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Benefits of SMOGRA for Pro-Environmental Behavior at SD Muhammadiyah 24 Surakarta

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ABSTRACT

Environmental awareness in schools plays an important role in supporting sustainable environmental behavior and strengthening the implementation of the Adiwiyata program. SD Muhammadiyah 24 Surakarta is one of the schools that aims to become an environmentally friendly school; however, the school still faces several challenges, including limited environmental awareness among students, inadequate waste management behavior, and the lack of technology utilization in supporting environmental management activities. This community service program aimed to introduce Smart Monitoring Green Action (SMOGRA) and improve pro-environmental behavior among students, teachers, and educational staff at SD Muhammadiyah 24 Surakarta. The methods used in this activity included coordination, environmental socialization, counseling, demonstrations, and interactive discussions. The activities were conducted in several stages, starting from coordination with the school principal, environmental socialization for students, counseling for teachers and staff, and demonstrations of SMOGRA utilization as an Internet of Things (IoT)-based environmental monitoring medium. The results of the activity showed positive responses from participants regarding the implementation of environmentally friendly school culture and the importance of pro-environmental behavior. Students demonstrated enthusiasm during the environmental socialization activities, while teachers and staff showed interest in utilizing technology to support environmental education and school environmental management. The implementation of SMOGRA provided additional understanding regarding the integration of technology and environmental education to support the development of sustainable environmentally friendly school culture.

Keywords: SMOGRA, pro-environmental behavior, environmental awareness, Adiwiyata, IoT

1. Introduction

Environmental problems have become one of the global issues that require serious attention from various sectors, including the education sector. Schools are not only places for transferring knowledge, but also strategic institutions for shaping students' character and environmental awareness from an early age. Environmental education is important in creating sustainable behavior and encouraging students to actively participate in preserving their surroundings (Ardoin et al., 2020). According to Thohir et al (2025), the implementation of environmental-based education programs in schools can foster students' environmental care character and strengthen sustainable environmental behavior.

The Indonesian government, through the Ministry of Environment and Forestry, has developed the Adiwiyata program as an effort to create environmentally friendly schools. The Adiwiyata program encourages schools to integrate environmental values into school policies, learning activities, participatory programs, and environmentally friendly infrastructure management. Aqilah & Lathifah (2023) explained that the implementation of the Adiwiyata program contributes positively to increasing environmental awareness and building a green school culture. In addition, Wijayanti et al (2021) stated that the success of Adiwiyata schools is strongly influenced by the participation of all school members and the school's strategy in implementing environmental management practices.

SD Muhammadiyah 24 Surakarta is one of the Muhammadiyah elementary schools located in Gajahan, Pasar Kliwon District, Surakarta. The school has a vision of creating students who excel in faith, knowledge, and technology. Based on observations and interviews conducted with the school management, SD Muhammadiyah 24 Surakarta has a strong intention to become an Adiwiyata school.

Figure 1. Profile and Physical Environment of SD Muhammadiyah 24 Surakarta

However, several challenges are still faced by the school, including the limited implementation of environmentally based learning, low environmental awareness among students, and the lack of optimal environmental management practices within the school environment (Njo & Sugondo, 2025).

In addition, the school still experiences challenges in encouraging pro-environmental behavior among students, particularly in waste sorting habits and environmental cleanliness awareness. The formation of pro-environmental behavior among elementary school students requires innovative, interactive, and sustainable educational approaches. Therefore, schools need supporting media and technologies that can increase students' participation in environmental activities in a more engaging way (Nabif et al., 2023).

One of the solutions that can be implemented is the utilization of Internet of Things (IoT)-based technology through Smart Monitoring Green Action (SMOGRA). IoT technology has been widely used in environmental monitoring systems because it enables real-time monitoring and interactive learning experiences. Luhur Adi Prasetya et al. (2025) explained that IoT-based environmental monitoring systems can improve environmental management effectiveness and increase user engagement in maintaining environmental sustainability. In the educational context, SMOGRA can be utilized as a monitoring and educational tool to support waste management and strengthen students' pro-environmental behavior in schools (Febriyanti & Rahmandani, 2024).

Pro-environmental behavior refers to individual actions that reflect concern for environmental sustainability, such as sorting waste properly, reducing environmental pollution, and maintaining cleanliness in daily activities. (Kuswati, 2020) explained that environmental awareness and environmental concern significantly influence the emergence of pro-environmental behavior. Therefore, integrating technology into environmental education is expected to increase students' awareness and motivation to participate in green activities at school.

