

Utilizing Household Waste Turning Household Waste into Economically Valuable Products to Train Teacher Entrepreneurship in Junior High Schools in Tegal Regency

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Abstract. Students' ability to conduct scientific activities, including research, problem-solving, and decision-making based on Pancasila values, needs to be enhanced through the implementation of the Pancasila Student Profile Strengthening Project (P5). This community service aimed to train teachers and students in utilizing used cooking oil to create economically valuable aromatherapy candles, fostering entrepreneurial skills. The methods included training and mentoring involving 43 science teachers of the MGMP in Tegal Regency as change agents. The results demonstrated that participants successfully understood the techniques for processing used cooking oil into aromatherapy candles, marketing products via social media, and innovating packaging. The conclusions revealed that the training effectively enhanced participants' understanding of transforming household waste into economically valuable products, aligning with character education and entrepreneurial development.

Keywords: household waste; aromatherapy candles, an economically valuable product

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INTRODUCTION

Education plays a pivotal role in equipping students with essential competencies, including scientific inquiry, problem-solving, and decision-making skills. In Indonesia, the Ministry of Education and Culture introduced the Pancasila Student Profile Strengthening Project (P5) to incorporate character education based on the noble values of Pancasila into the national curriculum. P5 aims to foster holistic development in students by emphasizing six key dimensions: faith and morality, global diversity, independence, cooperation, critical reasoning, and creativity (Wahidah et al., 2023). However, the implementation of P5 in educational institutions, particularly in Tegal Regency, faces significant challenges. Teachers in this region often have a fragmented understanding of the P5 framework, resulting in inconsistent practices that hinder the Ministry's goal of achieving comprehensive

character education. The Science MGMP (Subject Teacher Conference) in Tegal Regency has identified obstacles in implementing P5, particularly within science education. These challenges manifest in the limited capacity of teachers to design and execute classroom activities that engage students in scientific and entrepreneurial endeavors, leading to low levels of research and innovation skills among students. Compounding this issue is the community's insufficient awareness of environmental sustainability, particularly concerning the improper management of household waste such as used cooking oil.

Tegal Regency has considerable potential in trade and eco-friendly industries, making it an ideal region for integrating local strengths into education. The community surrounding SMP N 1 Slawi, for instance, generates a substantial amount of used cooking oil due to high consumption from households and street food vendors. This waste, commonly referred to as "jelantah" is typically

disposed of improperly, leading to environmental pollution and health hazards. Studies have shown that repeated use of cooking oil can generate free radicals, posing risks to cardiovascular health, liver function, and the gastrointestinal system (Bachtiar et al., 2022; Delta, 2019). Improper disposal exacerbates water pollution and harms aquatic ecosystems, further underscoring the need for effective waste management strategies (Inayati & Dhanti, 2021). At the same time, used cooking oil can be repurposed into economically valuable products, such as aromatherapy candles, providing a sustainable and innovative solution to waste management challenges. This dual-purpose approach addresses environmental concerns while fostering entrepreneurial skills among students, aligning with the objectives of the P5 framework.

Entrepreneurial education has gained traction as an effective means of equipping students with creativity, resilience, and problem-solving skills. Integrating entrepreneurship into science education, particularly through hands-on projects that address real-world challenges, is increasingly recognized as a best practice in fostering student engagement and skill development (Adhina & Fatmawati, 2019). Studies have demonstrated the effectiveness of such approaches in promoting both environmental awareness and economic empowerment. For instance, training students and teachers to process used cooking oil into eco-friendly products has proven to enhance their understanding of sustainability while providing practical entrepreneurial skills (Subali & Ellianawati, 2020). The P4-E model (Training, Practical Implementation, Marketing, and Evaluation) offers a structured framework for implementing community-based educational initiatives. This model emphasizes active participation from all stakeholders, fostering a sense of ownership and accountability (Tamrin, 2013). In Tegal Regency, adopting this approach can bridge the gap between the educational objectives of P5 and the region's socio-economic context, providing a practical and impactful pathway to achieve these goals.

