

UTILIZATION OF RICE HUSK ASH AS AN ENVIRONMENTALLY FRIENDLY BUILDING MATERIAL THROUGH SEMINAR AND WORKSHOP ACTIVITIES IN SILUTUNG VILLAGE

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ABSTRACT

Silutung Village as a tropical agricultural area produces large amounts of rice husk waste, but its utilization is still not optimal, so it not only has the potential to cause environmental problems, but also causes the loss of opportunities to develop this waste as an environmentally friendly building material; therefore, this community service activity aims to examine the effectiveness of implementing seminars and workshops in increasing public literacy regarding the use of rice husk ash as an alternative construction material. This study uses a mixed methods approach with an explanatory sequential design, which combines quantitative data collection through pretests and posttests and qualitative data through observations and interviews, with 20 participants consisting of farmer groups, craftsmen, and students. Data analysis was carried out using N-Gain and descriptive percentages, which showed that 65% of participants were in the medium improvement category and 35% in the high category, with no participants in the low category, so it can be concluded that the seminar and workshop activities were effective in increasing public literacy regarding the use of rice husk ash as a sustainable construction material.

Keywords: Rice Husk Ash, Scientific Literacy, Environmentally Friendly Materials, Community Empowerment.

1. INTRODUCTION

Agricultural waste, particularly rice husks, is a frequent environmental issue in agricultural areas. The large volume of rice husk production is generally not accompanied by adequate management, so it is often simply burned or dumped without further use. This situation has the potential to cause air pollution and degrade the overall environmental quality. Silutung Village, as a tropical agricultural region, has a high rice production rate, which directly generates significant amounts of rice husk waste. However, this potential has not been optimally utilized as an economically valuable resource, reflecting the imbalance between the availability of local materials and the community's capacity to process them into useful products.

From a scientific perspective, rice husks, after being burned to ash, are known to contain high levels of amorphous silica, acting as a pozzolanic

material. This material can increase the strength and durability of concrete, while simultaneously reducing the use of cement, a key component in construction (Mehta & Monteiro, 2014; Li et al., 2021). Furthermore, the use of rice husk ash as a building material aligns with the principles of sustainable development and the circular economy approach, which emphasizes optimizing resource use and reducing waste (UNEP, 2022).

However, implementing this utilization at the community level still faces various obstacles, including low scientific literacy, limited access to information, and a lack of relevant technical training. These factors are major obstacles to maximizing local potential.

Based on these conditions, a community empowerment strategy is needed through organizing seminars and workshops that combine conceptual understanding with direct practice. This approach is expected to improve community knowledge and skills in processing rice husk ash effectively. Furthermore, hands-on learning can strengthen scientific literacy by linking scientific concepts to everyday life contexts. Therefore, this study aims to assess the effectiveness of seminars and workshops in increasing community literacy regarding the use of rice husk ash as an environmentally friendly building material. The findings of this study are expected to contribute to the development of empowerment models based on local potential and support sustainable development efforts.

Most previous studies on rice husk ash focus on laboratory testing, concrete strength, durability, or material characterization. Meanwhile, studies that connect RHA utilization with community literacy, local empowerment, and practical training at the village level are still relatively limited. This article fills that gap by examining how seminar and workshop activities can transform local agricultural waste into a learning resource and community empowerment medium. Thus, the novelty of this study lies in integrating sustainable material knowledge, scientific literacy, and participatory community practice in the context of Silutung Village.

Seminars are useful for developing conceptual awareness, while workshops strengthen procedural knowledge through direct practice. The combination of both methods is aligned with experiential learning, where participants construct meaning through concrete experience, reflection, conceptualization, and application (Kolb, 1984). Recent educational studies also indicate that hands-on and practice-based learning can increase conceptual understanding, engagement, and problem-solving skills because participants are not only receiving information but also testing ideas directly (Rahmawati et al., 2022; Sari et al., 2023; Amelia, 2025). Therefore, the seminar-workshop model used in this activity is theoretically appropriate for improving community literacy regarding the utilization of rice husk ash.

Scientific literacy in community empowerment refers to the ability of people to understand scientific information, relate it to real environmental problems, and use it to make practical decisions. In the context of agricultural waste management, literacy is not limited to knowing that rice husk can become ash, but also includes understanding why ash can be useful, how it should be processed, and what environmental risks occur when waste is burned or dumped without control. Studies on science education and environmental learning show that contextual, local, and problem-based activities can improve understanding because participants learn from issues

that are close to their daily lives (OECD, 2018; Zikargae et al., 2022; Nainggolan et al., 2023; Paz et al., 2025).