This community service program was conducted through socialization, counseling, and workshops regarding the implementation of SMOGRA for teachers and students at SD Muhammadiyah 24 Surakarta. The program aimed to increase environmental awareness, improve understanding of pro-environmental behavior, and introduce the use of IoT-based technology to support the Adiwiyata program (Azzam & Fani, 2021). The benefits of this activity are expected to strengthen the school's environmental culture, improve student participation in environmental management activities, and support SD Muhammadiyah 24 Surakarta in becoming an environmentally friendly and technology-based Adiwiyata school.

2. Method

This community service activity was conducted at SD Muhammadiyah 24 Surakarta, located in Gajahan, Pasar Kliwon District, Surakarta. The participants involved in this activity consisted of students, teachers, and educational staff. Based on school data, SD Muhammadiyah 24 Surakarta has a total of 218 students from grades 1 to 6. In addition, the activity involving teachers and educational staff was attended by 25 participants.

The implementation of this community service program was carried out through three stages, namely the preparation stage, implementation stage, and evaluation stage. These stages were systematically arranged to ensure that the implementation of the Smart Monitoring Green Action (SMOGRA) program could address the environmental issues faced by the partner school.

Preparation Stage

The preparation stage began with a coordination meeting between the community service team and SD Muhammadiyah 24 Surakarta. The coordination activity was

conducted with the school principal on March 31, 2026. The purpose of this activity was to identify environmental conditions within the school, recognize the main environmental problems faced by the school, and determine the schedule for implementing the community service activities.

At this stage, the team also conducted preliminary observations regarding students' environmental awareness and waste management behavior within the school environment. In addition, socialization materials, presentation media, and SMOGRA introduction materials were prepared before the implementation activities were conducted.

Implementation Stage

The implementation stage consisted of environmental socialization, counseling activities, and the introduction of Smart Monitoring Green Action (SMOGRA) technology. The activities were carried out in two separate sessions targeting different participant groups.

The first session was conducted on Monday, April 6, 2026, in the form of environmental socialization activities for students of SD Muhammadiyah 24 Surakarta. This activity aimed to improve students' understanding of environmental cleanliness, waste sorting habits, and pro-environmental behavior from an early age (Ima Riris Mulati, 2022). During the session, students received education regarding the importance of maintaining school cleanliness and participating in environmentally friendly activities within the school environment.

The second session was conducted on Monday, May 4, 2026, involving teachers and educational staff of SD Muhammadiyah 24 Surakarta. A total of 25 teachers and staff members participated in this activity. The session focused on counseling and discussions regarding environmentally friendly school culture and the utilization of SMOGRA as an Internet of Things (IoT)-based environmental monitoring tool to support the Adiwiyata program (Munandar et al., 2023).

The methods used in this community service activity included lectures, discussions, demonstrations, and interactive training sessions. Lecture methods were used to deliver environmental awareness materials, while discussion and question-and-answer sessions were conducted to increase participant engagement during the activities. Demonstration and interactive training methods were also implemented to introduce the functions and operational mechanisms of SMOGRA in supporting environmental management and waste monitoring activities at school. The use of participatory methods in community service activities is considered effective in increasing participant understanding and involvement (Munandar et al., 2023).

Evaluation Stage

The evaluation stage was conducted through direct observation, discussions, and participant feedback during the implementation process. The evaluation aimed to identify participants' understanding regarding environmental awareness and the utilization of SMOGRA technology in supporting pro-environmental behavior within the school environment.

To simplify the understanding of the implementation process, the stages of the community service activity are illustrated in Figure 2.