This community service activity aims to address the identified challenges by enhancing the capacity of teachers and students in Tegal Regency to implement the P5 framework effectively. The initiative specifically focuses on training teachers and students in utilizing used cooking oil to create economically valuable aromatherapy candles. This project aligns with the educational goals of fostering scientific and entrepreneurial skills while addressing environmental sustainability. The

activity also aims to promote awareness of sustainable waste management practices within the broader community. By engaging 43 science teachers from the MGMP and students from SMP N 1 Slawi, the project seeks to create a ripple effect that extends the benefits of this initiative to other schools and communities. Through hands-on training and mentoring, participants will gain practical skills in processing waste cooking oil, product packaging, marketing through social media platforms, and building sustainable business networks.

METHODS

This community service activity utilized a structured and systematic approach based on the P4-E model, comprising four interconnected stages: Training, Practical Implementation, Marketing, and Evaluation. These stages were designed to empower teachers and students with the knowledge and skills required to transform waste cooking oil into economically valuable products, specifically aromatherapy candles, while integrating principles of entrepreneurship and environmental sustainability.

The Training Stage formed the foundation of the activity, emphasizing theoretical and conceptual understanding. Participants, including MGMP Science teachers and students from SMP N 1 Slawi, were introduced to the environmental consequences of improper waste disposal and the potential of waste cooking oil as a valuable raw material for creating products like aromatherapy candles. This stage also linked these activities to the Pancasila Student Profile Strengthening Project (P5), reinforcing the integration of character education with practical applications. Training sessions included discussions on sustainable waste management, the process of repurposing waste cooking oil into value-added products, and entrepreneurial principles to enhance product marketability. These sessions equipped participants with a solid understanding of the technical, environmental, and economic aspects of the initiative.

The Practice and Implementation Stage followed the training, focusing on skill-building through hands-on workshops. Participants applied the knowledge gained in the previous stage to process waste cooking oil into aromatherapy candles. The step-by-step process included cleaning and preparing the oil, mixing it with aromatherapy fragrances and wax, and using molds to create candles of various shapes and

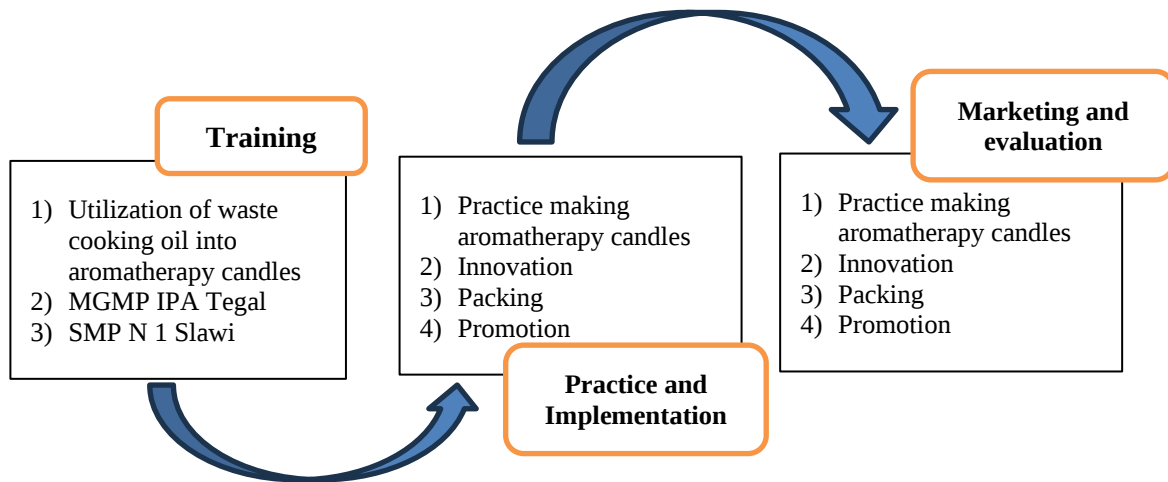


Figure 1. Stages of community service

designs. This phase also encouraged innovation, where participants experimented with different designs, scents, and packaging to make the products more appealing to consumers. Additionally, participants learned packaging techniques to ensure their products were visually attractive and market-ready. To prepare participants for market introduction, they were trained in promotion strategies, including leveraging social media platforms like Shopee to market and sell their products.

