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Managing the "Panah-Pasopati" Waste Awareness Program: A Qualitative Case Study of Program Management and Environmental Learning in Elementary Schools in Pacitan Regency

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Abstract. School-based waste programs give children opportunities to practice environmental responsibility through everyday activities. This study examines the management and implementation of the Pasukan Anak Hebat Pengolah Sampah Sejati ("Panah-Pasopati") waste awareness program in elementary schools in Pacitan Regency, Indonesia, where annual waste generation rose from approximately 103,960 tons in 2019 to 105,340 tons in 2023. A qualitative descriptive case-study design was used, with the program's management and learning processes as the unit of analysis. Data were collected through observation, semi-structured interviews with the school principal, program advisor teachers, and student members, and analysis of planning documents, daily duty reports, and waste-bank records. The data were analyzed using Miles and Huberman's interactive model, and credibility was strengthened through source and method triangulation. The findings show that the program was managed through four functions: planning, which set objectives, targets, schedules, and a distinctive troop identity; organizing, which distributed roles among the principal, advisor teachers, student leaders, parents, and external partners; implementation, which combined troop inauguration, waste-duty rotations, a school waste bank, creative reuse, composting, school gardening, and curriculum integration; and monitoring and evaluation, which relied on duty reports and waste-bank records. Students associated the collective troop identity with pride and belonging, and the composting-to-gardening sequence served as a pedagogical cycle linking waste sorting, organic material recovery, and food growing. The study documents implementation processes and reported experiences rather than measured outcomes and proposes indicators for future outcome evaluation.

Keywords: Environmental Education, Program Management, Qualitative Case Study, School Gardening, Waste Awareness

1 Introduction

Waste is an increasingly pressing environmental challenge driven by population growth, urbanization, and changing consumption patterns; global municipal solid waste

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generation is projected to rise from 2.01 billion tons in 2016 to 3.40 billion tons by 2050 [1]. This challenge is also evident in Pacitan Regency, Indonesia. According to data from the National Waste Management Information System (Sistem Informasi Pengelolaan Sampah Nasional, SIPSN), as cited in Pacitan Regent Decree No. 147 of 2025 on the 2025–2026 Roadmap for Collaborative Action on Waste Management [2], waste generation in Pacitan increased every year between 2019 and 2023, from approximately 103,960 tons in 2019 to 104,310 tons in 2020, 104,650 tons in 2021, 105,000 tons in 2022, and 105,340 tons in 2023. This represents an increase of approximately 1,380 tons, or 1.3%, over the period, with no year-on-year decline (Fig. 1).

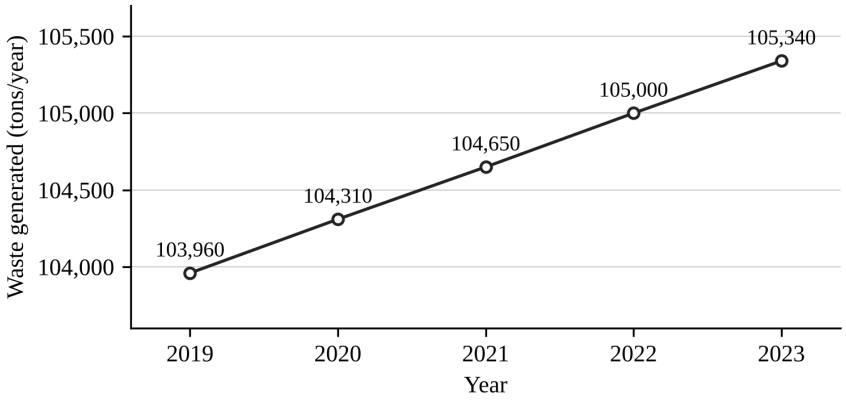


Fig. 1. Annual waste generation in Pacitan Regency, 2019–2023 (data from SIPSN as cited in [2]).

