integrating environmental and financial education, offering a replicable model for primary schools to support the sustainable development goals.

Keywords: Waste Management, Financial Literacy, Eco-Financial, Interactive Education, Primary School Students

1. INTRODUCTION

The escalating global challenge of waste management has emerged as a critical issue, particularly in developing regions, where rapid population growth and increasing daily activities contribute to significant waste accumulation. In areas such as Kelurahan Waru, Penajam Paser Utara Regency, East Kalimantan, Indonesia, waste proliferation poses substantial risks to environmental integrity, public health, and overall quality of life. Improper waste disposal practices exacerbate pollution, contaminate water sources, and degrade ecosystems, underscoring the need for effective waste management strategies. Concurrently, limited financial literacy among young populations in these regions impedes the development of responsible economic behaviors, such as saving and prudent financial management, which are essential for sustainable development. Addressing these dual challenges, such as environmental degradation and economic illiteracy, requires innovative educational approaches that foster sustainable behavior from an early age. This study introduces the "Trash to Cash: *Jago Atur Uang, Jago Rawat Bumi*" program, an educational initiative designed to integrate waste management and financial literacy education for primary school students, utilizing an interactive approach to cultivate sustainable practices and economic awareness.

The significance of this topic lies in its alignment with the Sustainable Development Goals (SDGs), particularly those related to responsible consumption and production (SDG 12) and poverty alleviation through economic empowerment (SDG 1). Waste management education is vital for equipping young learners with the knowledge and skills to differentiate between organic and inorganic waste, understand recycling processes, and recognize the economic potential of waste through mechanisms such as waste banks. Similarly, financial literacy education in early childhood lays the foundation for informed decision-making, enabling individuals to manage resources effectively and contribute to economic stability. By integrating these two domains, the "Trash to Cash" program seeks to foster a holistic understanding of the interconnectedness between environmental sustainability and economic viability, nurturing responsible global citizens who are both environmentally conscious and financially prudent.

The primary research problem addressed in this study is twofold: the low level of understanding among primary school students regarding waste classification and its economic potential, which leads to the underutilization of recyclable materials, and the limited financial literacy among young learners, which hinders the formation of saving habits and responsible financial management practices. These issues are compounded by the lack of engaging, contextually relevant educational approaches that effectively combine environmental and financial education. In many developing regions, including Kelurahan Waru, children often perceive waste as valueless, contributing to improper waste disposal practices. Simultaneously, the absence of early financial education limits their ability to recognize the economic benefits of resource recovery, such as waste banks, which can generate income and promote sustainable economic practices.

The proposed solution is the "Trash to Cash" educational program, which employs interactive methods such as presentations, educational games, and quizzes to teach students about waste classification, the operational mechanisms of waste banks, and basic financial literacy principles, such as calculating the economic value of waste and savings. This program is designed to be engaging and relevant to the local context, leveraging the presence of active waste banks in Kelurahan Waru to provide practical examples of how waste can be converted into economic resources. By fostering active participation through games like "*Tebak Sampah*: *Bisa Ditabung atau Tidak?*" and practical exercises, the program aims to enhance students' engagement and retention of knowledge, making learning both impactful and enjoyable.

The current literature highlights significant gaps in educational interventions that integrate waste management and financial literacy for children. Research indicates that waste management education for primary school students in developing regions faces challenges such as inadequate teacher training, insufficient resources, and cultural misalignments in environmental awareness strategies (Kasjono et al., 2023; Masjhoer & Vitrianto, 2024). These factors hinder the development of effective curricula, limiting students' ability to adopt sustainable practices for waste management.

Similarly, financial literacy education is often overlooked in early childhood curricula, with most studies focusing on adult populations, despite evidence that early exposure to financial concepts fosters responsible economic behaviors (Aidong et al., 2022; Săseanu et al., 2019). The integration of these two domains through the eco-financial concept remains underexplored, particularly in rural settings such as Penajam Paser Utara, where contextualized educational approaches are scarce. Furthermore, educators often lack the training and resources to deliver integrated content, undermining the potential to develop environmentally responsible and financially literate young citizens (Huang & Zhangbao, 2023; Zhou et al., 2019). This study addresses these gaps by proposing a novel interactive educational model that bridges waste management and financial literacy tailored to the needs of primary school students in a rural context.