The Marketing and Evaluation Stage focused on refining the products and assessing the overall effectiveness of the activities. Participants were introduced to advanced marketing strategies, including branding, pricing, and building sustainable business networks to expand their market reach. The evaluation process involved distributing surveys and questionnaires to gather feedback on participants' experiences and skill development. Observations of the quality and creativity of the candles produced provided insights into participants' progress. Additionally, the evaluation monitored participants' ability to independently market and sell their products, ensuring the initiative's sustainability. Continuous mentoring sessions were conducted to address challenges faced by participants and provide ongoing support for skill enhancement and problem-solving.

The activity engaged MGMP Science teachers and 43 students from SMP N 1 Slawi, Tegal Regency. The multipurpose room at SMP N 1 Slawi served as the venue, providing an ideal setting for both theoretical training and practical workshops. The space was equipped with the necessary tools and resources to facilitate

interactive and productive sessions.

Figure 1 illustrates the cyclical and interconnected stages of the P4-E model, emphasizing the iterative nature of the process. Each stage builds upon the previous one to ensure comprehensive skill acquisition, practical application, and sustainable outcomes. The diagram depicts arrows connecting the stages, highlighting the potential to revisit earlier phases for refinement and continuous improvement. The Training Stage established the theoretical foundation, which was then applied and enhanced during the Practice and Implementation Stage. The final Marketing and Evaluation Stage provided participants with the tools and feedback necessary to sustain and expand their entrepreneurial activities. This structured model serves as a replicable framework for similar community-based initiatives, demonstrating its adaptability to various contexts and challenges.

RESULTS AND DISCUSSION

This community service program was designed to address environmental challenges while equipping participants with entrepreneurial skills through the P4-E model: Training, Practical Implementation, Marketing, and Evaluation. The initiative targeted MGMP Science teachers and students of SMP N 1 Slawi, aiming to transform waste cooking oil into economically valuable aromatherapy candles. The program achieved significant milestones, highlighted through theoretical training, hands-on practices, and market-oriented strategies. This section evaluates the outcomes, challenges, and future opportunities

of the initiative, supported by figures and references.



opportunities (Wahidah et al., 2023). Participants demonstrated strong engagement, as the training



Figure 2. Waste cooking oil disposal and the commitment of the Tegal Regency government to treat waste oil

The primary objective was to introduce participants to sustainable waste management and empower them to transform waste cooking oil into marketable products. Figure 2 contextualizes the necessity of this initiative. On the left, the polluted waterways filled with household and industrial waste highlight the environmental consequences of improper waste management. This image underscores the urgency of intervention to mitigate pollution. On the right, the commitment of the Tegal Regency government is displayed through their structured waste cooking oil collection program. These two contrasting visuals set the stage for community-based efforts, aligning with the objectives of this program (Bachtiar, Irbah, & Islamiah, 2022; Inayati & Dhanti, 2021).

In the training phase, participants engaged in online sessions, as shown in Figure 3a, which introduced the technical processes of repurposing waste cooking oil. This stage laid the theoretical foundation, covering sustainable waste management principles and entrepreneurial

fostered an understanding of environmental challenges and solutions (Delta, 2019). In the practical implementation phase, participants translated theoretical knowledge into action. Figure 3b captures the hands-on preparation process, where teachers and students collaboratively processed waste cooking oil into aromatherapy candles. This phase emphasized creativity, teamwork, and technical skill-building, aligning with findings by Adhina and Fatmawati (2019), who noted the importance of hands-on activities in fostering innovation.

