

Sustainable Utilization of Wudu Water for Fish Farming Through a Community-based Integrated Learning Program in Madrasah Ibtidaiyah

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Abstract

This community service program aims to enhance teacher competence and create innovative learning media at MIS Handapherang by integrating the treatment of water waste abluion with fish farming. The methods used included training, mentoring, and building a functional abluion water installation and piping system to a fish pond. The results showed a significant increase in teacher capacity, evidenced by an average survey score above 4.0 out of 5. Teachers felt more skilled in designing STEAM-H and project-based lesson plans for integrated science and mathematics learning. These lesson plans also improved student engagement and their understanding of water conservation concepts. The project successfully installed environmental values and supported the school's Adiwiyata program. The construction of the fish farming installation served as a physical artifact that transformed waste into a productive resource and a sustainable learning medium. Thus, the program successfully achieved its goal of creating learning innovations with a positive impact on the school environment

Keywords: abluion water; fish farming; integrated learning; STEAM-H

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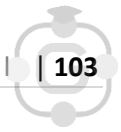
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INTRODUCTION

MIS Handapherang, an elementary Islamic school located in Ciamis Regency, West Java, is an Adiwiyata school (Environmental Agency, 2018; Deskjabar Team, 2021) that has demonstrated its commitment to environmentally conscious education through various prestigious achievements. As the only elementary school in Ciamis to receive the Adiwiyata Mandiri award in 2023 and a monitoring point for Adipura since 2020, MIS Handapherang has established itself as a pioneer in the environmental awareness and culture movement. This achievement is not only a source of pride but also demonstrates the school's significant efforts to integrate environmental values into the daily behavior of the school community, including through strategic partnerships with external parties in developing the Adiwiyata curriculum.

However, despite these remarkable achievements, MIS Handapherang faces challenges in terms of limited facilities for implementing the Adiwiyata technology and innovation program. A specific issue of primary concern is abluion water waste. Due to the high frequency of prayer in schools, the volume of wastewater produced is significant and has not been properly managed. This wastewater, although physically clean, remains an untapped potential. However, several studies have demonstrated the successful use of abluion wastewater for productive and educational activities, such as those conducted by Susanti et al. (2022), who successfully applied it to freshwater fish and hydroponic plant cultivation. Furthermore, Irmawanty et al. (2024), developed a comprehensive treatment system to make abluion



wastewater suitable for fish ponds, while Budiyanto (2019), combined ablution water recycling with biofloc technology for catfish cultivation. The absence of these wastewater treatment systems highlights a gap in water conservation efforts that could be optimized.

Given these conditions, handling ablution wastewater is a priority because it presents a specific challenge, is directly related to routine school activities, and has significant potential to be developed into a concrete learning medium. Wastewater management in schools can be integrated with innovative educational models, which have been the focus of research in recent years. Project-based learning models and the STEAM-H (Science, Technology, Engineering, Agriculture, Mathematics, and Health) approach have proven effective in increasing student engagement and developing 21st-century skills (Fatimah et al., 2024, 2025). STEAM-H itself is an expanded multidisciplinary educational framework that integrates agricultural and health components into traditional STEAM education (Fatimah et al., 2022). Research shows that this approach can address complex real-world problems by breaking down disciplinary boundaries (Fatimah et al., 2023; Toni, 2014).

By combining these two approaches, a program can be designed to address environmental issues while simultaneously developing teacher and student competencies. Therefore, the goal of this community service activity is to provide training to MIS Handapherang teachers in utilizing ablution wastewater for fish farming, as an effort to develop innovative learning media that integrates the STEAM-H approach, enabling waste to be transformed into a valuable resource and an integrated learning medium.

METHODS

The proposed solution to address the challenges at MIS Handapherang is a community service program focused on training and mentoring. This program is designed to address challenges related to learning innovation and water conservation by converting ablution wastewater into a productive resource.

