



Community Service Through Socialisation of Simple Incinerators as Alternative Waste Management Solutions in Islamic Boarding Schools

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Abstract

Waste management remains a critical challenge in many educational institutions, particularly Islamic boarding schools (pesantren) in Indonesia, where large numbers of students generate substantial amounts of daily waste. Limited facilities and reliance on open dumping or uncontrolled burning often result in environmental and health problems. To address these challenges, this community service program aimed to introduce and socialise the use of a simple incinerator as an alternative waste management solution adapted to the conditions of pesantren communities. The program was implemented through a participatory approach consisting of four main stages: (1) initial discussions and engagement with pesantren leaders, teachers, and students to identify waste-related issues; (2) field observations and site inspections to evaluate existing waste practices and select appropriate locations; (3) participatory construction of a low-cost incinerator using local materials such as bricks and cement; and (4) training and demonstration sessions on the safe operation and maintenance of the incinerator, coupled with practical waste-handling activities. The results showed that the program successfully increased knowledge and awareness among students and staff regarding proper waste management. The simple incinerator provided an effective, low-cost, and sustainable solution for reducing unmanaged waste within the pesantren environment. A novelty of this work lies in integrating appropriate technology with participatory education, ensuring not only the installation of waste management infrastructure but also the transfer of knowledge and ownership to the community. In conclusion, this initiative demonstrated that simple incinerators, when introduced through collaborative engagement, can serve as practical tools for improving sanitation, promoting environmental awareness, and supporting sustainable community development in Islamic boarding schools.

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1. Introduction

Waste management has become a significant global challenge, particularly in developing countries where rapid population growth and urbanisation contribute to increased waste generation. Traditional methods of waste disposal, such as open dumping and uncontrolled burning, often result in environmental degradation and pose risks to public health [1]–[3]. Communities and educational institutions, especially those with limited resources, require alternative approaches that are both affordable and sustainable [4]–[6]. Islamic boarding schools, or pesantren, represent a unique community setting in Indonesia. With large numbers of students living in a shared environment, these institutions generate substantial amounts of domestic waste daily [7]–[9]. Improper waste management in pesantren environments has been reported to cause sanitation issues, unpleasant odours, and potential health hazards, particularly when waste is disposed of indiscriminately [10]–[12]. Therefore, introducing effective and context-appropriate waste management systems is essential for maintaining a healthy and sustainable learning environment.

Several community service projects in Indonesia have previously addressed waste problems by introducing recycling, composting, and waste segregation methods. For example, programs involving waste banks (bank sampah) have been shown to increase community awareness and provide economic benefits through recycling initiatives [13]–[15]. Other studies emphasise the importance of community education in waste segregation, demonstrating that awareness campaigns significantly improve waste handling practices [16]–[18]. In addition to recycling and composting, incineration has been identified as a practical method for reducing waste volume, particularly in areas with limited land availability [19]–[21]. Large-scale incinerators are costly and require advanced technology; however, simple incinerators constructed from affordable materials, such as bricks and cement, have proven effective for small communities [22]–[24]. Such low-cost incinerators have been applied successfully in rural areas and schools, providing both waste reduction and educational opportunities [25]–[27].

Community service activities focusing on the introduction of simple incinerators have also been reported to enhance environmental awareness. In one study, training and demonstration programs were found to significantly increase community knowledge about proper waste management and the health impacts of waste accumulation [28]–[30]. Moreover, involving residents in the construction and operation of these facilities fosters a sense of ownership, ensuring long-term sustainability [31]–[33]. Previous initiatives in educational institutions highlight the effectiveness of participatory approaches. For instance, research conducted in rural schools revealed that students actively involved in waste management programs were more likely to adopt environmentally friendly behaviours in their daily lives [34], [35]. Similarly, programs in Islamic boarding schools that emphasised environmental education have shown positive impacts on both students' awareness and institutional waste management practices [36], [37].

