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Community Empowerment through SERUNI: Utilization of Used Coffee Grounds and Tea Residues for Innovative Diffuser Production in Gonoharjo Village

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Abstract

This community empowerment program aimed to optimize household organic waste management in Gonoharjo Village, Kendal Regency, through the SERUNI (Semerbak Ruangan Unik dan Inovatif) initiative, which transforms used coffee grounds and tea residues into innovative fragrance diffusers. Implemented under the UNNES GIAT 16 scheme, the study involved community residents, primarily housewives (56.25%), from Gono Timur and Gono Barat Hamlets. The intervention followed a six-stage methodology consisting of a pre-test, educational presentations on organic waste management, expert demonstrations, hands-on production practice, a post-test, and an evaluation session. Participants formulated diffusers using a ratio of 70% fragrance material (coffee/tea residue extract), 10% ethanol (96%), 15% propylene glycol, and 5% coconut oil. Quantitative evaluation demonstrated high participant knowledge post-program, with 100% of responses answered correctly on the knowledge assessment. Furthermore, 92.3% of participants expressed high satisfaction with the training, 61.5% indicated strong interest in replicating the diffuser-making process at home, and 69.2% were willing to recommend the program to others. Qualitative testimonials reinforced these findings, highlighting the practical, environmental, and economic potential of the initiative. Based on these findings, it is recommended that local stakeholders expand this program through advanced aroma variation, enhanced packaging design, and targeted marketing strategies to foster small-scale eco-friendly entrepreneurship.

Keywords: *community empowerment; diffuser; organic waste; tea residues; used coffee grounds*

INTRODUCTION

UNNES GIAT is a form of *Merdeka Belajar Kampus Merdeka* (MBKM) learning activity organized by *Universitas Negeri Semarang* (UNNES), which provides opportunities for students to contribute directly to rural communities through community empowerment and village development activities. The program encourages students to work collaboratively with communities to optimize local potential and resources, including through economic and creative initiatives. Villages possess various local resources that can be developed into innovative and useful products. The utilization of these resources requires creativity to transform readily available materials into products with greater functional and economic value. Such initiatives are also relevant to the Village Sustainable Development Goals (*SDGs Desa*), which emphasize integrated village development, including economic growth, environmental sustainability, innovation, and community empowerment.

Gonoharjo Village, Limbangan District, Kendal Regency, has the potential to develop simple innovations based on resources that are easily found in everyday life. Used coffee grounds, brewed tea, liquid laundry soap, and perfume can be utilized as alternative fragrance sources. Transforming these materials into room fragrance products provides an opportunity to increase their functional value while introducing a simple form of product innovation that may be further developed by the local community.

In line with the "Village Innovation" theme of the UNNES GIAT program, SERUNI (*Semberbak Ruangan Unik dan Inovatif*) was developed as an innovative diffuser utilizing alternative fragrance sources. SERUNI consists of 70% fragrance material, 10% 96% ethanol, 15% propylene glycol (PG), and 5% coconut oil. Ethanol and propylene glycol are among the volatile compounds identified in fragrance diffuser emissions, demonstrating their relevance in fragrance diffuser formulations. Based on this background, this activity aims to develop SERUNI as an innovative diffuser product and introduce the utilization of alternative fragrance sources to the community of Gonoharjo Village. The development of SERUNI is expected to serve as an initial step toward creating a locally based product that can be further improved through aroma variation, packaging design, and marketing strategies, while providing potential economic value for the community.

METHOD

This community empowerment activity was implemented in Gono Timur and Gono Barat Hamlets, Gonoharjo Village, Limbangan District, Kendal Regency, as part of the UNNES GIAT 16 program organized by Universitas Negeri Semarang. The program participants consisted of residents of Gonoharjo Village from diverse age groups and occupational backgrounds who voluntarily participated in the SERUNI training activities.

The materials used in this activity consisted of used coffee grounds and tea residues as the primary fragrance source, combined with 96% ethanol, propylene glycol (PG), and coconut oil. The SERUNI formulation consisted of 70% fragrance material, 10% 96% ethanol, 15% propylene glycol, and 5% coconut oil. The tools used included diffuser reeds, glass containers, measuring instruments, and other basic production equipment.