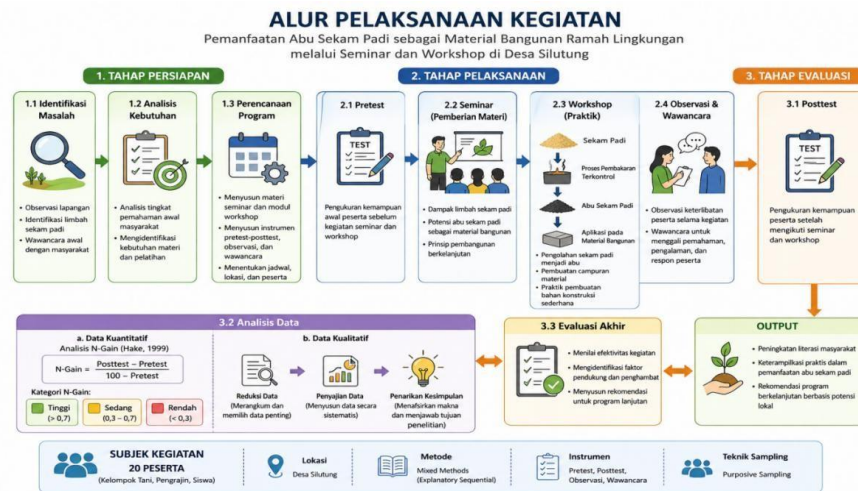
The use of RHA as a partial cement replacement supports sustainable construction because it can reduce the consumption of Portland cement, minimize agricultural waste accumulation, and contribute to lower carbon emissions in the building sector. Several recent journal studies report that RHA can improve concrete properties when applied at appropriate replacement levels, although its effectiveness depends on mixture composition, particle size, curing condition, and material processing quality (Thiedeitz et al., 2020; Mounika et al., 2022; Camargo-Pérez et al., 2023; Xi et al., 2023; Barbhuiya et al., 2025). These findings are relevant for Silutung Village because the availability of rice husk waste can be connected with community needs for affordable, locally sourced, and environmentally responsible construction materials.

Rice husk ash (RHA) is increasingly discussed in sustainable construction research because it contains silica that can react with calcium hydroxide in cementitious systems and form additional calcium silicate hydrate, which contributes to strength and durability. Recent studies emphasize that the quality of RHA is strongly influenced by combustion temperature, burning duration, fineness, and carbon content; therefore, uncontrolled burning may produce ash with lower reactivity, while controlled combustion and grinding can improve its pozzolanic performance (Siddika et al., 2021; Endale et al., 2022; Indumathi et al., 2024). In this study, RHA is positioned not only as construction material innovation, but also as a local scientific resource that can be introduced to communities through practical education.

2. LITERATURE REVIEW METHOD IMPLEMENTATION

This research was conducted as a community service activity, employing a mixed methods approach through an explanatory sequential design. This approach integrates the collection and analysis of quantitative and qualitative data in stages to generate a more comprehensive and in-depth understanding. Quantitative data were collected through pretests and posttests, aimed at identifying the level of community literacy improvement. Meanwhile, qualitative data were obtained through observation and interviews to strengthen and clarify the results of the quantitative analysis.

The participants in this activity were 20 people from various backgrounds, including farmer groups, artisans, and students in Silutung Village. Subjects were selected using a purposive sampling technique, ensuring that the participants selected were representative and relevant to the activity's objectives. Overall, the activity was divided into three main stages: preparation, implementation, and evaluation, which assessed the effectiveness of the activities.



Gambar 1. Alur pelaksanaan kegiatan

1. Preparation Stage

The initial stage involved identifying problems related to rice husk waste management in Silutung Village. Next, a community needs analysis was conducted to determine the initial level of understanding and potential uses of the waste. Based on the analysis, a program plan was developed, including seminar materials, workshop modules, and research instruments in the form of pretest and posttest questions.

2. Implementation Stage

The implementation phase of the activity was carried out through two main forms: seminars and practical workshops. The seminar activities aimed to provide participants with a conceptual understanding of the impact of rice husk waste on the environment, especially if the waste is simply piled up or burned openly. In addition, participants were also introduced to the potential of rice husk ash as an alternative material in the construction sector that is useful and environmentally friendly. The seminar material was linked to the principles of sustainable development, namely the wise use of local resources to reduce pollution, increase the economic value of waste, and support environmental conservation. The methods used were interactive lectures and discussions, so that participants could ask questions, share experiences, and understand the problem of rice husk waste more contextually.

