



“MY WASTE MY RESPONSIBILITY”: EARLY EDUCATION TO IMPROVE ELEMENTARY SCHOOL STUDENT’S KNOWLEDGE OF WASTE REDUCTION

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ABSTRAK

Pengelolaan sampah di institusi pendidikan dasar menuntut orientasi proaktif yang tidak sekadar berfokus pada pemilahan dan pembuangan akhir, melainkan pada upaya pencegahan timbulan sampah sejak dari sumbernya. Inisiatif pengabdian kepada masyarakat ini bertujuan meningkatkan pengetahuan siswa SDN Tunggulsari 02 Surakarta mengenai pengurangan sampah melalui pendekatan edukatif dan partisipatif, sekaligus menyediakan model aktivitas aplikatif guna memperkuat budaya lingkungan dalam implementasi Program *Adiwiyata*. Kegiatan yang melibatkan 136 peserta didik dari kelas 1 hingga 6 ini dilaksanakan dalam serangkaian tahapan interaktif mencakup sosialisasi, permainan edukatif, pemutaran video, dan diskusi reflektif. Evaluasi pengetahuan mengombinasikan asesmen lisan terstruktur untuk kelas 1–2 serta kuesioner pilihan ganda terstandar untuk kelas 3–6, sehingga capaian kelompok awal tidak dibandingkan secara langsung dengan kelas tinggi. Hasil akumulatif mencatatkan kenaikan rerata skor *pre-test* dari 65,41 menjadi 73,70 pada *post-test*, yang merepresentasikan peningkatan sebesar 8,29 poin. Secara inferensial, rerata skor kelas 3–4 meningkat dari 1,72 menjadi 2,15 ($p = 0,001$), sedangkan kelas 5–6 naik dari 2,44 menjadi 3,29 ($p < 0,001$). Data ini mengonfirmasi bahwa metode pembelajaran multisensori secara nyata mampu memperkuat kapasitas kognitif siswa dalam mengidentifikasi langkah pencegahan sampah dari sumbernya. Program ini memberikan landasan awal yang relevan untuk mendukung pengembangan budaya peduli lingkungan yang berkelanjutan di sekolah.

Kata Kunci: *Kesadaran Lingkungan, Pendidikan Lingkungan, Pengurangan Sampah, Sekolah Dasar*

ABSTRACT

Waste management in primary educational institutions demands a proactive orientation that extends beyond sorting and final disposal, focusing instead on efforts to prevent waste generation right at its source. This community service initiative aims to enhance the knowledge of students at SDN Tunggulsari 02 Surakarta regarding waste reduction through an educational and participatory approach, while simultaneously providing an applicable activity model to strengthen the environmental culture within the implementation of the *Adiwiyata* Program. The activity, involving 136 pupils from grades 1 to 6, was carried out through a series of interactive stages encompassing socialization, educational games, video screenings, and reflective discussions. Knowledge evaluation combined structured oral assessments for grades 1 to 2 with standardized multiple-choice questionnaires for grades 3 to 6, ensuring that the baseline group outcomes were not directly compared with the older student cohorts. Accumulative results



recorded an increase in the mean *pre-test* score from 65.41 to 73.70 on the *post-test*, representing an improvement of 8.29 points. Inferentially, the mean score for grades 3 to 4 increased from 1.72 to 2.15 ($p = 0.001$), while grades 5 to 6 rose from 2.44 to 3.29 ($p < 0.001$). These data confirm that multisensory learning methods effectively strengthen students' cognitive capacity to identify waste prevention measures at the source. This program provides a relevant preliminary foundation to support the continuous development of a sustainable, environmentally conscious culture within the school.