The novelty of this research lies in its integrative approach, combining waste management and financial literacy within a single educational framework for primary school students using the eco-financial concept as a unifying principle. Unlike previous studies that have addressed these topics separately, this study explores their synergy, demonstrating how waste can serve as an economic resource while fostering financial responsibility. The theoretical contribution includes the development of a conceptual framework for sustainable education that integrates environmental and economic principles and offers a replicable model for primary schools. Practically, this study provides a scalable educational intervention that can be adopted in other rural settings, supporting community-based waste management initiatives such as waste banks and contributing to local economic empowerment. By aligning with the SDGs, this research underscores the potential of early education to drive long-term environmental and economic sustainability.

The scope of this research is limited to the "Trash to Cash" program implemented at SDN 008 Waru, involving 30 sixth-grade students aged 11–12 years. The focus is on waste management education, specifically the classification and economic valuation of inorganic waste (e.g., plastic bottles, cardboard, and paper) through waste banks and basic financial literacy, emphasizing savings from waste-derived income. The program was conducted on July 22, 2025, with immediate post-intervention evaluation, excluding the long-term impact assessment. This study employed an action research approach, allowing researchers to actively participate in the design, implementation, and evaluation of the intervention, ensuring contextual relevance and practical applicability.

Community-based waste management initiatives, such as waste banks, have proven effective in promoting sustainable practices in rural areas by encouraging community participation and financial engagement (Vinti & Vaccari, 2022; Wu et al., 2022). In Kelurahan Waru, the presence of three active waste banks highlights the community's growing awareness of sustainable-WM. However, sustaining these initiatives requires educating younger generations to view waste as a resource with economic potential. By linking waste management to financial literacy, the "Trash to Cash" program addresses environmental challenges and empowers students to contribute to their communities' economic and ecological well-being. This study offers a pioneering approach to fostering sustainable behavior through education, with implications for both policy and practice in developing regions.

2. LITERATURE REVIEW

Integrating environmental sustainability and financial literacy within educational frameworks is a critical step toward fostering sustainable behavior among young learners, particularly in developing regions facing environmental and economic challenges. This study builds on the concept of eco-financial education, which seeks to combine waste management and financial literacy to promote sustainable practices among primary school students. The theoretical and empirical foundations for this integration are rooted in several key areas: Education for Sustainable Development (ESD), the impact of eco-financial education on behavior, the efficacy of interactive learning methods, and the role of community-based initiatives, such as waste banks, in promoting sustainability and economic empowerment. This literature review synthesizes these perspectives to establish a robust foundation for the "Trash to Cash: *Jago Atur Uang, Jago Rawat Bumi*" program, highlighting its relevance to sustainable development and identifying gaps that the current study aims to address.

Education for Sustainable Development (ESD) provides a foundational framework for integrating environmental and economic education. ESD emphasizes interdisciplinary learning, encouraging curricula that foster critical thinking and problem-solving skills to address complex sustainability challenges (Fiedler et al., 2023). By blending environmental education with economic considerations, ESD equips students with the knowledge and skills required to make informed decisions that balance ecological and economic priorities. Sousa (2022) argues that ESD promotes a holistic understanding of sustainability, enabling students to recognize the interconnectedness of environmental stewardship and economic viability. This framework is particularly relevant to primary school education, where early exposure to interdisciplinary concepts can shape lifelong sustainable behaviors. For instance, teaching children to view waste as a resource with economic potential aligns with ESD's goal of ESD to foster critical thinking about resource management. However, the application of ESD in developing regions, such as rural Indonesia, often faces challenges like inadequate teacher training and limited resources, which hinder the effective integration of such curricula (Zhou et al., 2019). This study leverages ESD principles to design an educational intervention that bridges waste management and financial literacy tailored to the local context of Kelurahan Waru.

The concept of eco-financial education, which links financial decision-making to environmental outcomes, is central to this study. By teaching students to recognize the economic value of waste through mechanisms like waste banks, eco-financial education fosters responsible consumption and resource management practices (Nurlila & Fua, 2022). This approach encourages students to view waste not as a burden but as an asset that can generate income, thereby promoting environmental sustainability and economic empowerment. Paolo & Pizziol (2023) demonstrate that when children understand the financial implications of ecological actions, such as recycling or reducing waste, they are more likely to adopt sustainable behaviors. Similarly, Rakhmawati et al. (2023) highlight that integrating financial literacy with environmental education enhances students' awareness of how their actions impact both the environment and their economic well-being. For example, understanding that selling recyclable materials to a waste bank can fund personal savings, instills a sense of agency and responsibility. However, the literature reveals a gap in the application of eco-financial education at the primary school level, particularly in rural settings, where access to such integrated programs is limited (Săseanu et al., 2019). This study addresses this gap by introducing an eco-financial framework tailored to young learners, emphasizing practical applications, such as waste banks, to foster sustainable behavior.

