

Building Environmental Awareness among Preschoolers through Simple Hydroponic Farming: A Community Service at ABA XVI Kindergarten North Purwokerto, Banyumas Regency

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ARTICLE INFO

Article history

Received: April 15, 2025

Revised: May 25, 2025

Accepted: June 30, 2025

Keywords

Environmental Awareness

Hydroponic Farming

Early Childhood Education

Waste Recycling

Community Service

ABSTRACT

The decreasing interest of the younger generation in agricultural activities poses a serious challenge for future sustainability. Integrating environmental education into early childhood learning is therefore essential. This community service activity aimed to introduce eco-friendly farming practices to preschoolers at TK ABA XVI, North Purwokerto, Banyumas Regency through a simple hydroponic system using recycled waste materials. The program involved interactive lectures, discussions, Q&A sessions, and hands-on hydroponic planting. Results showed an increase in students' knowledge about hydroponics and a growing awareness of the importance of recycling plastic waste to protect the environment. This initiative highlights the effectiveness of early intervention in cultivating environmental consciousness among young learners, and provides a replicable model for integrating sustainability concepts into early childhood education curricula.

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1. Introduction

Today's educational environment demands optimal efforts to cultivate a generation that can master, apply, and innovate in science and technology [1]. Schools, alongside families and communities, play a crucial role in shaping children's development by guiding them towards productive interests [2]. Developing genuine interests among students is essential, yet complex, requiring active involvement from parents, educators, and society at large [3]. This project represents an innovative approach to environmental education tailored for early childhood, framed within a community service context. By introducing hydroponics as a hands-on learning tool, the activity serves as both a civic engagement initiative and a pedagogical model aligned with the goals of Sustainable Development—particularly in ensuring quality education and promoting environmental responsibility from an early age.

One pressing concern is the declining interest of the younger generation in agriculture. Agriculture is often perceived as an outdated, low-status profession associated with rural poverty [4]. In contrast, modern agriculture offers innovative techniques such as hydroponics a method of farming that uses nutrient solutions instead of soil, making it feasible in limited spaces [5], [6]. Hydroponics not only allows

farming in small home areas but also fosters creativity by utilizing recycled materials such as used bottles and plastic containers [7].

TK Aisyiyah Busthanul Atfal (ABA) Kindergarten XVI, located in Grendeng Village, North Purwokerto, Banyumas Regency, serves 91 students. Like many urban schools, ABA XVI faces challenges with limited green spaces and a lack of agricultural exposure among its students. Consequently, opportunities to use their small yard for environmental education and greening activities remain underutilized.

To address these issues, this community service initiative introduced simple hydroponic farming techniques using recycled materials. By combining theoretical instruction with hands-on practice, the program aimed to increase students' environmental awareness, promote sustainable practices, and optimize the use of the limited schoolyard space for educational greening activities. This approach also brings a novel contribution to early childhood education, as the integration of hydroponics with upcycling principles remains underexplored at the preschool level. This raises the research question: how can a simple hydroponic activity based on recycled materials improve environmental awareness among early childhood students.

2. Method

2.1. Activity Design

This activity utilized a combination of lectures, discussions, question-and-answer sessions, and hands-on hydroponic farming practice using household waste materials. The lectures were supported by informational leaflets distributed to students and their caregivers. These sessions aimed to build knowledge and understanding about hydroponic systems and promote environmental awareness regarding sustainable farming practices.

The learning approach combined interactive lectures, Q&A sessions, and practical training using household waste materials. Informational leaflets were distributed to both students and caregivers to reinforce the theoretical concepts. The hands-on method was selected based on early childhood pedagogical principles that emphasize learning through direct experience, sensory involvement, and active participation. Engaging children in real-world activities like planting helps to strengthen conceptual understanding, stimulate curiosity, and enhance environmental awareness at an early age.

2.2. Tools and Materials

The tools and materials used during the hydroponic farming session included: plant seeds, net pots, used plastic jam jars (as planting containers), rock wool (a water-retaining growing medium), flannel-made wicks (for nutrient absorption), and AB mix fertilizer. These components were selected not only for their functional role in hydroponic farming but also to introduce the concept of upcycling waste materials into educational and productive tools.

2.3. Participants

The activity involved a total of 91 participants, consisting of preschool students and their caregivers. This inclusive model allowed for intergenerational learning, where children learned alongside adults, fostering collaboration and shared environmental responsibility. The presence of caregivers also helped scaffold the children's understanding of abstract environmental concepts through dialogue and guided assistance.

