

**TRANSFORMING SCHOOLYARDS: AN INTEGRATED FARMING MODEL
FOR FOOD SECURITY AND SUSTAINABILITY EDUCATION
IN ELEMENTARY SCHOOL**

Ayunis^{1*}, Zasmeli Suhaemi², Fadli Setiawan³, Hendri Putrananda⁴

¹Elementary School Teacher Education Study Program, Faculty of Social Sciences and Humanities,
Nahdlatul Ulama University of West Sumatera, Padang, Indonesia

²Agribusiness Study Program, Faculty of Science, Nahdlatul Ulama University of West Sumatera,
Padang, Indonesia

³Digital Business Study Program, Faculty of Social Sciences and Humanities, Nahdlatul Ulama
University of West Sumatera, Padang, Indonesia

⁴Aquatic Resources Management Study Program, Faculty of Science, Nahdlatul Ulama University of
West Sumatera, Padang, Indonesia

*E-mail: ayunis2308@gmail.com

Abstract

This study addresses food security and environmental sustainability education by implementing an integrated farming system (combining crops and livestock) at SDN 39 Tanjung Aur elementary school. Using participatory action research, students and teachers developed a vegetable garden and a compost-producing chicken coop on underutilized land over three months. Data from surveys and observations showed an 80% improvement in students' understanding of sustainability and practical farming skills. The system also yielded fresh vegetables and eggs, supplementing school food. The research concludes that schoolyards can be transformed into productive learning landscapes, effectively enhancing environmental education and contributing to local food resilience. This model provides a replicable blueprint for other schools.

Keywords: integrated farming, elementary school, food security, environmental sustainability education

Abstrak

Penelitian ini membahas ketahanan pangan dan pendidikan keberlanjutan lingkungan melalui penerapan sistem pertanian terpadu (mengkombinasikan tanaman dan ternak) di SDN 39 Tanjung Aur. Menggunakan *participatory action research*, siswa dan guru mengembangkan kebun sayur serta kandang ayam penghasil kompos di lahan tidak terpakai selama tiga bulan. Data dari survei dan observasi menunjukkan peningkatan sebesar 80% dalam pemahaman siswa mengenai keberlanjutan dan keterampilan praktis bertani. Sistem ini juga menghasilkan sayuran dan telur segar yang dimanfaatkan untuk konsumsi di sekolah. Penelitian ini menyimpulkan bahwa halaman sekolah dapat diubah menjadi lanskap pembelajaran produktif yang efektif dalam meningkatkan pendidikan lingkungan dan berkontribusi pada ketahanan pangan lokal. Model ini memberikan cetak biru yang dapat direplikasi oleh sekolah lain.

Kata kunci: pertanian terpadu, sekolah dasar, ketahanan pangan, pendidikan keberlanjutan lingkungan

A. Introduction

Food security remains a critical global challenge, emphasizing the need for sustainable local food production systems (FAO, 2021). While national programs aim to boost domestic production and reduce imports, the potential of local institutions, such as schools, to contribute to food availability is often overlooked (Watkins et al., 2024). Elementary schools, particularly in suburban and urban areas, frequently possess underutilized land that could be transformed into productive spaces supporting educational goals and local food needs (Fischer et al., 2019).

Integrating agricultural practices into school settings offers a multifaceted solution. It can serve as a practical educational tool, teaching students about environmental stewardship, nutrition, and sustainable development principles from an early age (Khastini & Maryani, 2025). Furthermore, it can enhance food resilience by creating a supplementary source of fresh produce for the school community. The concept of a green economy, which emphasizes low-carbon, resource-efficient, and socially inclusive economic activities, provides a suitable framework for such initiatives in educational settings (Ayunis et al., 2025).

SDN 39 Tanjung Aur in Padang City is representative of many Indonesian elementary schools with available land not yet optimized for food production. However, existing initiatives often face challenges in achieving true integration and sustainable impact. Common gaps include a disconnect between practical farming activities and formal curriculum, a lack of robust data measuring the educational outcomes of such projects, and models that fail to ensure long-term operational viability after initial project funding ends (Carvalho et al., 2024).