Keywords: *Environmental Awareness, Environmental Education, Waste Reduction, Elementary School*

INTRODUCTION

Educational institutions at the primary level play a pivotal role in shaping ecological awareness because pupils' daily activities ranging from classroom instruction and food consumption to the use of learning materials generate material residues on a daily basis. Empirical evidence highlights this complexity in Mataram City, where waste generation in elementary schools reached an average of 0.17 liters or approximately 0.04 kg per person per day, with plastic comprising a dominant share of 42.71% (Littaqwa et al., 2025). A parallel pattern observed in educational institutions in Istanbul reveals distinct compositional variations, with paper accounting for 92.3% and plastic 5.7%, demonstrating a strong connection between waste characteristics and the recycling habits of the school community (Sena Sağlam & Aydın, 2024). These empirical realities suggest that school waste management cannot remain confined to end-of-pipe disposal and sorting practices; rather, it demands proactive interventions designed to minimize material consumption before waste is created.

This operational imperative aligns directly with circular economy principles, which call for shift in individual choices and material management choices immediately following consumption. Environmental education serves as a fundamental catalyst for cultivating this cognitive foundation, particularly when learning concepts are directly tied to students' lived experiences within their immediate school environment (Azima, 2021). Within this paradigm, enhancing student knowledge must extend beyond mere categorization of waste types to embrace an understanding of daily decision-making that prevents waste generation at its source. Furthermore, students' intentions and actual behaviors regarding inorganic waste management are shaped by a complex interplay of educational environment determinants and behavioral development factors (Wardani et al., 2025).

Such transformative education becomes especially critical in schools committed to the *Adiwiyata* Program, which aims to establish an environmentally responsible culture through the active engagement of the entire school community (Nursofah et al., 2025). Cultivating *green behaviour* within Indonesian schools through this framework cannot be realized solely through physical infrastructure or routine sorting drills; it requires embedding sustainable daily habits into the socio-cultural fabric of the school community (Utomo et al., 2023). Consequently, waste reduction education must be embedded as a core driver of the school's broader environmental culture rather than delivered as an isolated instructional unit.

Despite these established ideals, a persistent disconnect exists in standard school practices, where instruction overwhelmingly favors sorting categories and proper disposal receptacles while neglecting source reduction strategies. Earlier community service interventions have demonstrated the utility of interactive approaches in developing waste management routines (Widyasari & Sari, 2025), plastic hazard awareness linked to hands-on



activities (Handayani et al., 2025), and *ecobrick* crafting as a form of plastic waste utilization (Supriani et al., 2023). While these initiatives underscore the value of experiential learning, they overwhelmingly center on managing, repurposing, or handling waste *after* it has already been produced, leaving a distinct gap for interventions that explicitly prioritize waste prevention at the source before material reaches subsequent management stages.

The efficacy of environmental education hinges on how messages are received and internalized by young learners through age-appropriate, interactive media. The strategic deployment of visual media, such as instructional videos and leaflets, has proven effective in delivering health and waste-sorting concepts that resonate with children's everyday experiences (Bustomi & Sulistiana, 2025), supporting the premise that environmental education is essential for acquiring responsible solid waste management behaviors (Akintunde & Akintunde, 2023). Designing educational approaches for primary school pupils therefore necessitates careful alignment with developmental characteristics, interaction needs, and opportunities to link concepts directly to daily choices.

This operational gap between established sorting routines and source prevention needs was directly observed at SDN Tunggulsari 02 Surakarta. As a recognized city-level *Adiwiyata* school, initial field observations revealed that while the school possessed functional sorting bins and enforced proper disposal routines, pupils regularly generated substantial single-use plastic food packaging during break times, demonstrating minimal awareness of how to avoid creating waste initially. This discrepancy between functional sorting compliance and the absence of upstream reduction habits underscored the need for a targeted educational intervention. The "*My Waste, My Responsibility*" program was specifically developed to bridge this gap through a multi-faceted approach combining socialization, interactive materials, educational games, and visual media, shifting pupil engagement from passive reception to active decision-making.