This trend suggests that waste management at the regency level has not yet been sufficient to curb the continued increase in waste generation. Without measures to reduce waste at its source, the growing volume may place additional pressure on final disposal facilities and increase the risk of soil, water, and air pollution [1], [3]. Source reduction is also a central component of national policy. Law No. 18 of 2008 emphasizes waste prevention, reuse, and recycling [3], while the National Policy and Strategy for the Management of Household Waste and Similar Waste set targets of a 30% reduction and a 70% handling rate by 2025 [4]. Waste management, therefore, cannot rely solely on collection and disposal; it also requires changes in public attitudes and behavior, beginning in childhood through education. A review of evidence from developing countries likewise identifies formal education as a key lever for raising awareness of solid waste management [5].

Schools have a strategic role in this effort. Elementary education provides an important setting in which environmental values and habits can be introduced and practiced from an early age, and the early years are widely regarded as a formative period for environmental knowledge, dispositions, and behavior [6]. Schools can also give students direct experience of waste management. Nevertheless, littering continues

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to occur in elementary schools, including among older pupils, indicating that environmental discipline and responsibility have not yet been fully internalized [7]. At the policy level, the Adiwiyata Program encourages schools to develop environmentally responsible and environmentally conscious school communities [8], [9], and participation in this eco-school program has been associated with students' environmental literacy [10]. Its success depends in part on schools' ability to manage activities systematically through planning, organizing, implementation, and supervision, which correspond to the core management functions described by Terry and Rue [11].

Previous studies have examined a range of school-based waste awareness initiatives in elementary education. Amalia et al. [12] described the internalization of the "Mari Buang Sampah Pada Tempatnya" ("Put Waste in Its Proper Place") program at SDN Taman Ciruas Permai, using a qualitative descriptive approach to examine students' habitual practices. Puspitasari et al. [13] examined a waste-free program at SDN Loji 3 in Bogor and reported an 82% level of environmental concern among fifth-grade students based on questionnaire findings, and Septia [14] reported a comparable figure of 90.6% for the Adiwiyata Program at SDN Ciceri. In a qualitative case study at SD Muhammadiyah Pendowoharjo, Santosa et al. [7] found that littering persisted and proposed several strategies to strengthen discipline, including clear and consistent classroom rules, daily monitoring records involving parents, and student-designed creative waste bins. At the lower-secondary level, Mauludiah [15] examined a waste-picking campaign at SMP Negeri 7 Bandung through a descriptive study. However, Siskayanti and Chastanti [16] found that elementary students' understanding of waste categories and the 3R principles (reduce, reuse, and recycle) remained relatively low, at 37.38% and 45.27%, respectively. These findings suggest that the existence of a school waste program does not necessarily guarantee effective implementation, echoing the broader observation that environmental knowledge and awareness do not automatically translate into pro-environmental action [17]. Across these studies, the emphasis has generally been on describing activities and reporting students' attitudes or understanding. Less attention has been given to the complete management cycle, from planning through supervision, or to the use of a collective identity to strengthen students' emotional engagement, pride, and sense of ownership.

This research gap can be considered through several theoretical perspectives. First, Lickona's character education theory [18] suggests that environmental character is not developed through moral knowledge alone; it also requires moral feeling and moral action, reinforced through repeated practice until they become habits. Second, Bandura's social learning theory [19] highlights the importance of modeling and reinforcement in shaping children's behavior, including environmentally responsible behavior. These perspectives indicate that school waste programs should be examined not only in terms of students' observable behavior but also in relation to how programs are systematically managed and designed to engage students' emotional and social dimensions. A similar emphasis is found in Santosa et al. [7], who argue that character education should foster internal awareness rather than mere formal compliance with rules, with teacher modeling playing an important role.