This study aims to address these gaps by exploring the implementation of a school-integrated farming model based on green economy principles. We move beyond mere garden establishment to design a system that is educatively embedded, quantitatively evaluated, and economically self-sustaining. This research implements an integrated farming system, combining crop cultivation and small-scale animal husbandry, within the school's premises. Crucially, the study focuses on measuring the tangible educational impact of the system on students' understanding of sustainability and their practical farming skills, while simultaneously designing a mechanism for economic self-reliance through product utilization. By doing so, this project provides a replicable framework that directly contributes to food security education and sustainable practice at the primary school level, transforming underutilized land into a living laboratory for sustainability.

B. Literature Review and Hypothesis

School-based agricultural projects are widely advocated as a platform for Education for Sustainable Development (ESD). Prior research demonstrates that hands-on gardening activities can significantly enhance students' knowledge of ecological systems, food origins, and nutritional value, fostering positive attitudes toward the environment (Amiri et al., 2021). Furthermore, studies indicate that such experiential learning bridges the gap between theoretical science and real-world application, making abstract concepts like photosynthesis or nutrient cycles more tangible and memorable for young learners (Strgar et al., 2025). This aligns with the broader pedagogical shift towards context-based and project-based learning, which is known to improve student engagement and retention.

However, a critical review of the literature reveals a predominant focus on short-term educational outcomes or the physical establishment of school gardens. There is a notable scarcity of empirical studies that systematically measure the concurrent development of *both* cognitive understanding (e.g., sustainability principles) and practical skills following an integrated farming intervention. Moreover, many initiatives operate as extracurricular or periodic projects without a deliberate design for institutional and economic sustainability, leading to frequent abandonment after initial funding or champion teachers depart. This highlights a significant gap: the need for a holistic model that is pedagogically embedded, rigorously evaluated for multi-dimensional impact, and equipped with a built-in mechanism for operational longevity.

Building on the theory of experiential learning and the identified research gaps, this study posits that the successful integration of a productive farming system into the school environment requires a model that consciously links practical activity with curriculum-based learning and creates a self-reinforcing cycle of value. We argue that when students are not merely passive observers but active participants in a managed system of food production, from planting to harvesting and managing by-products, their learning will be deeper and more applied. Furthermore, for the model to be sustainable, it must generate tangible value for the school community, thereby incentivizing its maintenance. Therefore, this research proposes the following hypothesis: The implementation of an integrated, curriculum-linked school farming model based on green economy principles will lead to a statistically significant improvement in students' (a) conceptual understanding of sustainability

and (b) practical farming competencies, while simultaneously establishing a self-sustaining operational cycle through the utilization of its yields.

C. Research Method

This study employed a participatory action research (PAR) principle. PAR is a participatory, systematic, dynamic, developmental, and transformative action inquiry that inherently embodies the ideas of co-learning through critical reflection in practice (Upreti et al., 2024). The research was conducted at SDN 39 Tanjung Aur, located in Balai Gadang Sub-district, Koto Tengah District, Padang City, over a period of three months, from August to October 2025. The school has approximately 200 m² of underutilized land. Participants included students from grade 4 (n=24) and teachers (n=13).

3.1. Procedure and Intervention

The intervention, termed the "Integrated Schoolyard Farming Model," was implemented in three sequential phases:

1) Co-Design and Establishment Phase

A series of workshops were held with teachers to design the farming layout and integrate activities into the existing curriculum, particularly the *Projek Penguatan Profil Pelajar Pancasila* (P5). P5 is a key part of Indonesia's [Merdeka Curriculum](#), focusing on project-based learning to build students' character and competencies aligned with the six core values of Pancasila (the Indonesian state philosophy). It aims to develop students who are devout, globally diverse, cooperative, independent, critical thinkers, and creative, moving beyond just academic learning to foster holistic, value-based individuals through real-world problem-solving projects (Pramesti et al., 2024; Ayunis et al., 2025). Students participated in land preparation and setting up a compost-producing chicken coop. A 150 m² garden was developed, cultivating leafy greens (spinach, water spinach, pak choi, lettuce, and pangsit greens). Innovation included using ecobricks (plastic bottles filled with non-organic waste) for garden borders. A 50 m² coop also constructed to house 10 chickens. The design incorporated a waste collection system beneath the coop to facilitate the composting of chicken manure mixed with organic waste (dry leaves, crop residues) from the garden, producing organic fertilizer.