The implementation of the SERUNI program was carried out through six sequential stages: (1) a pre-test to measure participants' initial knowledge of organic waste utilization; (2) delivery of educational materials on organic waste management and diffuser fragrance technology; (3) a demonstration of the diffuser production process by the facilitators; (4) hands-on practice, in which participants directly produced their own diffuser products using used coffee grounds and tea residues; (5) a post-test to measure the improvement in participants' knowledge after the activity; and (6) an evaluation session to assess participants' satisfaction, their interest in applying the technique at home, and their willingness to recommend the program to others.

Data were collected using structured pre-test and post-test questionnaires to measure the change in participants' knowledge before and after the activity. Participants' satisfaction, interest, and willingness to recommend the program were measured using a Likert-scale questionnaire administered at the end of the activity. Additional qualitative data were obtained through open-ended testimonials to enrich the interpretation of the quantitative findings.

RESULTS AND DISCUSSION

Gonoharjo Village has the potential to generate organic waste from daily household activities and local agricultural practices. Organic materials such as used coffee grounds, tea residues, and other biodegradable household waste are commonly discarded without further utilization. The limited utilization of these materials indicates that organic waste management at the household level remains an important issue that needs to be addressed. Improper handling of organic waste may contribute to waste accumulation, unpleasant odors, and reduced environmental quality. Previous studies have highlighted the potential of organic waste streams to be incorporated into circular economy practices and transformed into value-added products rather than being disposed of directly (Ddiba et al., 2022; Kharola et al., 2022). Therefore, an appropriate and practical approach is needed to encourage the community of Gonoharjo Village to recognize the potential of organic waste and utilize it through simple and environmentally friendly processing.

In response to this issue, the SERUNI (*Semberbak Ruang Unik dan Inovatif*) program was developed as a community empowerment initiative that introduces the utilization of organic household waste through diffuser production. The program focuses on processing used coffee grounds and tea residues into functional diffuser products using simple production techniques. The utilization of spent coffee grounds and tea residues is supported by previous studies demonstrating their potential for various value-added applications (Lee et al., 2023; Çakmak et al., 2024; Zhao et al., 2024). Through a combination of education, demonstration, and hands-on practice, SERUNI aims to improve community knowledge and skills while encouraging the transformation of organic waste into products with practical and potential economic value.

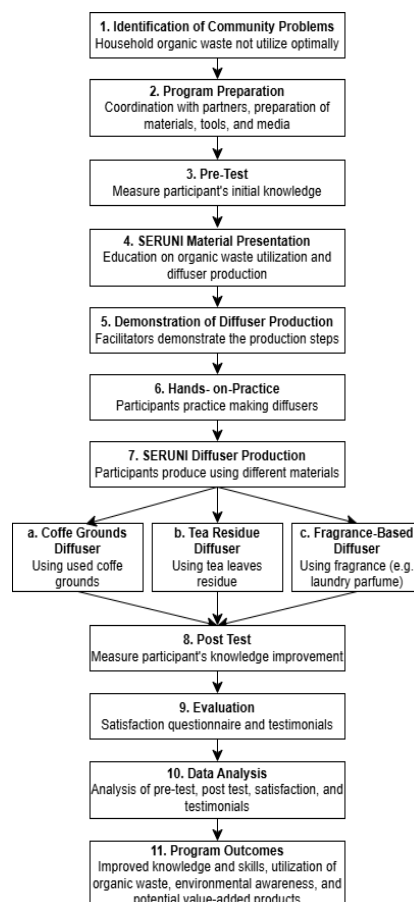


Figure. 1. SERUNI Program Implementation Process

The SERUNI program was conducted in two hamlets of Gonoharjo Village, namely Gono Timur and Gono Barat. The implementation consisted of several sequential activities, including a pre-test, delivery of educational materials, demonstration of diffuser production, hands-on practice, post-test, and evaluation. Through direct participation in the production process, participants were introduced

to the potential utilization of organic household waste as a material for value-added diffuser products. The combination of theoretical explanation, demonstration, and hands-on practice was designed to facilitate participants' understanding and improve their practical skills.