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To address these gaps, the Pasukan Anak Hebat Pengolah Sampah Sejati program, abbreviated as "Panah-Pasopati," was developed. The name was designed to be memorable and appealing to elementary school students while conveying a specific philosophy: "troop" represents togetherness and mutual cooperation; "great children" expresses appreciation and motivation; and "true waste processors" emphasizes the program's central aim of developing students who do more than dispose of waste properly—they also learn to process and reuse it, consistent with the principles of reuse and recycling [3]. The collective "troop" identity is also consistent with social identity theory, which explains how group membership can foster pride and a sense of belonging [20]. Direct student involvement in activities, such as decorating classroom waste bins, may likewise strengthen ownership and concern for environmental cleanliness [7].

Other research has examined school management within the Adiwiyata Program, commonly framed through the functions of planning, organizing, implementation, and supervision [11]. Rasyid et al. [21], in a multisite case study at SDN Kauman 1 Malang and SD Plus Al-Kautsar Malang, described Adiwiyata planning, organization, implementation, and supervision based on teams, working groups, budget allocation, and activity reporting. Andika et al. [22] used a qualitative phenomenological approach at SD Negeri 03 Pulosari, Pemalang Regency, to examine these four management functions in Adiwiyata curriculum development, including the integration of environmental education and periodic internal audits. Munandar et al. [23] adopted a research-and-development approach in Karanganyar District, Demak Regency, and produced a school environmental-management model that experts and teachers rated as highly feasible after identifying that the target schools had not applied management functions explicitly. These studies primarily considered organizational governance, curriculum, or model development led by principals, Adiwiyata teams, and teachers; waste management was treated as one component of a broader program, and students' emotional engagement was not a central concern.

The present study therefore focuses on a specific waste awareness program, traces its implementation from planning to supervision, and examines how the collective "troop" identity may foster students' pride and sense of ownership. "Panah-Pasopati" is positioned as an approach that connects two dimensions often discussed separately: systematic program management and collective identity as a means of strengthening students' emotional engagement. Accordingly, this study aims to describe how the program is planned, organized, implemented, and monitored and how its activities create opportunities for environmental learning. It is expected to contribute theoretically to research on environmental education program implementation in elementary schools and practically by offering an applicable strategy for other elementary schools, particularly in Pacitan Regency.

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2 Methods

2.1 Research Design

This study employed a qualitative descriptive approach with a case-study design. The case was the implementation of the "Panah-Pasopati" waste awareness program in elementary schools in Pacitan Regency, Indonesia. The case is bounded conceptually by the program itself and its management and learning processes rather than by a comparison among schools. The unit of analysis was the program-management and learning process, including planning, organization, activities, and monitoring and evaluation. Students' environmental concern was explored through participants' accounts and program-related practices; it was not measured using a validated attitude scale or a pretest–posttest design.

2.2 Informants and Data Collection

Informants were purposively selected because of their direct involvement in or experience of the program. Three informant roles were included: the school principal, program advisor teachers, and student members. To protect confidentiality, the perspectives are reported using role-based codes: N1 for the principal, N2 for the program advisor teachers, and N3 for the student members (Table 1). These codes identify informant roles rather than individual participants.

Data were collected through three techniques. First, direct observation focused on program activities, including waste-duty rotations and patrols, waste-bank activities, waste sorting, composting, and school gardening. Second, semi-structured interviews were used to obtain the perspectives of the school principal, program advisor teachers, and student members. Third, document analysis examined program-planning documents, daily duty reports, and waste-bank records. The analysis was limited to the documentary evidence available to the researchers, and no numerical outcomes were inferred beyond these records.

Table 1. Informant roles, codes, and data sources

Informant role	Code	Main data sources	Focus of information
School principal	N1	Semi-structured interview; planning documents	Program initiation, objectives, targets, policy support, and external partnerships
Program advisor teachers	N2	Semi-structured interview; observation; daily duty reports	Coordination of activities, supervision, curriculum integration, and recognition of members
Student members	N3	Semi-structured interview; observation	Participation in duties, sorting, waste bank, composting, gardening, and perceived experience

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Informant role	Code	Main data sources	Focus of information
Program records	—	Planning documents; duty reports; waste-bank records	Corroboration of reported activities and monitoring practices

2.3 Data Analysis and Trustworthiness

Data were analyzed using Miles and Huberman's interactive model of data reduction, data display, and conclusion drawing and verification [24], as summarized in Fig. 2. Interview information, observation records, and documents were compared iteratively. Source triangulation involved comparing the perspectives of the principal, program advisor teachers, and student members, while method triangulation involved comparing interview accounts with observations and documentary evidence [25]. Where systematic evidence was unavailable—for example, behavioral counts, baseline measurements, or quantitative composting and gardening records—no numerical outcome or verified change was inferred. Data adequacy was therefore judged through the convergence of sources and methods rather than through a formal saturation test.