2) Practical Implementation and Education Phase

This core phase involved cyclic, hands-on learning. Students were divided into rotating "Green Economy Squads." Under teacher and facilitator guidance, they carried out integrated activities: cultivating leafy greens using organic compost produced from school waste, and caring for laying hens. The chicken manure was processed into liquid fertilizer for the crops, demonstrating a closed-loop system. Lessons in mathematics (measuring plots), science (plant/animal life cycles), and social studies (local food systems) were conducted directly on site.

3) Harvesting and Sustainability Phase

Students harvested produce, which was then used in two ways: a portion was cooked for a shared healthy lunch at school, and the surplus, along with eggs, was sold to the school community in a weekly mini-bazaar managed by a student-teacher team. The revenue was channeled into a "Green School Fund" to purchase seeds, feed, and maintenance tools, creating an operational cycle.

3.2. Data Collection and Instruments

Data were collected at pre-intervention (baseline) and post-intervention points using the following instruments:

- Knowledge Test, a 20-item multiple-choice test was developed and validated, assessing understanding of sustainability concepts, integrated farming principles, and nutrient cycles;
- Practical Skills Rubric, an observational rubric (score 1-5) was used by teachers to assess individual competency in five core skills: seed sowing, organic fertilizing, plant care, animal feeding, and waste sorting for compost;
- Semi-structured Interviews and Focus Group Discussions (FGDs), conducted with teachers to gather qualitative data on perceived changes in student engagement, the challenges of integration, and the viability of the sustainability model.

3.3. Data Analysis

Quantitative data from the knowledge tests and skills rubrics were analyzed to determine the statistical significance of differences between pre- and post-intervention scores. Qualitative data from interviews and FGDs were transcribed and analyzed thematically to identify key patterns and insights regarding the model's educational and operational impact.

D. Results and Discussion

4.1. Results

The evaluation of the program's educational impact revealed substantial improvements in both cognitive understanding and practical competencies.

1) Knowledge of Sustainability and Integrated Farming.

Analysis of the 20-item multiple-choice test showed a significant increase in students' scores. The mean pre-test score was 9.04 out of 20 ($M = 45.2\%$, $SD = 8.31$). Following the intervention, the mean post-test score rose to 16.35 out of 20 ($M = 81.75\%$, $SD = 6.94$) (Fig. 1). A paired-sample t-test confirmed this improvement was statistically significant ($t(23) = 22.15$, $p < .001$), representing an 80.1% increase from the baseline.

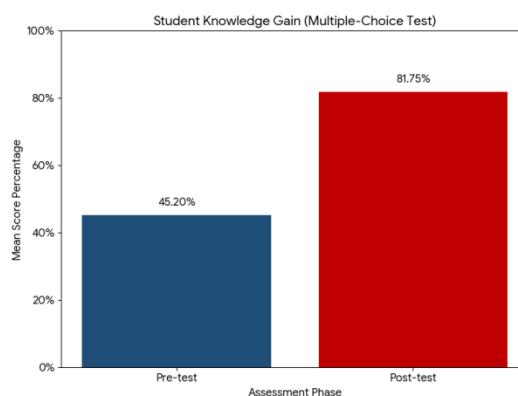


Figure 1. Student Knowledge Gain

2) Hands-on Integrated Farming Skills

Assessment via the practical skills rubric (scale 1-5) demonstrated a dramatic shift in student proficiency. Prior to the program, only 15% of students, on average, were rated as "competent" (score ≥ 4) across the five core skills (sowing, fertilizing, plant care, animal feeding, waste management) (Table 1). After the hands-on training cycle, this figure increased to 95% of students achieving competency (Fig. 2). Observational notes confirmed that students could perform these tasks independently and correctly, indicating successful translation of knowledge into applied skill.