Figure 2. Presentation of the Training Materials



Figure 3. Participants' Diffuser-Making Practice

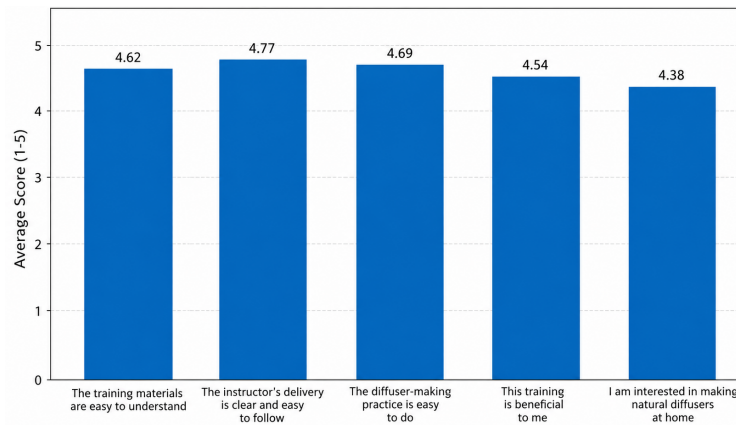
The implementation of the SERUNI program resulted in the production of diffuser products utilizing household organic waste. Participants successfully practiced the production process and produced functional diffuser products using different materials, particularly used coffee grounds and tea residues. The use of these materials demonstrates that organic household waste that is commonly discarded can be repurposed into products with practical value. The resulting diffuser products can be used as room fragrances while providing an alternative form of household waste utilization. The hands-on production process also provided participants with direct experience in processing waste materials into simple, useful, and potentially marketable products.

As shown in Table 1, the participants represented diverse age groups and occupational backgrounds. The largest proportion of participants belonged to the 41-50 years age group, accounting for 31.25 % of the total participants, while housewives constituted the largest occupational group with a proportion of 56.25%. The participation of individuals from different age and occupational groups indicates that the SERUNI program was able to engage various segments of the community. This diversity is relevant to the program because household organic waste management involves daily activities across different community groups.

Table 1. Characteristics of Participants

Characteristic	Category	Frequency (n)	Percentage (%)
Age	< 20 years	0	0.00%
	20-30 years	3	18.75%
	31-40 years	4	25.00%
	41-50 years	6	31.25%
	> 50 years	0	0.00%
Occupa-tion	Housewife	9	56.25%
	Student/Unive-rsity Student	1	6.25%
	Civil Servant	1	6.25%
	Farmer	0	0.00%
	Entrepreneur	0	0.00%
	Private Sector Employee	0	0.00%
	Others	2	12.50%
Total		16	100%

The post-test results showed that all 13 participants answered the five knowledge questions correctly, resulting in 65 correct answers out of 65 responses (100%). However, the pre-test score could not be determined because the answer key was not explicitly provided. Therefore, the results indicate a high level of participants' knowledge after the SERUNI program. The participants' satisfaction with the SERUNI program is presented in Fig. 4. The results show that 92.3% of participants were satisfied or very satisfied with the activities, particularly in terms of the materials, demonstrations, and hands-on practice. This indicates that the SERUNI program was well received and provided a positive learning experience for the participants.

**Figure 4.** Participants' Satisfaction Level

The participants' interest in implementing the SERUNI program at home is presented in Fig. 5. The results show that 61.5% of participants expressed interest in applying the diffuser-making technique using household organic waste. This finding indicates that SERUNI has potential to encourage participants to continue utilizing organic waste independently at the household level.

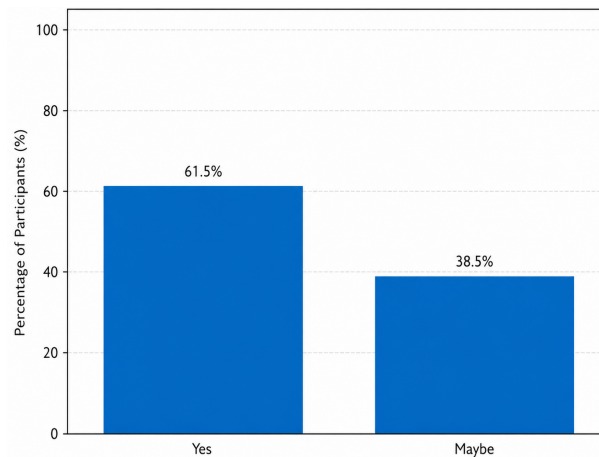


Figure 5. Participants' Interest in Implementing SERUNI at Home

The results show that 69.2% of participants were willing to recommend the program to others. This finding indicates that SERUNI was positively accepted by the participants and has potential to be introduced to a wider community. The participants' testimonials provided additional qualitative evidence of the positive response to the SERUNI program. The participants perceived the activity as useful, practical, and applicable to their daily lives. These responses also support the quantitative findings regarding participants' satisfaction and interest in implementing SERUNI at home.