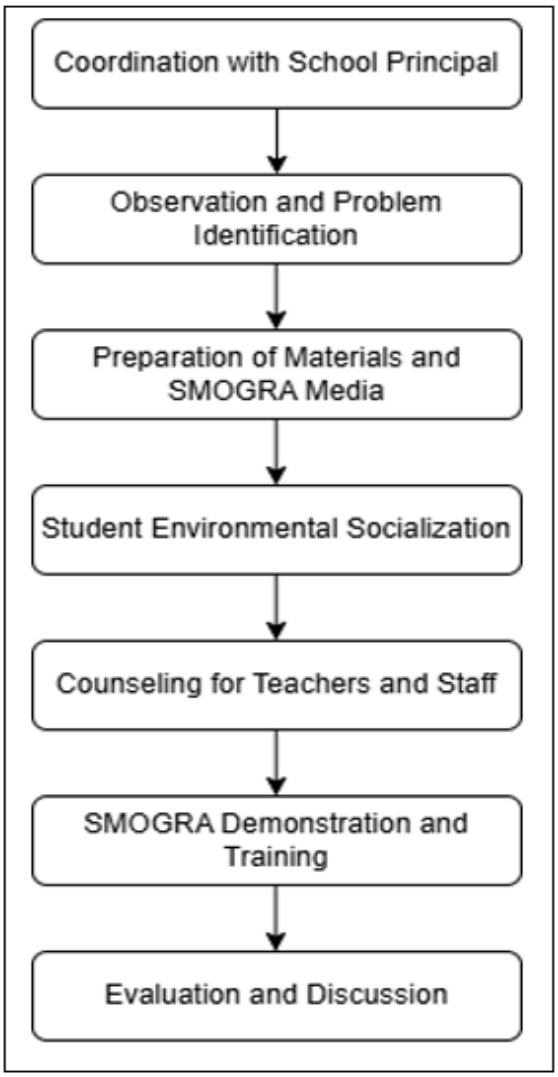

Figure 2. Flowchart of Community Service Implementation

3. Results and Discussion

The community service program regarding the socialization and counseling of Smart Monitoring Green Action (SMOGRA) at SD Muhammadiyah 24 Surakarta was implemented through several stages, including initial coordination with the school, environmental socialization for students, counseling for teachers and educational staff, and demonstrations of SMOGRA utilization as a medium for monitoring pro-environmental behavior. This activity was carried out as an effort to support the school in increasing environmental awareness and strengthening its readiness toward becoming an Adiwiyata school (Anas et al., 2026).

Before the implementation of the community service program, SD Muhammadiyah 24 Surakarta still faced several challenges related to environmental management practices within the school environment. Based on observations and coordination with the school, students' awareness regarding environmental care behavior still needed improvement, particularly in maintaining school cleanliness and practicing waste sorting habits. In addition, the utilization of technology to support environmental management had not been optimally implemented. After the implementation of the activities, the school community began to better understand the importance of environmentally friendly school culture and the utilization of IoT-based technology to support pro-environmental behavior in schools.

Coordination with the School

The initial stage of the community service activity was conducted through coordination with the principal of SD Muhammadiyah 24 Surakarta on March 31, 2026. This coordination activity aimed to discuss the school's environmental conditions, identify the environmental challenges faced by the school related to the Adiwiyata program, and determine suitable activities based on the school's needs.

During this activity, the community service team and the school management discussed the importance of increasing environmental awareness among students and teachers. In addition, discussions were also conducted regarding the utilization of SMOGRA as an educational and monitoring medium to support pro-environmental behavior within the school environment (Tristiana & Sukartono, 2023).

Figure 3. Coordination Meeting with the Principal of SD Muhammadiyah 24 Surakarta

The coordination activity was conducted successfully, and the school provided positive support for the implementation of the community service program carried out by the Universitas Muhammadiyah Surakarta community service team.

Environmental Socialization for Students

The environmental socialization activity for students was conducted on Monday, April 6, 2026, at SD Muhammadiyah 24 Surakarta. This activity aimed to improve students' understanding of environmental cleanliness, encourage waste sorting habits, and foster pro-environmental behavior from an early age.

During this activity, students received educational materials regarding the importance of maintaining environmental cleanliness, the impact of waste on the school environment, and simple actions that students can take to preserve school cleanliness. The materials were delivered interactively to make the learning process more engaging and easier for students to understand. In addition, students were introduced to the concept of Smart Monitoring Green Action (SMOGRA) as a supporting medium for monitoring environmentally friendly behavior in schools.

Students showed high enthusiasm throughout the activity, particularly during the discussion and question-and-answer sessions related to environmental care behavior. This finding is in line with (Qodriyanti et al., 2022), who explained that increasing environmental awareness can encourage the development of pro-environmental behavior among individuals.

Figure 4. Environmental Socialization Activity for Students of SD Muhammadiyah 24 Surakarta

The socialization activity contributed positively to improving students' understanding regarding the importance of maintaining environmental cleanliness and practicing proper waste sorting behavior.