Interactive learning methods, such as gamification and hands-on activities, are critical for enhancing environmental awareness and financial literacy in children. These methods engage students by making abstract concepts relatable and memorable, thereby improving knowledge retention (Paolo & Pizziol, 2023). For instance, educational games that simulate waste classification or financial calculations allow students to apply theoretical knowledge in practical, real-world scenarios. Houmam & Ibourk (2023) argue that interactive approaches, such as role-playing or quizzes, foster positive attitudes toward sustainability by creating engaging and meaningful learning experiences. These methods are particularly effective for young learners, whose cognitive development benefits from experiential learning that connects theoretical concepts to tangible results. In the context of waste management, games that involve sorting organic and inorganic waste can enhance students' ability to categorize materials accurately, while financial literacy exercises, such as calculating the economic value of recyclables, reinforce mathematical and economic skills. However, the literature suggests that the effectiveness of interactive methods depends on teacher preparedness and resource availability, which are often lacking in rural schools (Huang & Zhangbao, 2023). This study employs interactive methods, such as the "*Tebak Sampah*: *Bisa Ditabung atau Tidak?*" game and price calculation quizzes to overcome these barriers by leveraging simple, low-cost materials and aligning with local waste bank practices.

Community-based waste management initiatives, particularly waste banks, play a pivotal role in promoting environmental sustainability and economic empowerment. Waste banks facilitate the collection and sale of recyclable materials, providing financial incentives that encourage community participation in waste management (Wu et al., 2022). By transforming waste into economic resources, these initiatives reduce landfill waste, promote recycling, and support circular economies in rural communities. Fayyaz et

al. (2023) highlight that waste banks not only mitigate environmental degradation but also empower individuals by generating income from recyclable materials, fostering a sense of economic agency. In rural settings such as Kelurahan Waru, where three active waste banks operate, these initiatives have increased community awareness of sustainable waste management. However, sustaining such programs requires ongoing education, particularly for younger generations, to ensure long-term behavior change (Vinti & Vaccari, 2022). Integrating waste bank concepts into school curricula can bridge this gap by teaching students to view waste as a valuable resource, thereby reinforcing community efforts. The literature indicates that while waste banks are effective, their impact on children's education is underexplored, particularly in terms of combining waste management with financial literacy (Kasjono et al., 2023). This study addresses this issue by incorporating waste bank principles into educational programs, linking environmental actions to financial outcomes.

Despite the growing body of literature on environmental and financial education, there are still significant gaps. Most studies on waste management focus on technical or policy-oriented solutions, with limited attention paid to educational interventions for children (Masjhoer & Vitrianto, 2024). Similarly, financial literacy research predominantly targets adult populations, overlooking the importance of early education in shaping economic behavior (Aidong et al., 2022). The integration of these two domains through an eco-financial approach has rarely been explored, particularly in the context of primary education in rural areas. Existing curricula often fail to address the economic potential of waste or the practical application of financial literacy in environmental contexts, limiting students' understanding of the intersection of these areas (Săseanu et al., 2019). Furthermore, educators in developing regions frequently lack the training and resources to deliver integrated educational content, undermining their potential to foster environmentally and financially literate citizens (Zhou et al., 2019). This study addresses these gaps by developing a contextually relevant, interactive educational program that integrates waste management and financial literacy, leveraging local waste bank systems to enhance its applicability.

The theoretical contributions of this study lie in its synthesis of ESD and eco-financial concepts to create a novel framework for primary education. By combining environmental and economic education, this study offers a model for fostering sustainable behavior that can be adapted to other rural contexts. Practically, the "Trash to Cash" program provides a scalable intervention that aligns with community-based initiatives, such as waste banks, offering a blueprint for educators and policymakers. The program's emphasis on interactive methods addresses the limitations of traditional teaching approaches, which often fail to engage young learners. By building on the strengths of ESD, eco-financial education, interactive learning, and community-based waste management, this study establishes a robust foundation for promoting sustainable behavior among primary school students, contributing to both environmental sustainability and economic empowerment.