Following the seminar, the activity continued with a practical workshop to provide participants with hands-on experience in processing rice husks into ash and utilizing it as a building material mixture. At this stage, participants were introduced to the rice husk processing process, simple techniques for using rice husk ash in construction material mixtures, and a demonstration of simple building material production. The approach used was hands-on learning, as participants not only received information but also directly participated in the practical process. Through this activity, participants are expected to gain a more concrete understanding that rice husk waste can be processed into useful materials, have economic value, and support more environmentally friendly development.

3. Evaluation Stage

a) Data Collection

Data collection in this activity was carried out through several techniques, namely pretests, posttests, observations, and interviews. The pretest was given before the activity began to determine the initial abilities of participants, particularly regarding their understanding of rice husk waste, the potential of rice husk ash, and the concept of sustainable development. After the seminar and workshop activities were completed, participants were given a posttest to measure their increase in literacy and understanding after participating in the entire series of activities. In addition to the test, observations were also conducted during the activity to assess participant engagement, such as active participation in discussions, attention during the presentation of material, and participation in practical activities. Interviews were conducted to explore participants' experiences, responses, and deeper understanding of the benefits of the activities they had participated in.

b) Data Analysis

The data obtained in this activity were analyzed quantitatively and qualitatively. Quantitative data derived from the pretest and posttest results were analyzed using the N-Gain formula according to Hake (1999) to determine the level of increase in participants' literacy after participating in the activity. The N-Gain results were then categorized into three categories: high if the N-Gain value is more than 0.7, medium if it is in the range of 0.3 to 0.7, and low if it is less than 0.3. Meanwhile, qualitative data obtained through observation and interviews were analyzed through three stages: data reduction, data presentation, and drawing conclusions. Data reduction was carried out by selecting important information relevant to the objectives of the activity, data presentation was done in the form of descriptive descriptions, while drawing conclusions was done to obtain a comprehensive picture of the involvement, experience, and changes in participants' understanding during the activity.

4. Final Evaluation Stage

At this stage, the results of the activities are comprehensively interpreted to obtain a picture of the success of the seminar and workshop. Interpretation is conducted by examining the extent to which the activities improved participants' understanding of the use of rice husk ash as an environmentally friendly material, as well as their response to the activities. Furthermore, this stage aims to assess the effectiveness of the methods used, both through the presentation of seminar materials and hands-on practice during the workshop.

An evaluation was also conducted to determine the level of improvement in community literacy after participating in the activity, including changes in participants' understanding, attitudes, and engagement throughout the process. Factors influencing the activity's outcome, such as participant engagement, availability of tools and materials, relevance of the material to community needs, and ease of application of simple technology, were also analyzed. The evaluation results were then used as the basis for formulating conclusions and

recommendations so that similar activities can be developed more effectively, contextually, and sustainably.

5. RESULTS AND DISCUSSION

1) Preparation Stage

In the preparation phase, initial steps included identifying problems and analyzing community needs related to rice husk waste management in Silutung Village. Based on field observations, it was discovered that the majority of residents were not optimally utilizing rice husks and even tended to burn them without proper processing. This situation indicates a low level of scientific literacy among the community, particularly in understanding the potential of waste as a valuable resource. Furthermore, the needs analysis revealed that the community lacks sufficient knowledge and skills to process rice husk ash into building materials. Therefore, the seminar and workshop materials were designed to introduce basic concepts, explain practical benefits, and present simple techniques that are easy for the community to apply. This preparation phase plays a crucial role as it serves as the basis for determining the suitability of the materials to the participants' needs, ensuring that the activities are contextual, effective, and on-target.



Picture 1 . Identification of the quality of unutilized rice husk ash

2) Implementation Stage

The implementation phase of this activity consists of two main parts: a seminar and a workshop (practical) . Both activities are designed in an integrated manner to improve public literacy through a conceptual approach and hands-on experience.

a) Seminar Activities

This seminar is designed to provide participants with a conceptual understanding of the issue of rice husk waste and to explore its potential use as an environmentally friendly building material. The material presented covers the ecological impacts of rice husk waste, the characteristics of rice husk ash as a pozzolanic material, and the basic concepts of sustainable development.