2.4. Indicators of Success

The success of the activity was measured qualitatively through teacher and facilitator observations during the event. Key indicators included: increased student engagement and curiosity during the lecture and Q&A sessions, their ability to identify hydroponic components and their functions, active participation during the planting process, and verbal expressions of enthusiasm (e.g., "I want to grow one at home!"). Teachers also reported that students retained information about hydroponics during subsequent classroom activities, indicating that the learning had a lasting impression.

3. Results and Discussion

The community service activity was conducted on Saturday, November 16, 2023, at Aisyiyah Busthanul Atfal (ABA) XVI Kindergarten in Grendeng Village, North Purwokerto District, Banyumas

Regency. The activity was made possible through good collaboration between lecturers and the teaching staff at ABA XVI Kindergarten.

A total of 91 students and 60 parents attended, based on invitations distributed by the school. Although the attendance was not as high as the number of invitations sent, the enthusiasm shown by the students and their parents made the activity highly effective. This was evident from the active participation during the lecture and practice sessions. Many parents, students, and teachers took part in making hydroponic installations using waste plastic containers and fabric. In addition, the PAUD teachers were actively involved throughout the process, from preparing the learning environment to guiding the children during the hands-on hydroponic activities. Their participation not only supported the flow of the activity but also reinforced the pedagogical goals by connecting the experience with existing classroom themes such as plants, recycling, and healthy living.

As a follow-up to this initiative, the school has expressed commitment to developing a routine eco-friendly gardening activity using hydroponic methods. They plan to integrate hydroponic planting into thematic learning and explore collaborations with local agricultural offices to sustain and scale the program.

The program was divided into three sessions: (1) lectures, (2) discussion and Q&A, and (3) hands-on hydroponic farming practice. During the lecture session, materials were presented about hydroponics, its benefits, and how to formulate hydroponic nutrients. The discussion and Q&A followed the lecture, allowing participants to better understand the practical aspects of hydroponic farming.



Fig. 1. Introduction on hydroponic materials

Hydroponics was chosen as the topic because it is an engaging concept for children and a practical solution for urban or land-limited communities to grow vegetables and fruits without soil [8]. This method can be implemented year-round, independent of season, and supports a variety of crops [9]. Beyond food production, hydroponics also serves educational and environmental purposes promoting clean and healthy agricultural practices and rural agribusiness with minimal environmental impact [10].

The hands-on session involved practicing hydroponic farming using household waste containers. The growing medium used was rockwool, chosen for its advantages: it is pathogen-free, retains water up to 14 times more than soil, minimizes disinfectant use, enhances fertilizer efficiency, and supports strong root development. Rockwool can also be reused, making it both effective and eco-friendly [11], [12].



Fig. 2. (a) Sowing vegetable seeds on rockwool; (b) The activity of transplanting vegetable seedlings in a hydroponic system

The containers used were recycled jam jars and plastic buckets, functioning as plant pots. Other easily available materials like used plastic bottles, jerry cans, food containers, and PVC pipes can also be utilized. This practice aims to reduce plastic waste in the community. Plastic waste is non-biodegradable and can

cause environmental problems such as soil infertility, clogged drainage systems, and even air pollution when burned [13].

This community service activity is expected to enhance both students' and parents' awareness of hydroponic farming and environmental sustainability. It also provides early exposure to upcycling plastic waste into productive, eco-friendly planting media. The community strongly supports hydroponic methods, citing benefits such as chemical-free food, the ability to garden without land, reusing waste materials, and avoiding direct contact with soil or pests [14].

The community engagement activity at Aisyiyah Busthanul Atfal (ABA) XVI Kindergarten successfully fulfilled its goals by introducing young children and their caregivers to the fundamentals of hydroponic farming through an engaging combination of lectures, interactive discussions, and hands-on practice. The enthusiasm displayed throughout the event indicated a genuine curiosity and excitement among the participants, especially the children.

From the outset, the students were visibly intrigued by the topic. Many of them had never heard of hydroponics before, let alone seen vegetables growing without soil. Their eyes lit up during the demonstration, and their eagerness to participate reflected the power of experiential learning in early childhood education. Hydroponics can serve as an effective entry point for introducing agricultural science in a modern, accessible way [15].

The use of simple tools and recycled materials—such as used jam jars, plastic bottles, and flannel wicks—not only made the activity cost-effective and environmentally friendly, but also highly relatable to the children's daily lives. As the children and their caregivers worked side by side to assemble their mini hydroponic systems, they discovered that growing plants is not as complicated or intimidating as they once thought. For many, this was a moment of realization: farming could be fun, clean, and creative.