The novelty of the "*My Waste, My Responsibility*" program stems from its explicit conceptual focus on upstream waste reduction integrated into a multi-sensory, participatory framework tailored for elementary students within an *Adiwiyata* school context. Rather than relying on static lectures or media in isolation, the program weaves together role-playing simulations, interactive scenario games, reflection discussions, and animated video media to render the consequences of material consumption tangible. Unlike standard school environmental programs that concentrate primarily on waste sorting, *ecobrick* crafting, or recycling activities, this initiative positions waste prevention at its source as the primary core message, empowering pupils as active agents of change and offering a replicable activity model to strengthen environmental culture in *Adiwiyata* schools.

RESEARCH METHOD

This community service initiative employed a quantitative evaluative framework utilizing a pre-test and post-test design to measure fluctuations in student knowledge levels following the implementation of the "*My Waste, My Responsibility*" environmental education intervention. The execution took place at SDN Tunggulsari 02, located within Laweyan District, Surakarta City, engaging a total of 136 pupils spanning from grade 1 to grade 6 (comprising 37 students in grades 1 to 2, 54 students in grades 3 to 4, and 45 students in grades 5 to 6). The project was deployed collaboratively by faculty members and student representatives from the Public Health Study Program, with continuous instructional supervision and classroom management assistance provided by the school's regular teaching staff. The core intervention centered on cultivating early-stage waste reduction awareness and



was delivered through a multi-method pedagogical sequence encompassing interactive lectures, structured educational games, guided focus discussions, and thematic audiovisual screenings.

The operational workflow of the program was divided into three structured phases spanning a total duration of three hours on July 25, 2024, designed meticulously to ensure complete replicability by future researchers. The preparation phase occupied the initial 45 minutes (07.00 to 07.45 WIB), which involved formal institutional coordination with the school administration, preliminary field observations of waste generation patterns and disposal facilities, development of tailored instructional materials, and the formulation of standardized evaluation instruments. The intervention phase was conducted over a 90-minute window (07.45 to 09.15 WIB), sequentially commencing with a baseline knowledge assessment, followed by 30 minutes of interactive material delivery regarding waste definitions, generation sources, and health impacts, 30 minutes of participatory flipchart-based games and role-playing simulations, and a 15-minute screening of the educational animation video #SampahkuTanggungJawabku – Jagoan Beraksi. Finally, the evaluation and closing phase occupied the remaining 45 minutes (09.15 to 10.00 WIB), consisting of final post-test administration, interactive reflection discussions, and a formal closing ceremony with the school community.

Data analysis procedures were structured to accommodate the distinct cognitive developmental stages of the participants through tailored instrument administration and robust statistical testing. For older cohorts in grades 3 through 6, evaluation relied on a standardized multiple-choice questionnaire comprising four items measuring specific indicators of waste definition, source identification, and upstream reduction actions, scored dichotomously (correct answers received 1 point and incorrect answers 0 points, yielding a raw score range of 0 to 4). Prior to conducting parametric inferential testing, the assumption of normality for the difference scores between pre-test and post-test measurements was verified using the Shapiro-Wilk test, which confirmed that the data distribution for both grade subgroups met normality requirements ($p > 0.05$). Consequently, a paired t-test was executed independently for grades 3 to 4 and grades 5 to 6 to evaluate the statistical significance of score variances alongside Cohen d effect size calculations. Meanwhile, due to developmental constraints in literacy, students in grades 1 to 2 were evaluated through a standardized oral question-and-answer format consisting of four structured verbal prompts administered individually by trained facilitators using simplified scoring rubrics, allowing their outcomes to be analyzed descriptively through percentage improvement metrics.

RESULT AND DISCUSSION

Result

The main program was conducted under the theme "*My Waste, My Responsibility*," focusing entirely on waste reduction education at the source. The event took place at SDN Tunggulsari 02, Laweyan District, Surakarta City, on July 25, 2024, from 07:00 to 10:00 WIB. This activity involved the active participation of lecturers and students from the Public Health Study Program, accompanied by school teachers who assisted in maintaining classroom conduciveness throughout the session. A total of 136 pupils from grades 1 to 6 participated comprehensively, and they were subsequently grouped into three educational tiers to facilitate material delivery. All activities were systematically structured to include an opening session, baseline assessment (*pre-test*), interactive educational presentations, educational games, thematic video screenings, and a final assessment (*post-test*).