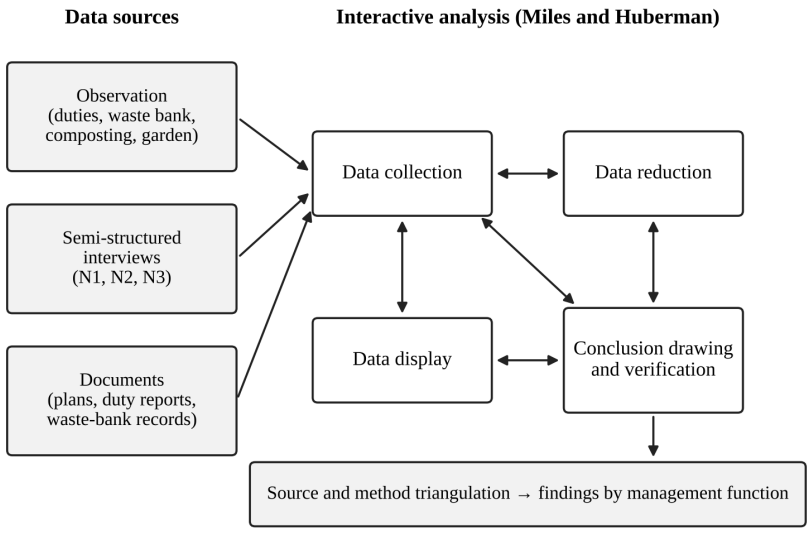


Fig. 2. Data collection and interactive analysis procedure used in the study (adapted from [24]).

The findings were organized using four program-management functions—planning, organizing, implementation, and monitoring and evaluation—based on Terry and Rue [11]. Descriptions of activities that were observed or documented are distinguished from recommendations derived from the literature and technical guidance, so that recommended procedures are not treated as empirical evidence that every school carried them out.

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3 Results and Discussion

The findings draw on the perspectives of the principal (N1), the program advisor teachers (N2), and the student members (N3), compared with the available observation and documentary material. They describe reported experiences and practices rather than measured changes in environmental concern.

From the principal's perspective (N1), the program was initiated in response to waste-related problems and the perceived need to establish environmentally responsible practices in elementary school. The principal described identifying school waste issues, formulating program objectives, and setting targets and schedules. The principal's role included appointing program advisor teachers, providing policy support, and seeking cooperation with the environmental agency, the school committee, and parents.

The program advisor teachers (N2) described the coordination of activities, including troop inauguration, waste-duty rotations and patrols, waste-bank activities, creative reuse, composting, and gardening. They also described the separation of waste at its source and adult supervision of potentially hazardous tasks. Environmental topics were connected with the IPAS (natural and social sciences) subject and the Pancasila Student Profile Strengthening Project (P5), while recognition of exemplary members was used to encourage participation.

The student members (N3) described feeling happy and proud to participate in "Panah-Pasopati," particularly in relation to the inauguration and the shared troop identity. They referred to rotating waste-duty and patrol activities, sorting organic and inorganic waste, depositing recyclable materials at the waste bank, observing composting, and helping to care for vegetables in the school garden. Taken together, the three role-based perspectives provide complementary descriptions of program direction, activity coordination, and student experience.