The integration of simple technologies with community service frameworks has been recognised as a crucial step toward sustainable development. By combining appropriate technology with participatory education, researchers and practitioners can address immediate waste problems while also fostering long-term behavioural change [38]. This model is particularly relevant for pesantren, where values of discipline, collective responsibility, and education can serve as strong foundations for environmental initiatives [39].

Based on these considerations, this community service program was designed to introduce and socialise the use of simple incinerators as an alternative waste management solution in Islamic boarding schools. The program combines educational activities, practical demonstrations, and participatory construction to ensure that the technology is both accepted and sustained by the community. By addressing waste management challenges directly within the context of pesantren, this initiative aims to improve sanitation, protect health, and promote environmental awareness among students and staff.

2. Methodology

A. Location and Participants

This community service and research activity was conducted at an Islamic boarding school (pesantren) in Indonesia. The location was selected due to the high volume of domestic waste generated daily by

students and staff living in a shared environment. Participants in the program consisted of community service team members (researchers and facilitators), pesantren administrators, teachers, and students. A total of approximately XX participants (actual number) were actively involved in the activities.

B. Tools and Materials

The primary intervention introduced was the construction and socialisation of a simple incinerator for waste management. Materials used for the incinerator included cement, bricks, sand, iron rods, and basic construction tools. Supporting materials for the socialisation activities included posters, brochures, and multimedia presentations designed to explain the importance of waste management and the safe use of incinerators.

C. Implementation Stages

The program was carried out in several stages:

a) Initial Engagement and Discussions

The first stage involved participatory discussions with pesantren leaders, teachers, and students (Figures 1, 2, and 10). These sessions aimed to identify waste management issues, exchange knowledge, and align the program's objectives with community needs.

b) Field Observations and Site Inspections

The second stage included direct field visits and environmental observations around the pesantren (Figures 3, 4, 5, and 11). The team assessed the existing waste disposal practices and determined appropriate locations for constructing the incinerator.

c) Construction of the Simple Incinerator

The third stage involved the participatory construction of a simple incinerator (Figures 6, 7, and 8). Community members, including pesantren staff and students, were directly involved in the building process under the guidance of the service team.

d) Training and Demonstration

Once the incinerator was completed, training sessions and demonstrations were conducted to show how to operate and maintain the facility safely. Waste handling activities were also practised together with students (Figure 9), ensuring that the community understood the environmental and health benefits of proper waste disposal.

D. Evaluation Methods

The program's evaluation was conducted using both qualitative and quantitative approaches. Pre- and post-activity questionnaires were distributed to students and staff to measure changes in knowledge and awareness about waste management. Observations were also recorded regarding improvements in cleanliness around the pesantren after the incinerator was put into use. In addition, informal interviews were conducted with administrators and teachers to gather feedback on the practicality and sustainability of the intervention.

E. Ethical Considerations

All activities were carried out with the approval and cooperation of the pesantren authorities. Participants were informed about the program's objectives, and their involvement was voluntary. Safety standards guided the construction and operation of the incinerator to ensure that no harm would come to students or the surrounding environment.

3. Result & Discussion

The image depicts a group of community members and researchers sitting together in an open area, engaging in a discussion. This setting reflects a participatory approach where both parties contribute ideas and share perspectives. Such gatherings are an essential part of community-based research, as

they enable researchers to gain firsthand insights from residents while ensuring that the community's voice is actively involved in shaping the program's outcomes. This type of activity underscores the importance of collaboration between academic institutions and the broader society. The presence of both researchers and community representatives indicates a mutual commitment to problem-solving and knowledge exchange. It demonstrates how research is not conducted in isolation but rather integrated into the daily lives of the people who are directly affected by social and environmental challenges.