The educational presentation delivered basic information regarding waste definitions and their connection to daily activities in the school environment. The covered material included the identification of waste generation sources, concrete examples of debris resulting from student consumption habits, and the environmental and health consequences of improper waste disposal. The core concept emphasized during this session was that waste reduction initiatives can begin through individual choices before waste is actually generated within the school setting. Facilitators guided the students to recognize various types of waste surrounding them and discussed simple actions to minimize daily waste generation volumes.

This presentation session was followed by educational games that involved the direct participation of students inside the classroom. These games utilized display media in the form of flipcharts and illustrated stickers representing different waste categories and waste-generating situations in the school environment. Students were asked to categorize waste types according to their sources and respond to simulated daily scenarios involving teachers, students, and school vendors. This activity was designed in group formats to contrast waste-producing behaviors with preventive actions that can minimize refuse.

As visual reinforcement, the program continued with the screening of an educational video lasting approximately six minutes titled *#SampahkuTanggungJawabku – Jagoan Beraksi*. This animated video presented visual narratives regarding environmentally responsible behaviors, such as bringing packed meals from home and reducing single-use plastic packaging. This audiovisual media placement followed the interactive gaming session to strengthen students' visual comprehension of the previously delivered materials. Guided by facilitators, students engaged in brief discussions to restate examples of practical waste-reduction actions applicable at school and at home.

The implementation of the *"My Waste, My Responsibility"* educational games was also documented to illustrate active student engagement firsthand. The visual documentation of this activity implementation is presented in Picture 1 below, capturing student enthusiasm in responding to facilitator inquiries.



Picture 1 : Educational games “My Waste, My Responsibility”



As illustrated in Picture 1, students can be observed listening to the facilitator's explanations, actively raising their hands, and participating in group discussions. The resulting classroom interactions provided a direct learning experience where children were encouraged to communicate their ideas concerning daily waste management choices. This interactive session operated concurrently with the screening of the educational video *#SampahkuTanggungJawabku – Jagoan Beraksi* to reinforce conceptual understanding regarding source-level waste reduction.

Monitoring and Evaluation of Learning Outcomes

The evaluation of this Community Service (*Pengabdian kepada Masyarakat*, PkM) activity was conducted quantitatively to measure changes in student knowledge scores before and after the educational intervention. Measurements were performed by comparing pre-test and post-test scores consistently categorized by grade level to accommodate differences in evaluation instruments. The assessment implementation was divided into oral question-and-answer methods for grades 1–2 and standardized multiple-choice questionnaires for students in grades 3 through 6. The distribution of knowledge score achievements across all respondent groups is presented comprehensively in Table 1.

Table 1. Distribution of Respondents' Knowledge Levels Based on Pre-test and Post-test Results of the "My Waste, My Responsibility" Education Program at SDN Tunggulsari 02

Grade	Mean pre-test score	Mean post-test score	Knowledge improvement (%)
Grade 1 and 2	0.00	70.00	70.00
Grade 3	52.14	67.20	15.06
Grade 4	66.67	71.11	4.44
Grade 5	79.35	85.00	5.65
Grade 6	66.25	71.05	4.80
Total	65.41	73.70	8.29

Based on the data in Table 1 above, the mean post-test score in each grade group demonstrated an increase compared to its pre-test score. The percentage of knowledge improvement varied across grade levels, with grades 1–2 achieving an improvement of 70.00% through oral assessments, whereas grades 3 through 6 exhibited written questionnaire-based gains ranging from 4.44% to 15.06%. Overall, the average knowledge level of all participants increased from 65.41 to 73.70, representing a total improvement of 8.29%. These descriptive results were subsequently followed by inferential statistical analyses specifically designated for student groups evaluated using uniform questionnaire instruments.