From a theoretical perspective, seminars are a form of learning that serve as an initial stage in developing participants' conceptual knowledge. According to constructivism theory, the learning process occurs when individuals construct new understandings based on their prior knowledge (Piaget, 1970). In this context, seminars serve to

activate participants' initial schemata while introducing scientific concepts relevant to their real-life situations.

Furthermore, the presentation of material in the seminar also contributed to improving the public's scientific literacy. Scientific literacy is not solely related to mastery of concepts, but also includes the ability to connect that knowledge to real-life situations (OECD, 2018). Through this activity, participants began to understand the relationship between rice husk waste, environmental issues, and innovation opportunities in the construction sector. However, the understanding formed at this stage was still at the conceptual level and had not yet been fully implemented in practice. This was reflected in the pretest results, which showed that most participants were still at the initial understanding stage. Therefore, further stages in the form of practical activities were needed to deepen and strengthen this understanding.



Picture 2 . Seminar activities at Silutung Village School

b) Workshop Activities (Practice)

The workshop is a follow-up activity designed to deepen participants' understanding through direct involvement in learning activities. At this stage, participants not only receive information but also actively participate in the process of processing rice husks into ash and using it as a material in simple construction.

From a theoretical perspective, the implementation of this workshop aligns with the *experiential learning approach*, which emphasizes that learning effectiveness increases when participants are directly involved in the learning experience (Kolb, 1984). Through this involvement, participants not only understand concepts at an abstract level but are also able to internalize and internalize the knowledge through real-world practice.

Furthermore, this approach is also in line with the principle of *hands-on learning*, which emphasizes that active participation in the learning process contributes to improved conceptual understanding as well as practical skills (Bybee, 2013). In the context of the workshop, participants are not positioned as passive recipients of information, but rather as key actors who directly carry out the process of processing and applying rice husk ash.

The results showed that the workshop activities had a significant impact on improving community literacy. This was reflected in the comparison of higher posttest scores compared to pretest scores, and is reinforced by Graph 1, which shows an increase in scores for all participants. Furthermore, participants who demonstrated higher levels of activeness during the practice tended to achieve higher N-Gain scores, indicating a relationship between participant engagement and learning outcomes. These findings are consistent with the research of Rahmawati et al. (2022), which found that experiential learning is more effective than conventional methods in improving understanding. Therefore, workshops can be viewed as a strategic tool for bridging the gap between conceptual understanding gained through seminars and mastery of practical skills relevant to everyday life.



Picture 3 . Workshop Activities (Practice)

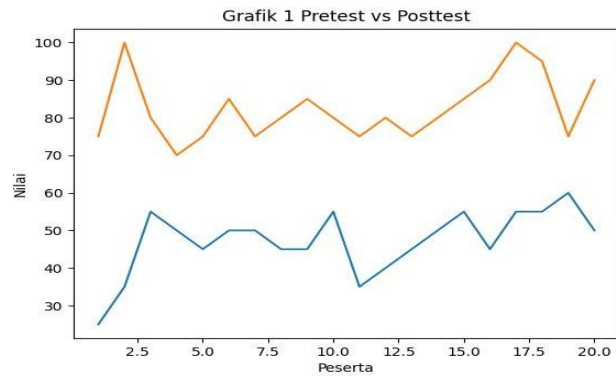
3) Evaluation Stage

The evaluation phase was conducted through analysis of pretest and posttest results using N-Gain. The analysis showed that 13 participants (65%) were in the medium category, 7 participants (35%) were in the high category, and no participants were in the low category. This indicates that the activities carried out were highly effective and evenly distributed. The summary of the participants' pretest and posttest scores can be seen in the following table:

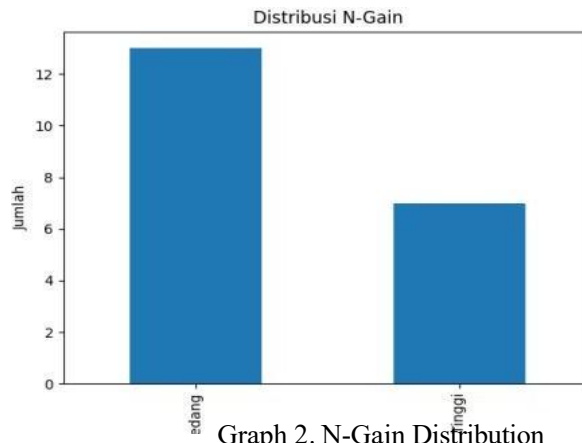
Table 1. Research Results

Participant	Pretest	Posttest	N-Gain	Category
1	25	75	0.67	Medium
2	35	100	1	High
3	55	80	0.56	Medium
4	50	70	0.4	Medium
5	45	75	0.55	Medium
6	50	85	0.7	High
7	50	75	0.5	Medium
8	45	80	0.64	Medium
9	45	85	0.73	High
10	55	80	0.56	Medium
11	35	75	0.62	Medium
12	40	80	0.67	Medium
13	45	75	0.55	Medium
14	50	80	0.6	Medium
15	55	85	0.67	Medium
16	45	90	0.82	High
17	55	100	1	High
18	55	95	0.89	High
19	60	75	0.38	Medium
20	50	90	0.8	High