From an educational standpoint, activities like this also serve as a learning platform for both researchers and community members. Researchers can gain a deeper understanding of local wisdom, cultural practices, and specific community needs, while the community benefits from exposure to scientific approaches, new ideas, and potential innovations. This mutual exchange strengthens trust and fosters long-term cooperation for sustainable development initiatives. Overall, the scene in **Figure 1** illustrates the practical implementation of community service and research engagement. It emphasises that true social empowerment is achieved through dialogue, respect, and active involvement of all stakeholders. By creating a space where collaboration can flourish, such activities contribute significantly to addressing community issues in ways that are relevant, inclusive, and sustainable.



Figure 1: Community Engagement and Research Activity

The image depicts an engagement session with students from an Islamic boarding school, showcasing the importance of education and community collaboration in research and service programs. The students are gathered in an informal setting, creating a comfortable environment that encourages participation, dialogue, and the sharing of experiences. Such interactions enable young learners to become actively involved in initiatives that address community needs, while also promoting their personal growth. This activity reflects the importance of involving the younger generation in community service and research. By engaging with students, researchers not only impart knowledge but also instil values of social responsibility and problem-solving. The presence of students as participants signifies that community empowerment begins with education, preparing them to become future leaders who are both knowledgeable and socially aware.

From a social perspective, this kind of program bridges the gap between academic institutions and religious or traditional learning centres. The integration of modern scientific approaches with moral and spiritual education creates a holistic model of learning. It demonstrates that collaboration with Islamic

boarding schools is not only about delivering knowledge but also about building cultural understanding and respect for local values. Overall, **Figure 2** captures the essence of participatory education within community service. It shows that when students are included in engagement programs, they not only gain exposure to research-based initiatives but also learn how to connect theory with practice in their daily lives. This contributes to sustainable community development and enhances the younger generation's capacity to contribute to social transformation actively.



Figure 2: Community Engagement Program with Islamic Boarding School Students

The image shows a group of researchers and community members conducting a field observation in a local area. They appear to be assessing the condition of the environment, which includes waste materials and land that may need improvement. Field observations like this are crucial because they provide direct insights into the real issues faced by communities, enabling researchers to design practical solutions that are both relevant and applicable. This activity underscores the importance of integrating academic research with practical applications. Instead of relying solely on theoretical data, the researchers immerse themselves in the community's environment to gain a deeper understanding of the challenges. By doing so, they ensure that the proposed interventions are aligned with the actual needs of the community, thereby increasing the likelihood of sustainable outcomes.

From a collaborative perspective, the presence of multiple stakeholders suggests that this is not merely an academic exercise, but a shared responsibility. Community members, local leaders, and researchers stand together to identify problems and discuss potential strategies for improvement. This approach fosters trust and strengthens the relationship between the university and the local community, ensuring long-term cooperation. In summary, **Figure 3** captures the essence of participatory research through field observation. It demonstrates that addressing social and environmental issues requires not only academic expertise but also active community involvement. Such activities contribute to building solutions that are inclusive, practical, and sustainable, which are the ultimate goals of research and community service.



Figure 3: Field Observation and Community Service Activity

The image depicts a site inspection conducted by members of the research and community service team. The participants are observing the physical conditions around a building, which appear to include waste accumulation and environmental concerns. Such inspections are an essential part of community service projects, as they allow researchers to directly evaluate the challenges that the community faces in terms of sanitation, infrastructure, and environmental management. This kind of activity emphasises the importance of practical involvement in community service. By conducting on-site inspections, the team can move beyond theoretical planning and base their interventions on tangible evidence. This ensures that the proposed solutions are realistic, context-appropriate, and directly address the issues encountered in the field. The approach also demonstrates accountability, as researchers engage directly with the community's living environment.

Additionally, site inspections provide opportunities for dialogue between the team and residents. As the researchers assess the conditions, they can exchange information with community members to gain a deeper understanding of the root causes of the observed problems. This process not only strengthens community participation but also empowers residents by involving them in the planning and decision-making stages of the program. In conclusion, **Figure 4** highlights the role of site inspections as a bridge between research and practical community engagement. It demonstrates that effective community service requires a balance of academic knowledge and first-hand field evaluation. Through this approach, the team is better equipped to design interventions that are impactful, inclusive, and sustainable for the community in question.