3. METHODOLOGY

This study adopts a qualitative (Kesuma et al., 2025) action research approach to evaluate the effectiveness of the "Trash to Cash: *Jago Atur Uang, Jago Rawat Bumi*" program, designed to integrate waste management and financial literacy education for primary school students at SDN 008 Waru, Penajam Paser Utara Regency, East Kalimantan, Indonesia. The action research methodology was selected for its ability to engage researchers directly in the design, implementation, and evaluation of the intervention, ensuring contextual relevance and responsiveness to local educational and environmental needs. This approach aligns with the study's objectives of assessing the program's impact on students' understanding of waste classification, the economic value of waste, and financial literacy while developing a framework for sustainable education. By employing participatory and iterative processes, this study addresses the practical and theoretical dimensions of integrating environmental and financial education in a rural setting.

The action research design follows best practices in educational research, incorporating participatory action research (PAR) principles to foster collaboration among students, teachers, and community stakeholders, such as local waste bank representatives (Khan Soomro et al., 2025). PAR ensures that the intervention is grounded in the specific challenges of Kelurahan Waru, where waste

accumulation and limited financial literacy among young learners are pressing concerns. The iterative cycle of planning, acting, observing, and reflecting, as outlined by Viga Ramos et al. (2020), was utilized to refine the program's implementation, allowing for real-time adjustments based on observed outcomes and feedback.

The study targeted 30 sixth-grade students, aged 11–12 years, at SDN 008 Waru, selected due to their cognitive capacity to grasp abstract concepts like the economic value of waste and basic financial principles (Lubis et al., 2022). The intervention was conducted on July 22, 2025, with the support of teachers, the principal, and a local waste bank. This collaboration ensured alignment with community-based waste management initiatives, thereby enhancing the program's practical applicability.

The intervention was structured into three phases: preparation, implementation, and evaluation. In the preparation phase, educational materials were developed on waste classification (organic vs. inorganic), waste bank operations, and financial literacy, using age-appropriate content with visual aids such as slides and physical waste samples (e.g., plastic bottles and cardboard). Interactive tools, including the "*Tebak Sampah: Bisa Ditabung atau Tidak?*" game and a quiz on calculating waste value were designed to engage students actively (Paolo & Pizziol, 2023).

During the implementation phase, the program began with a presentation on waste management and eco-financial concepts, emphasizing how recyclable waste can generate income through waste banks (Nurlila & Fua, 2022). The "*Tebak Sampah*" game followed, where students worked in groups to categorize waste as recyclable or non-recyclable, promoting teamwork and critical thinking skills. The session concluded with a quiz requiring students to calculate the economic value of waste (e.g., 5 kg of cardboard at Rp3,000/kg). These interactive methods were chosen to enhance engagement and retention, as supported by Houmam and Ibourk (2023).

The evaluation phase used a mixed-method approach to assess the program's impact. Qualitative data were collected through participatory observations and field notes, capturing student engagement, interactions, and responses during the intervention. Participatory observation, as noted by Onsrud et al. (2022), provides rich insights into learning dynamics in real-world contexts. Quantitative data were gathered via pre- and post-tests to measure knowledge gains in waste classification, with each test comprising five questions (maximum score: five points). The quiz on waste value calculation provided additional quantitative data on the participants' financial literacy skills. Data analysis employed qualitative descriptive techniques to identify patterns in engagement and behavioral intentions, while quantitative data were analyzed to calculate the percentage of correct responses, providing measurable evidence of learning outcomes (Lubis et al., 2022).

Data validity and reliability were ensured through triangulation, cross-referencing observations, field notes, and test results, and involving multiple stakeholders (students, teachers, researchers) to verify findings (Ogura et al., 2020). Member checking with teachers confirmed the accuracy of qualitative insights, and reflexivity was maintained by documenting the researchers' roles to minimize bias (Evangelou, 2023). These strategies enhanced the study's credibility by addressing challenges common in action research with young learners.

The scope of this study was limited to a single session on July 22, 2025, focusing on immediate outcomes without longitudinal assessment. The intervention leveraged local waste banks to ensure contextual relevance, aligning with community-based sustainability efforts (Wu et al., 2022; Fayyaz et al., 2023). This methodology provides a robust framework for evaluating the "Trash to Cash" program, contributing to the literature on integrated environmental and financial education in primary schools.