Based on the data in Table 1, it can be seen that all participants experienced an increase in their scores from the pretest to the posttest after attending the seminar and workshop. This increase indicates a change in participants' understanding of the use of rice husk ash as an environmentally friendly material. To visually clarify this pattern of improvement, the pretest and posttest data were presented graphically. This graphical presentation aims to more clearly demonstrate the differences in scores before and after the activity, allowing for easier and more informative analysis of the activity's effectiveness



Graph 1. Pretest vs Posttest results



Graph 2. N-Gain Distribution

The distribution of N-Gain categories shows a dominance of the medium level, indicating that the majority of participants experienced an increase in understanding from a basic to an intermediate level. Conversely, the presence of the high category indicates that some participants were able to achieve a deeper level of understanding. These differences in achievement reflect variations in improvement influenced by several factors, such as educational background, prior experience, and the intensity of participant involvement during the activity. The absence of participants in the low category indicates that the applied method was able to effectively reach all participants. This also demonstrates that the approach used was inclusive and adaptable to the diverse characteristics of participants. Furthermore, the implementation of an evaluation that combined quantitative and qualitative approaches also provided a more complete and comprehensive picture of the success of the activity.

4) Synthesis of Results (Interrelationships Between Stages)

When viewed comprehensively, the success of an activity cannot be attributed to a single stage, but rather is the synergistic result of a series of interconnected stages: preparation, implementation, and evaluation. A well-designed preparation stage contributes to the

development of appropriate and contextual materials, while an interactive implementation stage encourages active participant participation. Furthermore, the evaluation stage plays a crucial role in providing empirical data as a basis for assessing the overall effectiveness of the activity. These results confirm that implementing a learning approach that emphasizes hands-on practice and relevance to the local context is a proven effective strategy for improving community science literacy. These findings also align with research by Rahmawati et al. (2022), which demonstrated that the experiential learning approach is more effective than conventional learning methods in improving participant understanding.

6. CONCLUSION

Based on the research and discussion, it can be concluded that the seminar and workshop held in Silutung Village were effective in increasing public literacy regarding the use of rice husk ash as an environmentally friendly building material. This is demonstrated by the N-Gain analysis, which showed that 65% of participants were in the medium category and 35% were in the high category, with no participants in the low category.

Improving public literacy is influenced not only by the conceptual delivery of material through seminars, but also by the active involvement of participants in workshops. A learning approach that integrates theory and hands-on practice has been proven to foster deeper and more meaningful understanding.

Overall, this activity not only contributes to increasing community knowledge but also fosters practical skills in utilizing rice husk waste into valuable materials. Thus, this activity has important implications for supporting community empowerment based on local potential and sustainable development through more environmentally friendly waste management.

It is also recommended that future community empowerment programs collaborate with universities, village governments, construction practitioners, and local industries to develop simple processing standards for rice husk ash that are safe, affordable, and applicable at the village level. Training modules should be improved by adding visual guidelines, safety procedures, simple quality-control steps, and examples of small-scale products that can be produced by the community. For future researchers, this study can be developed into a comparative design by involving control groups, different training models, or different local waste materials, so that the most effective empowerment strategy for improving scientific literacy and sustainable construction awareness can be identified more accurately.

Based on the findings of this activity, future programs are recommended to expand the number and diversity of participants so that the effectiveness of rice husk ash literacy activities can be tested in broader community groups, including farmers, local builders, village youth, teachers, and small construction entrepreneurs. Future research should also include laboratory testing of rice husk ash-based mixtures, such as compressive strength, durability, water absorption, and optimum replacement percentage, so that community training is supported by stronger technical evidence. In addition, longitudinal studies are needed to examine whether

the literacy gained through seminars and workshops leads to sustained behavioral change, such as reduced open burning of rice husks and increased community initiative to process agricultural waste into useful products.

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