To test the statistical significance of knowledge score differences among older student groups, inferential analysis via paired t-tests was applied separately to the grade 3–4 and grade 5–6 cohorts. It should be noted that the scoring scale applied in the grade 3–6 questionnaires was based on the number of correct answers out of total standardized items (raw score range from 0 to 4), which differs in format from the percentage scale utilized for grades 1–2. The complete results of the inferential analysis alongside effect size calculations are presented in Table 3.

Table 3. Distribution of Respondents' Knowledge Levels and Statistical Analysis of the "My Waste, My Responsibility" Education Program Among Grades 3 – 6 Students at SDN Tunggulsari 02

Knowledge Score	n	Mean	SD	p-value	Effect Size (Cohen's d)
Pre-test (Grades 3 and 4)	54	1.72	0.81	0.001	0.55
Post-test (Grades 3 and 4)	54	2.15	0.76		
Pre-test (Grades 5 and 6)	45	2.44	0.79	0.000	1.02
Post-test (Grades 5 and 6)	45	3.29	0.87		

As detailed in Table 3, the post-test mean score for the grade 3–4 cohort increased from 1.72 to 2.15 with a significance value of $p = 0.001$ and an effect size of 0.55. Meanwhile, the grade 5–6 cohort demonstrated an increase in mean scores from 2.44 to 3.29 with a p -value of 0.000 and an effect size reaching 1.02. All comparative values fell below the 0.05 significance threshold, indicating significant score differences between pre-intervention and post-intervention measurements. The grade 1–2 group was excluded from this inferential test due to utilizing a distinct oral evaluation format.

The empirical data confirm that the implementation of the *"My Waste, My Responsibility"* program is associated with short-term increases in student knowledge scores regarding waste reduction practices. The combination of interactive lectures, educational games, and video screenings successfully facilitated material comprehension across diverse age groups. The identified score increases reflect the acquisition of new insights among students concerning waste generation sources and upstream preventive actions. Nevertheless, these findings remain bounded by the scope of short-term assessments administered immediately before and after the intervention without evaluating long-term retention.

Discussion

The empirical findings of this community service project reveal a measurable short-term increase in student knowledge regarding waste reduction after participating in the *"My Waste, My Responsibility"* program. This observed enhancement aligns with broader educational literature demonstrating that structured environmental interventions can effectively elevate cognitive awareness concerning sustainable waste management among young learners (Ahmadi et al., 2025; Tuwu et al., 2026; Zuhriyah, 2026). Rather than functioning as a standalone event, the intervention provided an essential empirical basis for integrating targeted source-reduction concepts directly into the daily ecosystem of an educational institution.

A closer examination of the pedagogical strategy indicates that combining multiple learning formats yields complementary cognitive benefits, though discerning the unique impact of each individual tool remains methodologically challenging. While prior studies have successfully utilized single-medium tools such as board games for sorting knowledge (Maulidina et al., 2024), color-coded bins (Ahmadi et al., 2025), or 3R curricula (Tuwu et al., 2026), the simultaneous integration of presentations, games, role-playing, and videos in this program creates a blended learning environment where components reinforce one another. Specifically, the introductory lecture establishes conceptual frameworks, the interactive games and role-play provide kinesthetic engagement, and the video media reinforces visual literacy, collectively helping students grasp abstract waste reduction concepts. However, because these components were delivered as a unified intervention package, it is difficult to isolate whether



the interactive games or the audiovisual media exerted the primary influence on the observed score gains.

Student engagement during the intervention was heavily mediated by participatory learning structures that required active cognitive processing rather than passive listening. By asking children to evaluate waste generation scenarios and discuss corrective actions, the program shifted their role from passive information recipients to active participants in localized problem-solving. This interactive orientation resonates with participatory action research models implemented by Felani et al. (2025) and findings by Arfian et al. (2026) regarding the utility of gaming formats in solid waste education. By anchoring discussions in everyday school consumption choices, the activities ensured that abstract environmental messages remained closely tethered to students' lived realities.

