JDIMAS
Jurnal Pengabdian Masyarakat
https://ejournal.unikama.ac.id/index.php/jdimas
ISSN: 3048-183X | Vol. 4, No. 1, 2026 |
pp. 32–38

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Training on Upcycling Used Bottle Caps into Keychains for PKK Women in Pandanmulyo Village

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ARTICLE HISTORY

Received:
April 2, 2026

Revised:
May 28, 2026

Published:
June 30, 2026

Keywords:
Upcycling; Used bottle caps; Keychains; PKK; Community empowerment

ABSTRACT

The utilization of waste plastic bottle caps as raw materials for handicrafts remains limited in Pandanmulyo Village, Tajinan District, Malang Regency. This community service program aimed to improve the knowledge and practical skills of Family Welfare Empowerment (PKK) members in transforming used bottle caps into keychain products. The program employed a structured training approach comprising conceptual introduction, technical demonstrations, independent practice, mentoring, and product finishing. Twelve participants were organized into three working groups. The training covered material cleaning, shredding, melting, molding, and keychain assembly. Evaluation through observation of practical activities indicated that participants were able to complete the production stages with guidance. Participants demonstrated active engagement through hands-on practice, group discussions, and technical consultations. Approximately 30 keychains featuring various motifs and color combinations were produced during the training. These results demonstrate the feasibility of using discarded plastic bottle caps as materials for functional handicrafts and provide participants with initial practical experience in waste upcycling. Further development should focus on improving product design, production consistency, packaging, and marketing strategies to explore potential economic opportunities and support sustainable community-based waste management.

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D. Wulandari, Y. M. R., Y. J. Sampoerna, N. K. Salsabila, A. R. Maharani, E. A. Mariya, A. S. Putri, M. A. Maulana, B. J. N. S., A. M. P., N. Faiz, and R. S. A., "Training on upcycling used bottle caps into keychains for PKK women in Pandanmulyo Village," *JDIMAS: Jurnal Pengabdian Masyarakat*, vol. 4, no. 1, pp. 32–38, 2026, doi: 10.21067/jdimas.v4i1.14905.

1. INTRODUCTION

Waste generated by anthropogenic activities represents a tangible threat to ecosystem stability, public health standards, and human survival. According to Law No. 18 of 2008

concerning Waste Management, waste is defined as residual material from daily human routines or non-anthropogenic natural phenomena in solid or semi-solid form, both organic and inorganic, which can be degradable or resistant to decomposition, accumulating in the environment after it is no longer utilized [1].

Environmental degradation resulting from the accumulation of synthetic inorganic waste does not merely damage biospheric structures, but also poses serious risks to human physical well-being. Polymer fragments that degrade into microplastic particles have the potential to contaminate food chain networks and disrupt the survival of biological species. Consequently, integrated plastic waste management represents a fundamental urgency within the framework of sustainable environmental carrying capacity preservation [2].

In Indonesia, high levels of single-use plastic consumption trigger spikes in unmanaged waste generation, demanding innovative breakthroughs to convert polymer residues into saleable and ecologically oriented commodities. Upcycling approaches are increasingly adopted due to their ability to directly escalate the functional value of waste without altering its basic material composition, offering a more environmentally friendly alternative compared to conventional recycling methods [3]. Conceptually, upcycling is defined as a series of transformations converting residual materials into new product entities with superior functionality and aesthetic value far exceeding their original state [4].

The lack of optimization of plastic bottle caps into commercially valuable craft commodities is an identified environmental challenge in Pandanmulyo Village, Tajinan District, Malang Regency. The implementation of waste management based on the 3R hierarchy Reduce, Reuse, and Recycle represents a relevant practical strategy to minimize the accumulation of synthetic residue volume in society. Furthermore, the 3R paradigm contributes positively to transforming community behavior toward more measured single-use product consumption while reconstructing public perception to view waste as a potential resource.

Reflecting on these pillars, Hulaikah (2022) emphasized that recycling instruments hold strategic prospects due to their capacity to re-engineer material residues into new goods that retain functional utility while delivering economic value. Re-engineering polymer waste into craft raw materials not only mitigates biospheric pollution levels, but also initiates business diversification and stimulates the growth of local potential-based creative economy sectors [5]. Therefore, community empowerment intervention is an absolute necessity to transfer scientific knowledge and technical expertise to residents in processing plastic waste into high-value-added products.

Based on this context, the Student Community Service (KKN) team of Universitas PGRI Kanjuruhan Malang 2026 in Pandanmulyo Village initiated an empowerment training program titled Upcycling Training for PKK Women, integrated with digital marketing literacy reinforcement to ensure the sustainability of program outcomes.