3.1 Program Planning

The planning stage of "Panah-Pasopati" began with identifying waste-related problems in the school environment, including the daily volume of waste, the most common types of waste generated, and the availability of supporting facilities. This step is relevant to the continued increase in waste generation in Pacitan Regency [2], which makes source reduction, including within schools, an immediate concern [3]. Based on this analysis, the school formulated the program's vision and objectives: to develop students' awareness, skills, and responsibility in waste management, consistent with the Adiwiyata Program's aim of creating an environmentally responsible school community [8], [9]. Planning also included the development of the program's identity, such as its logo, chants, and special troop uniform, to foster pride and collective spirit among students, in line with social identity theory [20]. In addition, the school established targets, activity schedules, and indicators of success, such as the number of active troop members, consistency in waste sorting, and the volume of waste processed or reused. Explicit targets, schedules, and indicators reflect the planning function in management [11] and are consistent with Adiwiyata planning practices involving team formation and budget allocation [21].

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3.2 Program Organization

The organizational structure of "Panah-Pasopati" placed the principal in overall charge, program advisor teachers as activity coordinators, and students as troop members recruited through a simple, educational inauguration process. Student leadership roles, such as team leaders or class troop commanders, were intended to develop leadership skills and a sense of ownership, consistent with findings that direct student involvement in school activities can strengthen ownership of environmental cleanliness [7]. The distribution of responsibilities among the principal, advisor teachers, and students reflects the organizing function of management [11] and resembles the team- and working-group-based organization found in Adiwiyata programs [21]. Organization also involved cooperation with external stakeholders, including the Pacitan Regency environmental agency, the school committee, and parents, to support the provision of waste-processing facilities and extend the program's influence into students' homes. Parental involvement is consistent with strategies that use daily monitoring records involving parents to reinforce discipline [7], while cross-sector collaboration aligns with the direction of Pacitan's collaborative waste-management roadmap [2].

3.3 Program Implementation

The program was implemented through activities designed to suit the characteristics and everyday experiences of elementary school children: (1) troop inauguration, an opening activity intended to build enthusiasm and a shared sense of pride in program membership [20]; (2) daily waste-duty rotations and patrols, through which troop members took turns monitoring school cleanliness and waste sorting, enabling environmentally responsible actions to be practiced repeatedly until they become habits [18]; (3) the "Panah-Pasopati" waste bank, where students collected and deposited recyclable materials with economic value, providing a practical introduction to waste recovery and reuse [3]; (4) creative waste-processing sessions, in which safe inorganic waste was made into crafts or learning media and organic materials—such as vegetable scraps, fruit peels, dry leaves, and grass clippings—were sorted for composting; (5) integration of environmental topics into classroom learning through IPAS and P5, consistent with the integration of environmental education into Adiwiyata curriculum development [22] and responsive to findings that elementary students' understanding of waste categories and the 3R principles remains limited [16]; and (6) recognition of exemplary troop members through periodic awards to classes or students who consistently carried out the program's mission, providing motivational reinforcement in line with social learning theory [19]. Sorting at the source is important because it prevents compostable materials from being contaminated by plastic, metal, glass, or other non-biodegradable waste. Table 2 summarizes how these activities relate to the four management functions.

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Table 2. Summary of the "Panah-Pasopati" program management cycle

Management function	Key program activities	Intended educational contribution
Planning	Identify school waste issues; set objectives, targets, schedules, and indicators; design the troop identity.	Establish a clear direction for environmental learning and participation.
Organizing	Assign roles to the principal, program advisor teachers, student troop leaders, parents, and partners.	Build shared responsibility, coordination, and student ownership.
Implementation	Conduct waste patrols, waste-bank activities, creative reuse, composting, gardening, and classroom integration.	Provide practical experience in sorting waste, cooperation, plant care, and environmental responsibility.
Monitoring and evaluation	Review daily duty records, waste-bank records, sorting practices, compost conditions, plant growth, and participation.	Identify implementation issues and inform program improvement.