The program's implementation procedure is divided into four main stages: outreach, training, technology implementation, mentoring, and evaluation.

The outreach phase begins with an initial meeting with partners and Handapherang village leaders. The goal is to explain in detail the program's objectives, benefits, and stages, and to receive input from the school and community. Through this meeting, the implementation team builds consensus and a shared commitment to the program's success. Outreach also continues through a WhatsApp group to ensure effective information flow throughout the program.

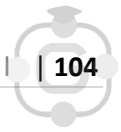
Training is provided to MIS Handapherang teachers as the core of this activity. The training focuses on designing lesson plans for utilizing ablution water for fish farming in tarpaulin ponds. Participants are provided with technical modules and guided in constructing a cylindrical tarpaulin pond installation. Furthermore, teachers are trained in designing STEAM-H-based learning that integrates ablution wastewater treatment.

Following the training, the team assisted partners in implementing the technology they had learned. This included installing tarpaulin fish ponds and constructing a piping network to channel ablution wastewater from the ablution area directly to the ponds. This process ensured that previously wasted wastewater could be directly and sustainably utilized. The project served as a tangible learning tool, allowing teachers and students to directly observe ecosystem cycles.

The team provided regular support to partners in managing the fish farming installations. The team also assisted teachers in designing STEAM-H lesson plans. During this phase, the program's effectiveness was evaluated through surveys using questionnaires, interviews, and direct observation. The results of these evaluations will be used to improve the program in the future and ensure its sustainability.

RESULTS AND DISCUSSION

The community service program at MIS Handapherang successfully achieved its goal of integrating ablution wastewater treatment with fish farming activities as an innovative learning medium. This result was achieved through a series of planned stages, from outreach to mentoring.



Teacher Training and Capacity Building

The results of the community service program at MIS Handapherang demonstrated success in improving teachers' professional capacity. Based on observations and questionnaire analysis, the program successfully provided an understanding of fish farming techniques in tarpaulin ponds and integrated the STEAM-H curriculum. Teachers not only understood the theoretical concepts but were also able to apply them by designing innovative Lesson Implementation Plans. Teachers were able to utilize ablution wastewater as an educational resource, connecting real-world practice with scientific concepts. This demonstrates the achievement of the training method's goal of being oriented toward practice and direct implementation in the school environment.

Questionnaires distributed to 25 respondents confirmed the positive impact of the program. As presented in the table below, the average score for all indicators was above 4.0, indicating a high level of agreement. The teacher-designed lesson plans proved effective in increasing student engagement and helping them grasp the concept of water conservation concretely. The project also successfully instilled environmental values in students and significantly contributed to a culture of environmental stewardship at school, in line with the Adiwiyata program.

Table 1. Summary of Training Program Effectiveness Survey Results

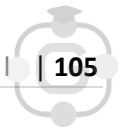
Indicator (Survey Statement)	Mean
This program is relevant to the needs of designing innovative lesson plans (RPP).	4.5
This program helps me design integrated thematic learning pathways.	4.4
I feel more skilled in developing STEAM-H-based lesson plans after participating in this program.	4.3
This program increases my confidence in designing project-based learning.	4.3
This lesson plan enhances student engagement in learning.	4.4
This lesson plan helps students understand water conservation concepts more concretely.	4.5
This lesson plan facilitates the integrated teaching of science and mathematics concepts.	4.5
This project supports the school's Adiwiyata program in terms of water conservation.	4.6
This lesson plan instills environmental awareness values in students.	4.5
This project contributes to fostering an environmentally conscious school culture.	4.6

Table 1 clearly shows that this community service program not only successfully improved individual teacher competencies but also had a significant and comprehensive positive impact on the quality of learning, as well as the development of character and a culture of environmental care at MIS Handapherang.