The increase in participants' knowledge was accompanied by practical experience in producing diffuser products. The combination of material presentation, demonstration, and hands-on practice enabled participants to understand the production process while directly applying the techniques provided. Similar outcomes have been reported in previous diffuser-making training programs, where direct practice was used to develop participants' knowledge and practical skills in producing fragrance-based products (Ardiyantoro et al., 2025; Marlana et al., 2025). This finding indicates that SERUNI not only improved participants' understanding of organic waste utilization but also developed their practical skills in processing waste materials into useful products.

From an environmental perspective, SERUNI provides an alternative approach to utilizing organic household waste, particularly used coffee grounds and tea residues. Previous studies have demonstrated that spent coffee grounds and tea waste possess potential for various value-added applications, supporting their utilization as resources rather than materials for direct disposal (Çakmak et al., 2024; Lee et al., 2023; Zhao et al., 2024). In this context, SERUNI introduces a simple household-level application by transforming these organic residues into functional diffuser products. This approach can contribute to increasing community awareness of waste reuse and encouraging more environmentally responsible practices at the household level.

In addition to its environmental benefits, SERUNI has potential economic value through the development of simple household products. The utilization of readily available organic residues can create opportunities for value-added product development while encouraging the use of local resources (Lee et al., 2023; Zhao et al., 2024). This approach is also in line with community empowerment initiatives that promote local resources as creative economic products (Aprillianto et al., 2026). Therefore, SERUNI products may be further developed for small-scale commercialization through product diversification, attractive packaging, and appropriate branding.

The findings of the SERUNI program are consistent with previous community empowerment activities focusing on diffuser production. Ardiyantoro et al. (2025) and Marlana et al. (2025) demonstrated that training on reed diffuser production using waste-based materials could introduce waste utilization while developing participants' practical skills. Similarly, Toepak et al. (2023) and Timur et al. (2025) reported that training activities related to natural fragrance and reed diffuser production could provide participants with applicable knowledge and practical skills. In contrast, SERUNI specifically integrates the utilization of used coffee grounds and tea residues as household organic waste with diffuser production, providing a simple and applicable alternative for household-level waste management in Gonoharjo Village.

Overall, the SERUNI program demonstrated positive outcomes in terms of knowledge improvement, practical skills, waste utilization, and participant acceptance. The combination of

education, demonstration, and hands-on practice enabled participants to transform organic household waste into functional diffuser products while gaining practical experience. These results indicate that SERUNI has potential to be developed as a sustainable community empowerment program that integrates environmental awareness, household product innovation, and small-scale economic opportunities.

CONCLUSION

The SERUNI (Semerbak Ruang Unik dan Inovatif) community empowerment program implemented under the UNNES GIAT 16 scheme in Gonoharjo Village, Kendal Regency, successfully established a sustainable approach to household organic waste management by converting spent coffee grounds and tea residues into functional fragrance diffusers. Through a structured six stage methodology comprising a pretest, educational presentation, expert demonstration, hands on production practice, posttest, and evaluation, the initiative effectively enhanced community knowledge and practical skills, achieving a 100% correct response rate on the post-test evaluation. The intervention resonated strongly with local residents, particularly housewives who represented 56.25% of participants, yielding a high overall program satisfaction rate of 92.3%. Furthermore, 61.5% of participants expressed a strong intent to replicate the diffuser formulation consisting of 70% fragrance extract, 10% ethanol (96%), 15% propylene glycol, and 5% coconut oil independently at home, while 69.2% indicated their willingness to recommend the program to others. By applying grassroots circular economy principles, SERUNI not only reduces organic waste accumulation but also creates meaningful economic and environmental value aligned with the Village Sustainable Development Goals (SDGs Desa). To build upon these positive outcomes, several strategic recommendations are proposed for future development and program expansion. Local stakeholders and future empowerment teams should focus on scent diversification by exploring combinations of coffee and tea extracts with local essential oils such as lemongrass or citrus peel to improve product fragrance profiles. Additionally, transitioning SERUNI from a household activity into a viable micro-enterprise requires enhancements in product packaging, safety labeling, and brand identity, alongside structured mentorship from village authorities in digital marketing and cost accounting. Finally, expanding this training model to neighboring hamlets and villages will help establish a broader cooperative network for organic waste collection and eco-product commercialization.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

CONFLICTING INTEREST STATEMENT

The authors states that there is no conflict of interest in the publication of this article.

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