4. RESULT AND DISCUSSIONS

The primary measurable outcomes of the program were assessed through pre- and post-tests, participatory observations, field notes, and a quiz to calculate the economic value of waste. The pre-test, administered before the intervention, revealed that only 40% of students (12 out of 30) could correctly classify waste as organic or inorganic, indicating a baseline lack of understanding of waste segregation. The post-test, conducted immediately after the intervention, showed a marked improvement, with 85% of

students (26 out of 30) accurately classifying waste items such as plastic bottles, cardboard, and food scraps. This increase aligns with findings from Sutisno et al. (2023), who note that interactive educational programs significantly enhance knowledge levels about waste segregation among primary school students. The program's focus on hands-on activities, such as sorting waste during the "*Tebak Sampah*: *Bisa Ditabung atau Tidak?*" game, likely contributed to this improvement by making abstract concepts tangible and engaging, as supported by Akliyah et al. (2019).

The quiz on calculating the economic value of waste provided further evidence of the program's impact on financial literacy. Students were tasked with calculating the monetary value of recyclable materials (e.g., 5 kg of cardboard at Rp3,000/kg equals Rp15,000). The results indicated that 80% of students (24 out of 30) accurately completed these calculations, demonstrating an ability to apply basic mathematical skills to real-world financial scenarios. This outcome supports Nur Azizah & Wulandari (2022), who highlight that interactive programs can improve practical skills related to financial literacy, such as managing income from waste banks. Common errors in the quiz, such as incorrect unit conversions or miscalculations of decimal values, were attributed to students' limited prior exposure to financial concepts, a challenge noted in the literature (Liao & Li, 2019). Nevertheless, the high accuracy rate suggests that the program effectively introduced students to eco-financial concepts, linking waste management to economic outcomes.

Participatory observations and field notes provided qualitative insights into the students' engagement and behavioral intentions. During the "*Tebak Sampah*" game, 95% of the students (28 out of 30) actively participated, working in small groups to categorize waste items as recyclable or non-recyclable. Observations noted high levels of enthusiasm, with students frequently discussing the economic potential of items such as plastic bottles and cardboard. For example, one student remarked, "If I collect plastic bottles at home, can I sell them to the waste bank and save money for a new book?" Such statements indicate an emerging awareness of the eco-financial concept, aligning with Adeniyi et al. (2023), who argue that integrating environmental and financial education fosters a holistic understanding of sustainability. However, excessive enthusiasm occasionally led to classroom management challenges, such as minor disruptions during group activities, a common issue in interactive educational settings (Variacion et al., 2025).

Post-intervention discussions further revealed students' intentions to apply their learning in daily life. Approximately 70% of students (21 out of 30) expressed plans to collect recyclable waste at home for sale to the local waste bank, suggesting the potential for long-term behavioral change. This finding is consistent with Debrah et al. (2021), who report that educational programs can increase participation in recycling initiatives within school communities. Students' discussions also highlighted an increased sense of environmental responsibility, with comments such as, "I didn't know plastic could harm the environment if we don't recycle it." These qualitative insights underscore the program's success in fostering attitudes toward sustainability, as supported by Liao and Li (2019), who emphasized the role of eco-financial education in promoting lifelong sustainable practices.

To synthesize the findings, Table 1 presents a comprehensive overview of the program's outcomes, contributions, and challenges, providing a clear framework for understanding its impact on the students.

Table 1. Synthesis of "Trash to Cash" Program Outcomes

Aspect	Indicator	Key Findings	Contributions	Challenges
Waste Management Knowledge	Classification of organic vs. inorganic waste	Increased from 40% to 85% of students correctly identifying waste types	Enhanced environmental awareness through practical waste classification skills	Excessive enthusiasm disrupted group activities
Economic Value of Waste	Recognition of recyclable waste as economic assets	95% of students identified plastic bottles, cardboard, and paper as economically valuable	Reinforced *eco-financial* concept, linking waste to economic outcomes	Limited discussion time due to session constraints

Financial Literacy	Calculation of waste value and saving habits	80% of students accurately calculated economic value (e.g., 5 kg cardboard = Rp15,000)	Fostered basic financial skills and saving awareness	Students' limited prior financial knowledge caused minor calculation errors
Student Engagement	Participation in games and quizzes	95% of students actively engaged, with productive group discussions	Increased motivation and knowledge retention through interactive methods	Classroom management issues during high-energy activities