Composting Organic Waste. Composting was one of the program activities. The process involved identifying organic waste sources at school, such as vegetable and fruit scraps, fallen leaves, and dry grass, followed by sorting and size reduction under teacher supervision. Unsuitable or potentially hazardous materials were excluded, and students did not handle sharp or contaminated waste. Students and teachers observed changes in compost color, texture, temperature, and smell during the process.

For a school-based system, recommended practice is to mix organic materials with dry materials to balance moisture and support aeration, place them in a ventilated container in a shaded area with adequate drainage, maintain moisture without waterlogging, and have turning carried out by adults or under close teacher supervision [26]. Gloves, suitable tools, handwashing facilities, and hygiene procedures are also recommended. Compost maturity can be judged by dark, crumbly material, an earthy smell, and the cessation of active heating, consistent with the national compost standard [27]. Because systematic records of compost temperature, moisture, maturation time, and quantity were not kept, these criteria are presented as guidance for the program rather than as measured results.

Using Compost in the School Garden. The program linked composting with school gardening, and students participated in planting and caring for vegetables using compost. Mature compost can be used as a soil conditioner, whereas immature compost should not be applied directly to plants [26]. A school garden can provide a contextual learning environment connecting science, mathematics, language, and character education: students may observe plant requirements and growth, measure plant height or leaf numbers, maintain growth journals, and discuss the relationship between organic decomposition and soil fertility. These learning opportunities are supported by the

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garden-based learning literature [28]–[30] and are presented here as pedagogical possibilities for the program rather than as measured outcomes.

The composting-to-gardening sequence can be understood as a pedagogical cycle of six stages (Fig. 3): (1) collecting and sorting organic waste; (2) processing it in a composter; (3) observing the maturation process; (4) applying mature compost to planting media; (5) planting and caring for vegetables; and (6) documenting plant growth and reviewing the process. Its contribution lies in the educational logic connecting waste sorting, organic material recovery, soil care, and food growing, which allows students to see waste as a resource rather than as something merely to be discarded.

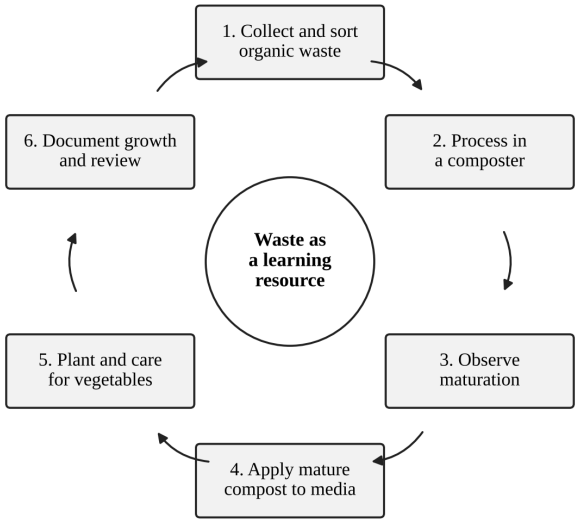


Fig. 3. Composting-to-gardening pedagogical cycle in the "Panah-Pasopati" program.

The collective "troop" identity provided a social context for students' engagement by offering a shared mission and a sense of belonging. Student accounts of pride and enjoyment are consistent with this interpretation, although they reflect perceived experience rather than proof of a lasting change in environmental attitudes or behavior. This interpretation is consistent with social identity theory [20] and with Lickona's distinction between moral knowledge, moral feeling, and moral action [18].

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3.4 Program Monitoring and Evaluation

Monitoring in the program relied on direct observations, daily waste-duty reports, and waste-bank records. These sources document whether activities took place and how students participated, which is consistent with implementation-focused evaluation of elementary school programs [31]. However, without a standardized behavioral rubric, a baseline, or a validated environmental-attitude scale, the available evidence supports conclusions about implementation and reported perceptions rather than a causal claim that the program increased environmental concern. Systematic reviews of environmental education emphasize that outcome claims require clearly defined and consistently measured indicators [32].