Counseling for Teachers and Educational Staff

The counseling activity for teachers and educational staff was conducted on Monday, May 4, 2026, involving 25 teachers and school staff members. This activity aimed to improve participants' understanding regarding environmentally friendly school culture and the utilization of technology to support the Adiwiyata program.

During the activity, the community service team delivered materials regarding pro-environmental behavior, school environmental management, and the introduction of SMOGRA as an Internet of Things (IoT)-based monitoring technology. Interactive discussions were also conducted regarding strategies for implementing environmental awareness culture within the school environment.

Teachers and educational staff responded positively to the activity. Participants showed interest in utilizing technology as a supporting medium for environmental education and school environmental management. This result supports the findings of (Herawati et al., 2024), which stated that the success of environmentally friendly school programs is strongly influenced by the involvement and awareness of all school members.

Figure 5. Counseling and Discussion Session with Teachers and Educational Staff

Through this activity, the school gained additional insights regarding the importance of integrating environmental education and technology in supporting environmentally friendly school programs.

Demonstration of SMOGRA Utilization

The next stage of the activity was the demonstration of Smart Monitoring Green Action (SMOGRA) as a medium for monitoring pro-environmental behavior within the school environment. The demonstration aimed to provide participants with an understanding of the functions and operational mechanisms of SMOGRA in supporting school environmental management.

The community service team explained that SMOGRA is a technology-based medium that can support environmental monitoring activities, particularly in waste management and increasing students' environmental awareness. Through this demonstration, participants gained insights into the implementation of Internet of Things (IoT)-based technology to support environmentally friendly school programs.

Figure 6. Demonstration of Smart Monitoring Green Action (SMOGRA)

The demonstration activity helped participants understand that technology utilization can become an alternative solution in building sustainable pro-environmental culture within the school environment. This finding is supported by (Pintar et al., 2025), who explained that IoT-based environmental monitoring systems can improve environmental management effectiveness and increase environmental engagement among users.

4. Conclusion

The community service program regarding the socialization and counseling of Smart Monitoring Green Action (SMOGRA) at SD Muhammadiyah 24 Surakarta was successfully implemented through coordination activities, environmental socialization for students, counseling for teachers and educational staff, and demonstrations of SMOGRA utilization as an IoT-based environmental monitoring medium. The implementation of this activity contributed positively to increasing participants' understanding of environmental awareness, waste sorting habits, and the importance of pro-environmental behavior within the school environment (Sholihah & Putri, 2024).

The results of the activity also showed that students, teachers, and school staff demonstrated positive responses toward the implementation of environmentally friendly school culture and the utilization of technology to support the Adiwiyata program. The introduction of SMOGRA provided additional insights regarding the potential use of technology-based environmental monitoring systems to strengthen environmental education and encourage sustainable environmental behavior in schools (Priyaji Agung Pambudi, 2022).

This community service activity is expected to become an initial step in supporting SD Muhammadiyah 24 Surakarta toward becoming an environmentally friendly and technology-based Adiwiyata school. In

addition, continuous environmental education activities and the sustainable implementation of SMOGRA are recommended to strengthen students' environmental awareness and maintain pro-environmental behavior within the school environment (Haifani & Shafarina, 2024).

5. Allowance

The authors would like to express their sincere gratitude to SD Muhammadiyah 24 Surakarta for the support, cooperation, and active participation during the implementation of this community service program. Appreciation is also extended to the teachers, educational staff, and students who participated enthusiastically in the socialization and counseling activities regarding Smart Monitoring Green Action (SMOGRA).

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6. Reference

Anas, M., Nur, M., Hikmah, L., & Arif, M. (2026). *Ecological Jurisprudence and Character Education : A Study of Implementation in the Adiwiyata Program at Madrasahs*. *7*(2), 648–659.

Aqilah, S., & Lathifah, S. S. (2023). *Implementation and Impact of Environmentally Sound Schools and Adiwiyata Program in East Java Province : A Literature Review*. *1*(1), 9–15.

Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation : A systematic review. *Biological Conservation*, *241*(November 2019), 108224. https://doi.org/10.1016/j.biocon.2019.108224

Azzam, A., & Fani, R. A. (2021). *Eksplorasi Pengetahuan Lingkungan (Environmental Knowledge), Sikap Terhadap Lingkungan (Environmental Attitude) Dan Perilaku Terhadap Lingkungan (Environmental Behaviour) Mahasiswa Pendidikan Biologi Ums*. *Clugston 2004*, 171–182.