Source: Data Processed (2025)

The program's success in improving waste management knowledge is attributable to its interactive approach, which aligns with the findings of Aguilar-Jurado et al. (2019) on the efficacy of gamification in environmental education. The "*Tebak Sampah*" game engaged students by simulating real-world waste sorting scenarios, making the learning process both enjoyable and practical. This approach mirrors the success of interactive methods in promoting active learning, as noted by Paolo and Pizziol (2023), who emphasized that games enhance motivation and make complex concepts accessible to young learners. The significant increase in correct waste classification (from 40% to 85%) reflects the program's ability to address the challenge of inadequate waste management education in primary schools, a common issue in developing regions (Nartey & Nyarko, 2020).

The high engagement levels observed during the intervention highlight the importance of interactive methods in fostering students' motivation. The 95% participation rate in the game and quiz activities underscores the program's ability to create a dynamic learning environment, as supported by Houmam and Ibourk (2023). However, the challenge of managing excessive enthusiasm underscores the need for structured facilitation, such as smaller group sizes or additional teacher support, to maintain order during interactive sessions (Variacion et al., 2025). The involvement of school teachers and waste bank representatives as facilitators was a key factor in the program's success, aligning with Nartey and Nyarko (2020), who identified supportive school administration and community collaboration as critical facilitators of effective waste management education.

The program's impact on financial literacy, particularly through the quiz on calculating waste value, demonstrates its potential to foster practical economic skills. The 80% accuracy rate in the quiz indicates that the students successfully grasped the eco-financial concept and understood how waste can generate income through waste banks. This finding aligns with Rakhmawati et al. (2023), who argued that linking environmental actions to financial outcomes enhances students' awareness of the economic benefits of sustainability. However, the 20% error rate in calculations, primarily due to unfamiliarity with financial concepts, reflects a broader challenge in developing regions where financial literacy education is often limited (Săseanu et al., 2019). Future iterations of the program could address this by incorporating additional practice sessions or simplified financial exercises tailored to students' developmental stages.

Qualitative data from post-intervention discussions provided compelling evidence of the program's potential to influence long-term behavioral changes. Students' expressed intentions to collect recyclable waste at home suggest that the intervention fostered a sense of agency and responsibility, consistent with Adeniyi et al. (2023), who highlighted the role of eco-financial education in promoting sustainable practices over time. Alignment with local waste banks, which are active in Kelurahan Waru, enhanced the program's relevance by providing a practical context for applying learned concepts, as supported by Wu et al. (2022). This community-based approach mirrors successful waste management initiatives that reduce waste generation and promote circular economy (Fayyaz et al., 2023).

Despite its success, the program faced challenges that warrant consideration. The limited session duration restricted the depth of discussions, particularly on complex topics such as the long-term environmental and economic impacts of waste management. This constraint aligns with the findings of Masjhoer and Vitrianto (2024), who noted that time limitations often hinder comprehensive educational interventions in rural schools. Additionally, the lack of prior financial knowledge among students posed a barrier to fully grasping economic calculations, a challenge also identified by Huang and Zhangbao (2023).

These issues suggest the need for extended program durations or follow-up sessions to reinforce the learning outcomes.

The program has both practical and theoretical implications. Practically, it offers a replicable model for integrating waste management and financial literacy into primary school curricula by leveraging local waste banks to enhance contextual relevance. This model can be scaled to other rural settings to support community-based sustainability efforts (Vinti & Vaccari, 2022). Collaboration with school administration and waste bank representatives was instrumental, highlighting the importance of stakeholder engagement, as noted by Kasjono et al. (2023). The program contributes to the literature by developing a conceptual framework for eco-financial education, bridging environmental and economic education in a manner that is accessible to young learners. This framework aligns with the principles of Education for Sustainable Development (ESD), which advocates interdisciplinary approaches to sustainability (Fiedler et al., 2023; Sousa, 2022).

The findings also underscore the need for teacher training to enhance the delivery of interactive educational program. Insufficient teacher preparation, a common barrier in rural schools, can undermine the effectiveness of these interventions (Zhou et al., 2019). Providing professional development on gamification and eco-financial concepts could strengthen future implementations, ensuring that educators are equipped to facilitate dynamic learning experiences. Additionally, longitudinal studies are recommended to assess the program's long-term impact on students' waste management behaviors and financial habits, addressing gaps in the current literature (Debrah et al., 2021).