For future monitoring, schools can use a teacher-verified observation sheet with clearly defined indicators (Table 3). Each indicator may be rated using a simple anchored scale (0 = not observed, 1 = observed after prompting, 2 = performed independently), with the date, location, observer, and number of opportunities recorded. To assess change, the same indicators should be recorded at baseline and follow-up under comparable conditions, and composting and gardening records should include the weight of organic waste collected, the quantity of compost produced and used, maturity assessment, the number of plants, plant survival, and harvest weight.

Table 3. Proposed indicators for monitoring "Panah-Pasopati" outcomes

Domain	Indicator	Recording method
Waste sorting	Waste placed in the correct category (organic, inorganic, residual)	Teacher observation sheet, rated 0–2
Duty compliance	Student follows the assigned waste-duty schedule	Daily duty report
Initiative	Student maintains cleanliness without an individual reminder	Teacher observation sheet, rated 0–2
Cooperation	Student cooperates with peers during troop activities	Teacher observation sheet, rated 0–2
Waste bank	Weight and type of recyclable materials deposited	Waste-bank ledger (kg per month)
Composting	Organic waste processed, compost produced, maturity status	Dated compost log and weighing record
Gardening	Number of plants, survival rate, harvest weight	Garden journal with photographs

3.5 Supporting Factors and Constraints

Several enabling conditions were identified, including the commitment of the principal and program advisor teachers, students' interest in the troop concept, and support from parents and the surrounding community. The constraints reported were limited waste-processing facilities, insufficient technical training for program advisor teachers, and the risk of inconsistent implementation without continued monitoring and activity

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innovation. Other potential challenges in operating such a program include limited land, inadequate composting containers, unstable moisture levels, odor, and poor plant growth, which schools should anticipate when adopting the composting-to-gardening cycle.

3.6 Strategies for Program Sustainability

Several strategies may help sustain "Panah-Pasopati": (a) incorporating the program into the school operational curriculum; (b) renewing troop leadership periodically; (c) providing regular training for program advisor teachers; (d) strengthening partnerships with the environmental agency, private-sector organizations, parents, and the community; and (e) establishing regular schedules for waste collection, composting, and garden care. Embedding the program within the Adiwiyata framework may further support continuity and environmental literacy [10], while systematic records of waste weight, compost production, plant growth, and harvests would support transparent monitoring.

4 Conclusion

The "Panah-Pasopati" program was managed through four functions: planning, organizing, implementation, and monitoring and evaluation. The program provided a structured setting for students to participate in waste sorting, waste-bank activities, composting, and school gardening, and student accounts suggest that the collective troop identity is associated with feelings of pride and participation. The composting-to-gardening sequence offers a pedagogical cycle with potential environmental and learning benefits. This study has limitations: it documents program implementation and reported experiences, it did not use a validated environmental-attitude measure or a behavioral baseline, and it did not quantify participants by role, observation frequency, or the volume of waste processed, compost produced, and vegetables harvested. Future studies should define the school or site boundary, report participant characteristics and data-adequacy procedures, apply a transparent behavioral observation rubric such as the indicators proposed in Table 3, and maintain quantitative waste and garden records over time. With these improvements and sustained institutional support, "Panah-Pasopati" may provide a contextually relevant approach to environmental learning in elementary schools.

DECLARATIONS

Author Contributions

Conceptualization, B.S.; methodology, B.S., D.S., and A.B.S.; investigation and data curation, B.S.; supervision, D.S. and A.B.S.; writing—original draft preparation, B.S.; writing—review and editing, D.S. and A.B.S. All authors have read and agreed to the published version of the article.

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Conflict of Interest
The authors declare that there are no conflicts of interest regarding the publication of this article.

Data Availability Statement
The interview transcripts, observation notes, and program documents supporting the findings of this study are available from the corresponding author upon reasonable request, subject to the confidentiality of informants.

Research Ethics and Informed Consent
Permission to conduct the study was obtained from the participating schools, and consent was obtained from teachers and from the parents or guardians of student informants, with students' verbal assent. Please add the approval or permission reference.

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