Indicators of success were evaluated through participants' ability to: process waste cooking oil into aromatherapy candles; innovate in design and packaging; market the products effectively through social media.

As depicted in Figure 4. 93% of participants successfully mastered marketing techniques using platforms like Shopee, a testament to the effectiveness of the program. However, 23% faced challenges in innovation, highlighting a need for more advanced training in creative product design

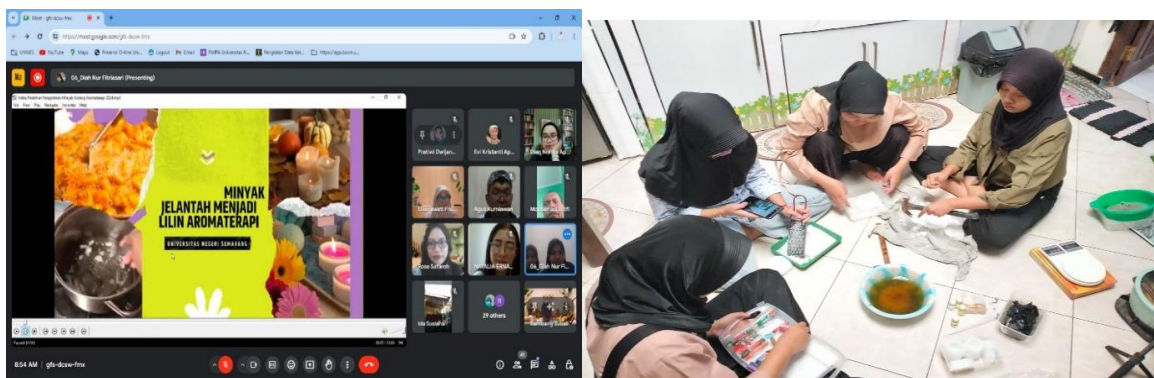


Figure 3. a) Online Training Participants; b) Aromatherapy Candle Making Preparation Process

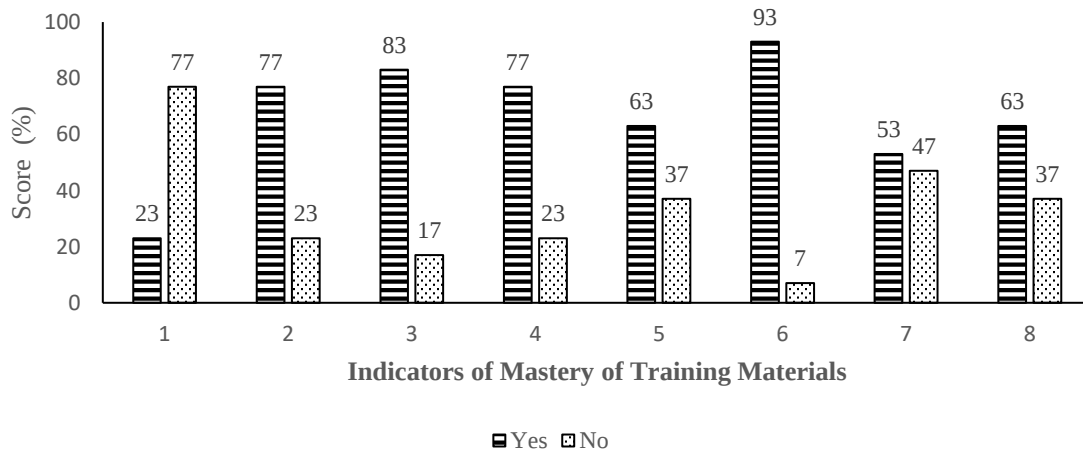


Figure 4. Mastery of aromatherapy candle making training materials and marketing techniques on social media

(Subali & Ellianawati, 2020). Similarly, 47% reported difficulties in disseminating knowledge to peers, suggesting opportunities for mentorship and collaboration.