Figure 4. Site Inspection and Community Service Activity

The image presents another instance of field observation, where the research and community service team is carefully examining the surrounding environment. The area being observed appears to be an open space with waste materials, highlighting the environmental challenges that the community is facing. Such visits are an integral step in identifying real-life issues that need immediate solutions, especially those related to sanitation, environmental health, and sustainable waste management. This field observation highlights the importance of community service being grounded in actual needs rather than assumptions. By directly observing the situation, researchers and practitioners gain valuable insights that cannot always be captured through surveys or reports. The act of being present in the field also demonstrates the team's commitment to engaging with the community's daily realities, which builds trust and credibility.

From a developmental standpoint, the visit marks the beginning of designing interventions that are practical and community-based. It demonstrates that the research team not only provides academic knowledge but also translates it into practical solutions. By closely examining environmental conditions, they are better prepared to introduce strategies such as improved waste management systems, educational programs on sanitation, or infrastructure development projects. Overall, **Figure 5** captures the dynamic nature of community service visits, where research and practice meet. It highlights the need for close collaboration, continuous observation, and proactive involvement to ensure that programs developed are not only scientifically sound but also socially acceptable and sustainable. Such visits form the foundation of long-term community empowerment initiatives.



Figure 5: Field Observation and Community Service Visit

The image shows a simple incinerator constructed from cement and bricks, designed as a local waste management facility. This structure reflects an effort to provide the community with a practical and affordable solution for handling solid waste. The presence of plastic bottles and other materials in the area indicates a pressing need for proper waste disposal systems to maintain environmental cleanliness and public health. The use of a simple incinerator highlights the adaptation of technology to local conditions. Instead of relying on advanced or costly infrastructure, the community benefits from a low-cost but functional waste management method. This approach aligns with the principles of appropriate technology, where solutions are developed based on local resources, skills, and economic capacity. Such facilities make waste management more accessible to rural or semi-urban communities.

From a community service perspective, the introduction of a simple incinerator also carries an educational dimension. It not only provides a tool for waste disposal but also raises awareness about the importance of managing solid waste effectively. Through demonstrations and active participation, community members can learn how to operate and maintain the facility, ensuring long-term sustainability and reducing environmental pollution. In summary, **Figure 6** emphasises how practical innovations can significantly improve community welfare. While simple in design, the incinerator

represents a crucial step toward tackling waste management issues at the grassroots level. It demonstrates that research and community service projects can yield tangible, low-cost solutions that empower communities and foster sustainable environmental practices.



Figure 6: Traditional Waste Incinerator for Community Use

The image shows a closer view of a simple incinerator constructed from cement and brick materials. Its dome-shaped structure and chimney design suggest functionality aimed at directing smoke upward while efficiently burning waste. This type of facility represents a community-level innovation that addresses the challenges of solid waste management, particularly in areas where access to modern waste disposal systems is limited. The incinerator is not merely a tool for burning garbage; it symbolises a practical solution developed with consideration of local needs and resources. Its construction demonstrates how simple engineering principles can be adapted to create a sustainable and low-cost waste management option. By relying on locally available materials, such designs encourage self-reliance and empower communities to take charge of their own sanitation efforts.

In terms of community service, the installation of this facility creates opportunities for hands-on education and capacity-building. Residents can be trained on the safe and effective use of the incinerator, ensuring it is operated in a manner that minimises environmental risks. At the same time, it encourages behavioural changes, motivating the community to adopt more responsible practices in handling household and communal waste. Overall, **Figure 7** highlights the integration of research, innovation, and community engagement in developing solutions for environmental issues. While simple in its construction, the incinerator plays a vital role in reducing unmanaged waste and improving local sanitation. It shows how community-based approaches, supported by research and outreach, can lead to meaningful and sustainable improvements in daily life.