Febriyanti, D. A., & Rahmandani, A. (2024). *Jurnal Teknologi Lingkungan Perspektif Siswa Sekolah Dasar Adiwiyata mengenai Perilaku Peduli Lingkungan Hidup : Sebuah Studi Mixed-methods Concurrent Explanatory Students ' Perspectives on Pro-Environmental Behavior in Adiwiyata Elementary School : A Mixed-methods Concurrent Explanatory Study*. *25*(1), 126–136.

Haifani, M. F., & Shafarina, A. Y. (2024). *Penerapan Literasi Lingkungan Melalui Program Edukasi Sampah Organik Dan Non Organik Pada Siswa Sekolah Dasar SDN 1*. *3*, 153–160.

Herawati, E. Y., Parahita, B. N., Zuhri, S., Sebelas, U., & Surakarta, M. (2024). *Kolaborasi Sekolah Dengan Bank Sampah Sekar Gendis Dalam Pembentukan Karakter Peduli Lingkungan Siswa*. *17*(1), 125–133.

Ima Riris Mulati, R. K. (2022). *Pengaruh Sikap Lingkungan Terhadap Pro Lingkungan Yang Dimediasi Oleh Kepedulian Lingkungan Dan Kemauan Membayar Lebih*. *18*(3), 157–167.

Kuswati, R. (2020). *Encouraging pro-environmental behavior through consumer innovativeness*. 13–19.

Luhur Adi Prasetya, Amir Rofiudin, H. W. H. (2025). Implementation of Internet of Things (IoT) in Education: A Systematic Literature Review. *Journal of Education and Computer Applications*, *2*, 1–45.

Munandar, A., Utaminingsih, S., & Borg, D. (2023). *Jurnal Manajemen Pendidikan Pengembangan Model Pengelolaan Sekolah Berwawasan Lingkungan Menuju Sekolah Adiwiyata di Sekolah Dasar Development of an Environmentally Friendly School Management Model Towards Adiwiyata Schools in Elementary Schools*. *5*(1), 81–94.

Nabif, M., Noor, F., & Kuswati, R. (2023). *The Effects of Environmental Value and Environmental Engagement on Sustainable Consumption Behavior*. *1*(January), 1517–1531.

Njo, A., & Sugondo, A. (2025). *Mewujudkan Green School : Generasi Hijau Sebagai Agen Perubahan Lingkungan Melalui Kegiatan Daur Ulang Sampah*. *9*(2), 200–209.

Pintar, S., Sekolah, D., Dasuki, M., Lusiana, D., & Rahman, M. (2025). *Pengenalan Teknologi Internet Of Things (Iot) Untuk Pengelolaan*. *6*(3), 1850–1856.

Priyaji Agung Pambudi, Savina Nurma Fardiani, Siti Zaenab, Amin Hidayati, Lala Julian Permana, N. H. A. (2022). *Penguatan Nilai Kepedulian Lingkungan Pada Siswa Jenjang Pendidikan Dasar*.

Qodriyanti, A., Yarza, H. N., Elvianasti, M., & Ritonga, R. F. (2022). *Analisis Sikap Peduli Lingkungan Siswa di Salah Satu MAN pada Materi Pelestarian Lingkungan (Analisis Sikap Peduli Lingkungan Siswa di Salah Satu MAN …..)*. *6*.

Sholihah, K. U., & Putri, M. A. (2024). *Intervensi untuk Meningkatkan Perilaku Pro-lingkungan pada Lingkungan Sekolah : Scoping Review*. *1*(1), 132–143.

Thohir, M. A., Rahayu, M., Shofiyah, M., & Andini, F. W. (2025). *Pelatihan Eco-Creation untuk Membangun Kreativitas dan Kepedulian Lingkungan melalui Inovasi Daur Ulang Sampah SDN Pandanwangi 3*. *9*(3), 813–825.

Tristiana, V., & Sukartono. (2023). *IMPLEMENTASI PROGRAM SEKOLAH SEKOLAH DASAR ELSE (Elementary School Education*. *7*(2).

Wijayanti, A., Hariri, H., & Karwan, D. H. (2021). *Principal ' S Strategies In Realizing Adiwiyata School : A Literature Review*. *1*(9), 841–849.