The use of rockwool as a growing medium, chosen for its clean, pathogen-free properties and excellent water retention, added to the ease of the planting process. Rockwool is highly suitable for beginners and children because it requires minimal maintenance and supports healthy root development [16]. This technical choice contributed to the smooth implementation of the practical session, boosting participants' confidence and sense of accomplishment.

The environmental message embedded in the activity was another important takeaway. Participants learned firsthand how everyday waste often seen as useless could be transformed into tools for sustainable gardening. The importance of reducing plastic waste through recycling and reuse to mitigate its harmful effects on the environment. The project not only taught agricultural techniques but also promoted a culture of environmental responsibility [17].

Despite the limited space and modest number of hydroponic kits available, the experience proved impactful. Although not every student had the opportunity to assemble their own kit, many took turns and shared roles, fostering collaboration and empathy. The level of engagement reflected in the number of questions asked and the hands-on excitement suggested that participants gained both knowledge and emotional connection to the activity.

Overall, the event reinforced that even young children can grasp and appreciate concepts like sustainability, plant cultivation, and recycling when these are taught in a hands-on, joyful, and meaningful way. This activity was conducted with the informal consent of the school and the students' guardians, ensuring alignment with ethical standards in early childhood education and community-based interventions. This activity demonstrated that hydroponics is not just a farming method it is a medium for education, creativity, and community transformation [18]. Through this experience, children began to view agriculture not as laborious, but as something innovative, empowering, and accessible even in the smallest of spaces.

Teachers observed that the students showed noticeable enthusiasm during the hydroponic activity. One teacher remarked, "The children were surprisingly curious. They asked questions like, 'Why do we not use soil?' and kept checking their plants after the session". A parent also shared, "This activity made my child more aware of waste. She even asked if we could grow lettuce at home using our old water bottles." These comments suggest that the program stimulated both cognitive curiosity and environmental responsibility among participants.

The implementation of the activity, from lecture to hands-on practice, brought different types of learning experiences. Table 1 summarizes the sessions, participants involved, and the observed immediate outcomes during the community service.

Table 1. Summary of Community Service Sessions, Participants, and Immediate Outcomes

Session	Participants	Direct Impact
Lecture on hydroponics	91 students, 60 parents	Improved basic understanding of hydroponic systems and environmental awareness
Discussion & Q&A	Mixed group	Active engagement, clarification of concepts, parent-child knowledge sharing
Hands-on hydroponic practice	Students, parents, staff	Boosted student interest, creative recycling of waste, collaborative learning

As shown in the table, each session played a unique role in fostering both cognitive and affective learning among preschoolers and their caregivers. The hands-on component in particular proved to be the most engaging and memorable for the children.

These results align with findings in early childhood environmental education, which emphasize the value of experiential, sensory-based learning. Hands-on activities related to sustainability can nurture eco-literacy and environmental responsibility from a young age [19]. Early exposure to environmental issues fosters a lasting ecological identity. Integrating upcycled hydroponics into preschool education provides a tangible medium to engage children in sustainability discourse—something often considered abstract in this age group [20].

4. Conclusion

This community engagement activity successfully introduced hydroponic farming to early childhood students and their caregivers in a creative and engaging way. The combination of lecture, discussion, and practical application fostered not only knowledge but also curiosity, environmental awareness, and hands-on skills. The children's enthusiastic responses demonstrated that even complex agricultural concepts like hydroponics can be understood and appreciated by young learners when presented in a fun, relatable manner. The use of recycled materials and simple tools emphasized sustainability and the value of reusing waste, aligning with broader environmental goals. Ultimately, this activity contributed meaningfully to students' early science education, promoted family involvement in learning, and inspired a more positive and modern view of agriculture among the younger generation. To ensure long-term impact, this program could be developed into a recurring annual event or integrated into the regular school curriculum, with support from local education authorities. Collaboration with local education offices or environmental agencies could also help expand its reach. The success of this initiative offers a practical and replicable model for other urban early childhood education institutions to promote ecological literacy, creativity, and sustainable habits through community-based learning.

Declarations

Author contribution.

Risqa Naila Khusna Syarifah contributed as a trainer and presenter for hydroponic cultivation practices. Eros Meilina Sofa was responsible for the conceptualization and writing of the manuscript. Dian Novitasari delivered materials on the benefits of hydroponic knowledge for early childhood. Lafi Na'imatul Bayyinah presented material on the importance of agricultural cultivation for early childhood.

Purwanto was involved in conceptualization and writing.

Agus Sarjito, Hana Hanifa, and Hanim Rahayuani Ratnaningsih contributed to data collection.

Funding statement.

This work did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest.

The authors declare no conflict of interest.

Additional information.

No additional information is available for this paper.

Data and Software Availability Statements

No data or software were used or generated in this work.

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