The "Trash to Cash" program demonstrates the efficacy of interactive eco-financial education in enhancing primary school students' understanding of waste management and financial literacy. Significant improvements in knowledge (from 40% to 85% in waste classification), high engagement levels (95% participation), and emerging behavioral intentions (70% planning to collect recyclables) highlight the program's potential to foster sustainable practices. By addressing challenges such as time constraints and limited prior knowledge, future iterations can enhance their impact. The program's alignment with community-based waste management initiatives and its contribution to a novel eco-financial framework position it as a valuable model for sustainable education, supporting the SDGs and offering insights for educators and policymakers in developing countries.

5. CONCLUSION

The "Trash to Cash: *Jago Atur Uang, Jago Rawat Bumi*" program integrated the eco-financial concept, which links waste management to economic outcomes through waste banks to foster sustainable behaviors and financial awareness. The findings confirm the program's effectiveness in achieving its objectives, offering valuable insights for educators, policymakers, and community stakeholders seeking to promote sustainable education in developing regions. This study contributes to the practical implementation of integrated environmental and financial education and establishes a conceptual framework that can be adapted to other educational contexts, supporting the broader goals of sustainable development.

The program significantly improved students' knowledge of waste classification, with the percentage of students correctly identifying organic and inorganic waste rising from 40% in the pre-test to 85% in the post-test. This marked improvement highlights the efficacy of interactive methods, such as the "*Tebak Sampah*: *Bisa Ditabung atau Tidak?*" game, making abstract concepts accessible and engaging for young learners. Additionally, 80% of students accurately calculated the economic value of recyclable materials, such as the income from selling 5 kg of cardboard at Rp3,000/kg, demonstrating the program's success in fostering basic financial literacy skills. These outcomes indicate that integrating waste management and financial literacy through the eco-financial concept effectively bridges environmental and economic education, enabling students to recognize waste as a valuable resource with economic potential.

High levels of student engagement, with 95% actively participating in games and quizzes, underscore the value of interactive learning approaches in sustaining student interest and promoting knowledge retention. Post-intervention discussions revealed that 70% of students expressed intentions to collect recyclable waste at home for sale to local waste banks, suggesting the potential for long-term

behavior changes toward sustainability. These findings affirm the program's ability to cultivate a sense of agency and environmental responsibility among young learners, aligning with the principles of Education for Sustainable Development (ESD). By linking waste management to tangible financial outcomes, the program fosters a holistic understanding of sustainability that is both contextually relevant and practically applicable.

The study's practical implications include the development of a replicable model for integrating waste management and financial literacy into primary school curriculum. By leveraging local waste banks, the program ensures contextual relevance, making it adaptable to other rural settings with similar, community-based initiatives. Collaboration with school teachers and waste bank representatives was instrumental, emphasizing the importance of stakeholder engagement in educational interventions. The conceptual framework developed in this study, which integrates environmental and financial education under the eco-financial concept, offers a novel approach to sustainable education, contributing to the achievement of Sustainable Development Goals (SDGs), particularly those related to responsible consumption and economic empowerment.

Recommendations for future practice include incorporating the program into extracurricular activities to ensure sustained engagement, providing teacher training to enhance the delivery of interactive methods, and fostering ongoing collaboration with local waste banks to support practical applications. Longitudinal research is also recommended to evaluate the program's long-term impact on students' waste management behaviors and financial habits, addressing the current study's limitation of focusing solely on immediate outcomes. Building on these findings, educators and policymakers can develop scalable interventions that empower young learners to contribute to environmental sustainability and economic resilience, fostering a generation of responsible global citizens.

Ethical Approval

Ethical approval was not required for this study.

Informed Consent Statement

All participants were informed of the purpose of the study, and informed consent was obtained prior to the data collection. Participation was voluntary, and all responses were kept confidential and used solely for academic-research purposes.

Authors' Contributions

SW and ASP contributed to the conceptualization of the study. MRK, SW, and ASP collaborated on the methodology and resources. MRK and SW contributed to the formal analysis and writing of the original draft. MRK contributed to the validation. ASP contributed to writing the review and editing.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data Availability Statement

The data presented in this study are available on request from the corresponding author due to privacy reasons.

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