The integration of visual and technology-supported tools further facilitated comprehension by translating complex environmental messages into digestible, age-appropriate formats. The utilization of animated videos and structured visual aids aligns with contemporary approaches documented by Kasmini and Rahmatillah (2023) on animated media for environmental literacy, as well as Balcha et al. (2025) on structured digital learning for young children. Within this intervention, these technological and visual resources functioned as reinforcing catalysts embedded within a broader pedagogical sequence rather than isolated instructional devices. This multimedia layering ensured that students with diverse learning styles could successfully process the core messages regarding upstream waste prevention.

When evaluating the knowledge improvements across different grade cohorts, distinct variations emerged that can be attributed to developmental and cognitive maturation stages. Older students in the upper grade brackets generally possessed higher baseline scores due to more advanced reading comprehension and cognitive capacity, while younger pupils exhibited larger proportional knowledge gains from a lower starting point. These grade-level disparities underscore the importance of tailoring environmental curricula to match children's cognitive milestones, confirming that educational outcomes cannot be assumed uniform across different developmental phases. Future initiatives must calibrate the complexity of interactive media and assessment tools to better fit the specific cognitive processing abilities of lower versus upper elementary grades.

These positive knowledge outcomes must also be contextualized within the existing institutional culture of SDN Tunggulsari 02 as an established Adiwiyata school. Prior to this intervention, the school had already operationalized routine sorting and disposal systems, yet students' upstream reduction practices required substantial reinforcement. This distinction is critical because true environmental stewardship in Adiwiyata institutions extends far beyond the technical management of refuse after generation, as discussed in student perspective studies by Febriyanti and Rahmandani (2024) and local wisdom frameworks by Rezeki et al. (2024). The present program successfully complemented this existing institutional orientation by shifting the pedagogical spotlight from downstream waste management to upstream source prevention.

Nevertheless, several methodological limitations must be acknowledged to properly interpret the scope of these findings. First, the evaluation design relied on a single-group pre-test and post-test framework without a parallel control group, meaning that external confounding factors such as concurrent classroom discussions or maturation effects cannot be entirely ruled out as contributors to the score increases. Second, the assessment was administered immediately surrounding the intervention period, capturing short-term cognitive



acquisition rather than sustained behavioral modification. As emphasized by Hernawan et al. (2024), knowledge, behavioral intention, and actual waste-handling habits represent distinct dimensions that do not automatically translate into long-term habits without continuous reinforcement. Consequently, future programming must incorporate longitudinal follow-up assessments, regular institutional monitoring, and student environmental cadres to evaluate whether short-term cognitive gains successfully translate into enduring, habitual waste reduction practices.

CONCLUSION

The implementation of the “*My Waste, My Responsibility*” initiative successfully achieved its core objective of elevating short-term ecological literacy among pupils at SDN Tunggulsari 02 Surakarta. Quantitative assessments revealed an overall average knowledge improvement from a baseline score of 65.41 to 73.70, alongside statistically significant score gains across upper-grade cohorts supported by moderate to high effect sizes. Rather than relying solely on conventional downstream waste sorting, this intervention demonstrated that participatory learning methods can successfully introduce upstream source reduction concepts to elementary school learners. These empirical outcomes provide a foundational cognitive framework that complements the school's existing *Adiwiyata* operational standards by embedding sustainable material choices directly into daily school routines.

To translate these short-term cognitive achievements into lasting ecological habits, future academic initiatives and school policies must establish structured longitudinal monitoring frameworks. Subsequent community service programs should incorporate periodic follow-up evaluations combined with the institutionalization of student environmental cadres tasked with weekly peer observations. Furthermore, integrating digital tracking logs or reward-based incentives for zero-waste pack lunches can provide the necessary external reinforcement to bridge the gap between initial knowledge acquisition and sustained, long-term waste prevention behavior.

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