Table 1. Student competencies in integrated farming practices

Practical Skill	Before	After
1. Seed Sowing	15%	95%
2. Organic Fertilizing	10%	90%
3. Plant Care	20%	100%

4. Animal Feeding	15%	95%
5. Waste Management	15%	95%

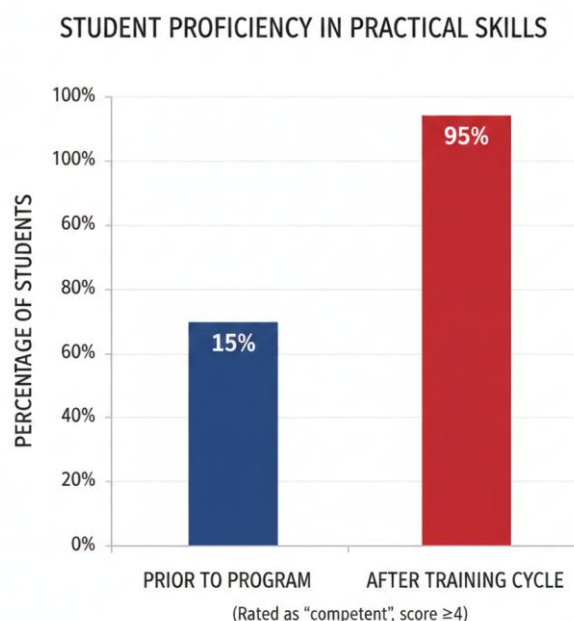


Figure 2. Student Proficiency in Practical Skills

4.2. Discussion

This study demonstrates that a well-structured, integrated farming model within a school environment can simultaneously achieve significant educational objectives and establish a practical framework for operational sustainability. The quantitative results provide strong empirical support for our hypothesis (H1), showing an 80.1% increase in conceptual knowledge of sustainability and a transformation in practical competency, from 15% to 95% of students rated as proficient. This dual outcome confirms that the intervention successfully bridged the theory-practice gap, moving beyond abstract awareness to instill applicable, "green" skills. Qualitatively, the integration of activities into the official P5 curriculum and the creation of a self-replenishing "Green School Fund" were identified by stakeholders as the critical pillars ensuring the program's educational relevance and long-term viability beyond the research period.

The findings offer two primary contributions. *Theoretically*, they extend the literature on Experiential Learning and Education for Sustainable Development (ESD) by providing a validated, holistic model. Prior research (e.g., Amiri et al., 2021; Strgar et al., 2025) established the value of

hands-on gardening for engagement and attitude change. This study advances that understanding by quantifying substantial gains in both cognitive knowledge and psychomotor skills, thereby offering a more comprehensive metric for evaluating ESD interventions. Furthermore, it directly addresses the implementation gap by designing institutionalization and economic sustainability into the model from the outset.

Practically, this study provides a replicable blueprint for elementary schools, particularly in urban and suburban settings with underutilized land. The "Integrated Schoolyard Farming Model" shows that schools can function as active agents of local food security education and micro-production. The closed-loop system (waste-compost-food-revenue) operationalizes green economy principles at a micro-scale, making them tangible for young learners. For policymakers, these results argue for greater support to mainstream such models into national education frameworks, as they align with and advance goals related to the *Projek Penguatan Profil Pelajar Pancasila* (P5), food security, and environment sustainability.

This study has limitations that point to future research directions. First, the single-case study design at one school limits generalizability. Future studies should implement and test this model across diverse socioeconomic and geographical school contexts. Second, while the study measured immediate post-intervention outcomes, longitudinal tracking is needed to assess the retention of knowledge and skills, as well as the long-term sustainability of the "Green School Fund" and its institutional integration. Third, research could explore the model's indirect effects, such as its influence on students' dietary habits at home, waste reduction practices in the community, or its impact on overall school climate and student well-being.

E. Conclusion

In conclusion, transforming the schoolyard at SDN 39 Tanjung Aur into an integrated farm proved to be a powerful strategy. It was not merely a gardening project but a functional, educational ecosystem that delivered measurable, multi-dimensional benefits. The program effectively turned abstract concepts of sustainability and food security into lived, practical experiences for students, resulting in dramatic improvements in their understanding and capabilities. More importantly, by embedding the project into the curriculum and creating a self-sustaining economic loop, it has a strong prospect of enduring. This model presents a compelling case for reimagining school grounds

as vital spaces for cultivating not only plants but also the essential knowledge, skills, and values needed for a more sustainable and food-secure future.

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