The outputs of this program, primarily the aromatherapy candles, offered significant strengths. The use of waste cooking oil, an abundant resource in Tegal Regency, ensured sustainability and practicality. Participants created eco-friendly products that addressed both environmental concerns and local economic needs (Megawati & Muhartono, 2019). The integration of entrepreneurial education enabled participants to develop skills in cost management, pricing, and marketing, providing a pathway for additional income generation. The high levels of creativity demonstrated by participants in the design and packaging of candles, as captured in Figure 2b, reflect the program's success in fostering innovation (Bogoriani & Ratnayani, 2015).

However, certain weaknesses were identified. As shown in Figure 3, participants struggled with specific indicators, such as innovation (Indicator 4) and knowledge dissemination (Indicator 7). These challenges highlight gaps in the program's structure, particularly in addressing the varying skill levels of participants. While some participants excelled, others required additional guidance, indicating the need for more tailored training approaches (Tamrin, 2013). Furthermore, sourcing consistent quantities of waste cooking oil for large-scale production posed a logistical challenge, emphasizing the importance of community engagement and partnerships with local businesses (Bachtiar et al., 2022).

One of the main challenges in this initiative

was ensuring consistency and quality in candle production. While participants mastered basic techniques, achieving uniformity in design, scent, and packaging required more advanced training. Additionally, the limited marketing reach of participants, despite their success in using social media platforms, constrained their ability to scale up production and distribution. Establishing partnerships with local businesses and community organizations could address these limitations and enhance market access (Inayati & Dhanti, 2021; Bogoriani & Ratnayani, 2015).

Despite these challenges, the program presents significant opportunities for future development. The growing demand for eco-friendly products offers a favorable environment for expanding the production and distribution of aromatherapy candles. Integrating this initiative into the school curriculum as part of the Pancasila Student Profile Strengthening Project (P5) could ensure its sustainability and reach a broader audience. Embedding such programs into formal education aligns with the findings of Wahidah et al. (2023), who emphasized the importance of fostering innovation and sustainability through educational interventions.

Technological advancements provide another avenue for growth. Introducing automated production methods could increase efficiency and reduce costs, enabling participants to scale up production (Delta, 2019). Exploring additional uses for waste cooking oil, such as biodiesel production, could diversify the program's outputs and contribute to broader sustainability goals (Tamrin, 2013; Subali & Ellianawati, 2020). The high levels of engagement and mastery observed

in Figure 3 suggest that participants are well-positioned to capitalize on these opportunities with the right support and resources.

The success of this program can be attributed to its alignment with local needs and its focus on sustainability and entrepreneurship. Figure 1 highlights the dual context of environmental challenges and governmental support, demonstrating the program's relevance. Figure 2 captures the systematic approach of training and hands-on application, ensuring participants gained both theoretical knowledge and practical skills. Figure 3 quantifies the program's outcomes, providing evidence of its effectiveness in fostering creativity, technical competency, and marketing skills.

However, the program's long-term sustainability depends on addressing its limitations. The challenges identified in Figure 3, such as innovation gaps and resource constraints, underscore the need for continuous mentorship and structured opportunities for collaboration. Future iterations of the program should focus on enhancing the scalability of outputs, building partnerships, and integrating advanced production techniques to maximize impact (Adhina & Fatmawati, 2019; Bachtiar et al., 2022).

CONCLUSION

The community service activities successfully achieved their objectives by empowering participants with the skills and knowledge to transform waste cooking oil into economically valuable aromatherapy candles while promoting environmental sustainability and entrepreneurship. Participants demonstrated a clear understanding of the training materials, mastering the process of preparing, processing, and packaging candles independently. Additionally, they developed entrepreneurial competencies, effectively leveraging social media platforms such as Shopee to market and sell their products. These outcomes highlight the program's success in addressing both environmental challenges and local economic needs. By integrating practical skill-building with innovative marketing strategies, the initiative not only fostered sustainable waste management practices but also provided participants with tools for economic empowerment. The program's alignment with the Pancasila Student Profile Strengthening Project (P5) underscores its broader educational impact, offering a replicable model for future community-based interventions aimed at

sustainability and entrepreneurship.

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