This finding aligns with various previous studies demonstrating that teacher competency development programs have significant positive impacts. For example, research by Syahidin et al. (2022) demonstrated that environmental character education through organic fertilizer production not only addressed waste issues but also fostered environmental awareness and created economic opportunities. Similarly, Erlisnawati et al. (2023) found that training in developing teaching materials based on local wisdom successfully improved teachers' ability to create relevant educational resources. Furthermore, the program on utilizing the environment as a learning resource studied by Kale et al. (2022), and the classroom action research training conducted by Baharuddin et al. (2024), also confirmed that improving teacher competency directly contributed to students' creative thinking, optimized educational costs, and improved innovative teaching methods. Thus, the results of this program strengthen the argument that investing in teacher competency development is key to improving the quality of education and developing environmentally conscious student character.

Construction of a Fish Farming Installation

This program successfully established a functional fish farming installation on the school grounds. The implementation team assisted partners in installing a tubular tarpaulin pond and constructing a piping network that directly channels ablution wastewater from the ablution area to the pond. This installation



serves as tangible evidence (artifact) of the application of the technology taught, transforming previously discarded wastewater into a productive fish pond.



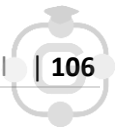
Figure 1. Ablution Water Installation and Fish Pond

The success of the program at MIS Handapherang aligns with various community service initiatives at other educational institutions. This program reinforces the finding that a practice-based approach to fish farming is effective in improving skills and knowledge. For example, at SMK Pesantren Al-Jauhariah, an integrated catfish and melon farming system successfully fostered students' entrepreneurial spirit (Irawan et al., 2024), similar to how the project at MIS Handapherang instilled environmental and entrepreneurial values. At the Mu'adalah Ala Gontoran-Najah Islamic Boarding School, an introduction to tilapia cultivation using tarpaulin ponds demonstrated an increase in participants' technical understanding (Herliani et al., 2022), similar to the experience experienced by teachers at MIS Handapherang.

Furthermore, an initiative at SDN Sarirejo 1 focusing on local fish feed has increased productivity and established the school as a model for aquaculture (Setyowati et al., 2024), while training at other Islamic boarding schools has successfully developed students' entrepreneurial skills and creativity (Ceceng Saepulmilah et al., 2022). All these findings reinforce that the construction of physical facilities such as fish ponds, integrated into the curriculum, not only serves as a concrete learning medium but also serves as a catalyst for the development of practical skills, environmental awareness, and entrepreneurial potential among students and the school community. Thus, the program at MIS Handapherang has successfully replicated and amplified the proven positive impact of similar initiatives across Indonesia.

CONCLUSION

Based on the analysis, the community service program at MIS Handapherang successfully achieved its goal of integrating ablution wastewater treatment with fish farming as an innovative and sustainable learning medium. This success is evident from the significant improvement in teacher competency, who are now able to design innovative STEAM-H-based lesson plans and projects, as well as from the positive impact on understanding environmental concepts concretely. Moreover, this project succeeded in instilling environmental values and concretely supporting the school's Adiwiyata program, reinforced by the



construction of a functional fish farming installation that serves as a tangible artifact of the application of knowledge and will continue to function as an effective learning medium.

Limitations and future direction

This community service program has several limitations, including its implementation in a single school context, which limits generalizability, and its relatively short duration, which does not allow for observation of long-term impacts on student learning, environmental behavior, and system sustainability. In addition, the evaluation relied mainly on teacher self-reported data, which may introduce subjectivity and does not fully capture measurable changes in learning outcomes or technical performance of the fish farming system. Therefore, future programs should involve broader implementation across diverse school settings, apply more rigorous evaluation methods such as pre- and post-assessments and classroom observations, and integrate simple water treatment technologies to improve system effectiveness. Long-term monitoring and the inclusion of student-centered and entrepreneurship-based activities are also recommended to enhance sustainability and educational impact.

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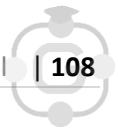
Statement and Declarations

The authors declare that this work is original, all data are available upon request, and there are no conflicts of interest. All authors contributed equally to this study.

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