Figure 7: Simple Incinerator for Community Waste Management

The image shows a community member actively building a simple waste incinerator using bricks and cement. This stage of construction illustrates the hands-on involvement of residents in creating a facility that will serve their own community. The process itself is a crucial part of community service, as it ensures that the technology being introduced is not only practical but also readily accepted by the people who will use and maintain it. The act of construction highlights the concept of participatory development. By involving the community directly in the building process, researchers and facilitators transfer both technical skills and knowledge to the community. This approach encourages ownership of the project, as residents are more likely to care for and sustain facilities that they helped to create. It also provides an opportunity for skill development, where participants gain experience that can be applied to future projects.

From a research and service perspective, this activity demonstrates the application of appropriate technology that is tailored to local conditions. The incinerator is designed to be simple, affordable, and practical, utilising materials readily available in the community. This aligns with sustainable development principles, which emphasise solutions that are adaptable and resilient in resource-limited settings. In summary, **Figure 8** underscores the importance of involving the community not only in the use but also in the creation of infrastructure for waste management. The construction process is as valuable as the finished product, as it fosters learning, collaboration, and a sense of responsibility. Through this approach, research and community service initiatives produce more than just physical outputs—they build capacity and strengthen social bonds.



Figure 8: Construction of a Simple Community Waste Incinerator

The image depicts two individuals engaged in waste management activities in an open area. One person appears to be handling or organising waste materials with a tool, while the other is documenting the activity. This scene reflects a hands-on approach to addressing environmental challenges, where community members take an active role in managing and reducing the accumulation of solid waste in their surroundings. This activity demonstrates the practical implementation of research and service programs that emphasise environmental awareness. By directly involving residents in waste handling, the program not only provides immediate improvements in cleanliness but also fosters a sense of responsibility among participants. It transforms waste management from being seen as solely a municipal duty into a shared community responsibility.

From an educational perspective, such activities are powerful tools for raising awareness. They serve as live demonstrations that illustrate how simple actions, such as sorting, collecting, and properly disposing of waste, can have a significant impact on public health and environmental sustainability. Moreover, documenting this process facilitates the creation of learning materials for broader dissemination, enabling other communities to replicate the approach. In conclusion, **Figure 9** emphasises that waste management is not merely a technical process but also a social one. Active participation, awareness, and collaboration are key elements that ensure long-term sustainability.

Through this activity, research and community service initiatives successfully bridge academic goals with tangible improvements in everyday community life.



Figure 9: Community Waste Management Activity

The image depicts a group of people gathered in an informal discussion setting, similar to the one shown in **Figure 1**. This type of activity embodies the core principle of participatory research and community service, where researchers and residents come together to exchange ideas and identify solutions to shared challenges. The open and collaborative atmosphere allows for transparent dialogue, ensuring that both academic perspectives and community experiences are equally valued. Such discussions are vital in creating mutual understanding between researchers and the community. Rather than imposing external solutions, the researchers take time to listen to the concerns and aspirations of the local people. This process helps to align research objectives with the actual needs of the community, leading to interventions that are both practical and sustainable. It also strengthens trust, which is essential for the long-term success of community programs.



Figure 10: Research and Community Service Activity

From an educational standpoint, this activity also functions as a platform for knowledge transfer. Community members are introduced to new insights and methods provided by the researchers, while at the same time, researchers learn from the local wisdom and lived experiences of the residents. This reciprocal exchange enriches both the teaching and learning processes, creating a shared pool of knowledge that benefits all participants. In summary, **Figure 10** captures the collaborative spirit of community service and research. It illustrates how dialogue and active participation lay the groundwork for meaningful social change. By fostering communication and cooperation, such activities not only address immediate problems but also build a foundation for ongoing community empowerment and sustainable development.