2. IMPLEMENTATION METHODS

The approach applied in this service program involved training in engineering plastic bottle cap waste into keychain accessories for members of the PKK in Pandanmulyo Village, Tajinan District, Malang Regency. This activity took place on August 19, 2026, involving 12 participants distributed into three working groups. The program flow was systematically designed through preparation stages, conceptual material presentation, technical demonstrations, independent simulations, guided mentoring assistance, and final product finishing. This initiative was motivated by the low utilization rate of domestic inorganic waste, particularly polymer bottle cap residue, in Pandanmulyo Village. Post-consumer bottle caps generally end up as ordinary household solid waste, despite possessing high reuse

potential as craft raw materials. Therefore, this workshop was presented to transfer practical skills to participants in transforming non-economical waste into functional, marketable commodities. Additionally, this intervention represents a concrete step toward implementing the Reduce, Reuse, Recycle (3R) paradigm through simple practical applications based on local material optimization. During the preparation phase, the KKN student team facilitated the procurement of all supporting instruments and materials, such as waste bottle caps, cookie press molds, baking paper as non-stick separators, electric irons, cutting scissors, punch tools, and keychain ring connectors. The implementation team also formulated output design specifications and prepared craft prototypes as initial visualization materials. Fabrication procedures adopted the reference from a digital tutorial video on the YouTube channel titled "DIY Keychains from Used Bottle Caps! Unique & Easy to Make" as the methodological foundation for product creation [6]. These technical procedures were subsequently contextualized to align with raw material characteristics, equipment availability, and execution dynamics in Pandanmulyo Village. The implementation phase commenced with theoretical explanations regarding the potential of plastic bottle cap residues and their processing prospects into craft commodities. Participants gained insights into the urgency of waste sorting and polymer recycling to reduce the volume of inorganic residue reaching landfills. Following the conceptual presentation, the team demonstrated the step-by-step fabrication of keychains from used bottle caps through a systematic assembly process: Waste bottle caps were collected, washed clean, and dried to ensure the material was free from contaminants. Bottle caps were shredded into small fragments using scissors and sorted by color pigments to create varied product motifs. The polymer shreds were evenly arranged on baking paper and covered with another layer of paper. Plastic materials were heated using an electric iron until softened and thermally fused. This thermal process was closely supervised by the guiding team to ensure safe and correct procedures. The homogenized molten polymer mixture was molded according to the designated keychain design. The outer edges of the workpieces were trimmed and adjusted to match the mold geometry precisely. Attachment points were measured and punched, then assembled with keychain rings until ready for use. Following the technical demonstration, participants immediately implemented the workflow in three small groups. The facilitator team provided continuous supervision throughout, particularly during thermal softening, matrix molding, and ring attachment assembly. Mentoring focused on these stages as several participants encountered technical challenges when compacting post-heated materials or installing metal connectors. Through this self-directed simulation, participants not only absorbed conceptual instructions but also actively tested their motor skills across each production stage. The final phase covered product finishing and quality evaluation. Participants completed all assembly steps and objectively evaluated the transformation of bottle cap waste into functional craft items. Throughout the training, the team evaluated participant engagement in following directions, practicing work steps, engaging in interactive discussions, and seeking technical assistance when facing operational challenges. The quantity and quality of fabricated commodities served as benchmarks for program effectiveness, demonstrating that inorganic bottle cap waste has diversified uses as value-added products.

3. RESULTS AND DISCUSSION

3.1 Implementation Results and Evaluation

The Student Community Service (KKN) team of Universitas PGRI Kanjuruhan Malang (UNIKAMA) 2026 in Pandanmulyo Village successfully conducted a plastic bottle cap recycling workshop with PKK women. The event opened with introductory ceremonies

and conceptual presentations on inorganic waste diversification into aesthetic craft products, accompanied by comprehensive explanations of visual promotion strategies via posters and brochures (covering ergonomic layouts, persuasive typography, and harmonious colors to attract consumers). The subsequent session transitioned into direct self-assembly implementation. This applied simulation approach for producing polymer waste keychains was purposefully chosen so that PKK members acquired not only theoretical understanding but also technical competence in re-engineering post-consumer materials into ready-to-use commodities. Practice-based training models are widely integrated into community empowerment schemes due to their ability to facilitate immediate application of transferred technical skills [7]. During execution, the structured workflow included raw material collection, cleaning and drying, polymer shredding into small particles, and color sorting. Plastic shreds were measured at a precise dosage of two tablespoons onto baking paper to maintain proportional cross-sectional thickness, covered with protective paper, melted using an iron, quickly molded into dedicated molds, trimmed, punched, and fitted with keychain rings. Several participants faced minor initial technical challenges, particularly in regulating melting levels, compacting materials into molds, and attaching metal rings. These operational hurdles stemmed from a lack of prior technical experience in thermal polymer processing. Consequently, the KKN team provided intensive supervision throughout the simulation until every participant successfully produced keychains independently.