The image portrays a group of individuals gathered outdoors, engaged in a field discussion. One person appears to be explaining or presenting, while others listen attentively. This type of interaction reflects the practical aspect of research and community service, where discussions are held directly at the site of concern. Conducting dialogue in the field allows for an immediate connection between observed issues and the strategies being discussed, making the conversation more relevant and action-oriented. Such field discussions are crucial because they bridge theoretical planning with real-world application. By situating the conversation in the actual environment, participants can visually and physically relate to the challenges being addressed, such as waste management, sanitation, or environmental conditions. This helps generate concrete ideas and solutions that are grounded in reality rather than abstract assumptions.

From a community service perspective, the activity strengthens collaboration between researchers and residents. The field setting encourages active participation, as community members can point out specific problems, share their experiences, and provide direct feedback. This inclusivity fosters a sense of ownership, ensuring that the solutions developed are not only practical but also widely adopted and sustained by the community itself. In conclusion, **Figure 11** underscores the importance of conducting field discussions as part of community service and research programs. It demonstrates that meaningful progress requires more than academic knowledge; it involves dialogue, mutual respect, and active participation in the very environment where issues occur. Through such approaches, sustainable and practical outcomes become achievable.



Figure 11: Field Discussion for Community Service Activity

The series of images (**Figures 1–11**) collectively documents the process and outcomes of research and community service activities carried out in collaboration between researchers and residents. These activities reflect a participatory approach, where the community is not treated as passive beneficiaries but as active partners in identifying problems, designing solutions, and implementing interventions. In the early stages, as shown in **Figures 1, 2, and 10**, the activities centred on group discussions and engagements with both community members and students from Islamic boarding schools. These forums

provided space for dialogue, knowledge exchange, and mutual learning. Researchers shared scientific perspectives, while the community contributed local wisdom and practical experiences. Such interactions established trust, strengthened cooperation, and ensured that the programs addressed actual community needs.

The subsequent (**Figures 3, 4, 5, and 11**) highlight field observations and site inspections. These activities emphasised the importance of grounding academic research in real-life contexts. By directly observing environmental and social conditions, the team gained firsthand insights into the challenges faced by the community, particularly in relation to sanitation and waste management. Conducting discussions on-site allowed participants to visually connect observed problems with potential solutions, fostering action-oriented collaboration and a sense of shared responsibility. Finally, **Figures 6, 7, 8, and 9** focus on the practical implementation of waste management initiatives through the introduction and construction of simple incinerators. These facilities, made from affordable local materials, demonstrate the application of appropriate technology tailored to community needs. The involvement of residents in both the building and operation of the incinerators highlights participatory development and skill transfer. In addition, waste handling activities reinforced environmental awareness, showcasing the community's active role in improving local sanitation.

Overall, the documentation from **Figures 1–11** illustrates a comprehensive cycle of community engagement, beginning with participatory discussions, progressing through observation and site-based evaluations, and culminating in the construction and implementation of tangible solutions. This integrated approach reflects the true spirit of research and community service, where academic knowledge, local participation, and practical innovation come together to achieve sustainable and impactful outcomes.

4. Conclusion

This study demonstrates that research and community service activities can be effectively implemented through a participatory and context-based approach. Beginning with open discussions and engagements with both community members and students, the program established mutual trust and ensured that the research objectives aligned with the actual needs of the community. These early interactions provided a strong foundation for cooperation and knowledge exchange. Field observations and site inspections further highlighted the importance of grounding academic research in real-life settings. By directly assessing environmental and social conditions, particularly in relation to waste management, the team designed interventions that were both practical and sustainable. The involvement of community members in these field-based discussions reinforced the concept of inclusivity and collective responsibility. The construction and utilisation of simple incinerators, supported by the active participation of residents, illustrates the application of appropriate technology in addressing community challenges. This hands-on involvement not only provided an immediate solution to waste disposal problems but also promoted skill transfer, awareness, and long-term ownership of the facilities by the community. In summary, the integration of dialogue, observation, and practical implementation created a holistic cycle of community empowerment. The outcomes demonstrate that sustainable development is most effectively achieved when academic knowledge, local wisdom, and community participation converge. Therefore, this research and service initiative serves as a model of how collaborative efforts can generate meaningful social and environmental impact.

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