The workshop on upcycling polymer bottle cap waste involved 12 members of the Pandanmulyo Village PKK, divided into three working groups. Throughout the program, all participants followed every stage systematically from opening to closing. Audience participation was reflected in high attention to concept presentations and technical demonstrations, active Q&A engagement, inter-group discussion interactions, and hands-on participation in accessory fabrication. Participants adhered to facilitator guidance and proactively consulted when encountering stages requiring special handling. Participant enthusiasm extended beyond theoretical sessions into the assembly simulation. PKK members followed key steps systematically according to established technical guidelines. Upon encountering mechanical obstacles, participants engaged in dialogue with student facilitators and group peers to identify operational solutions, re-practicing procedures after receiving technical guidance. This phenomenon demonstrated comprehensive audience engagement through observation, independent experimentation, and real-world material engineering application. Integrated training models combining instructional lectures, visual demonstrations, and hands-on practice align with waste conversion programs proven to effectively stimulate active community participation in product manufacturing [8]. Empirical achievements confirm that technical demonstrations and mentoring assistance play crucial roles in accelerating community understanding of plastic waste processing flows. This aligns with findings by Rizky Oktaverina et al. regarding the effectiveness of direct demonstration methods in synthetic waste management workshops for PKK groups [9]. Prior studies demonstrated significant motor skill improvements among participants before and after receiving keychain fabrication simulations. Overall, participant dynamism was reflected in full attendance, two-way communication during discussions, and persistence in refining difficult production steps. Regarding skill acquisition indicators, participants who initially relied heavily on demonstrations exhibited independence in executing most process chains following intensive guidance. Thus, the program successfully transferred practical skills to the community for re-engineering bottle cap waste into useful craft products, even though supervisor assistance remained essential during critical phases.

3.2 Discussion

Evaluation of the program involving 12 participants across three workgroups confirmed the successful production of approximately 30 keychain units under guided facilitation. This quantitative milestone proves that combining self-simulations with intensive technical guidance effectively accelerates participant understanding of craft manufacturing steps. This finding aligns with conclusions by Febrianti et al., confirming that bottle-cap keychain fabrication training using participatory approaches boosts participant creativity and technical skills in producing innovative items [10]. The keychains produced proved that plastic bottle cap waste can be converted into practical, easy-to-fabricate craft commodities. Although visual designs varied across groups, all products met functional standards for immediate use. Independent assembly enabled participants to observe directly that post-consumer inorganic materials retain utility through structured recycling. These physical results serve as a primary success indicator, proving participants did not merely absorb conceptual waste management concepts but produced tangible output through applied skills. Beyond keychains, the intervention broadened awareness that bottle cap waste holds prospects for diversification into various other craft items. Created commodities can serve domestic needs or be commercialized into marketable goods through visual differentiation and aesthetic packaging. Therefore, the workshop went beyond technical waste conversion by internalizing valuable community experience in engineering simple surrounding materials into high-value functional products.

In addition to physical output quantity and quality, participant enthusiasm served as a key evaluation variable. Participants followed all training stages systematically, from theoretical frameworks and demonstrations to independent assembly simulations. During direct production, PKK members proactively sought assistance on challenging steps. This dynamic demonstrated positive program reception and strong community interest in experimenting with bottle cap waste craft engineering. This aligns with findings by Santosa Putra et al., indicating that proactive audience involvement reflects strong commitment and drive to acquire new competencies through experiential learning [11]. Constructive participant feedback indicates promising potential for scaling craft product downstreaming. The fabricated keychains can be enhanced through geometric pattern diversification, color pigment combinations, ornamental additions, and visual concept developments to create competitive designs. Furthermore, skills gained provide a foundation for residents to explore other domestic inorganic waste streams into economic commodities. Downstream development and product diversification can be sustained progressively alongside growing creative capacity and technical mastery among group members.

4. CONCLUSION

The implementation of the KKN service agenda under the slogan "Collaborate, Empower, and Sustain" in Pandanmulyo Village, Tajinan District, via the workshop on upcycling polymer bottle cap waste into keychains, demonstrates that synergy between student teams and PKK groups creates a strategic foundation for community capacity building. Involving 12 PKK members, this initiative transferred conceptual knowledge of inorganic waste management while providing hands-on experiential learning. Through collection, decontamination, shredding, thermal fusion, matrix molding, and ring assembly, participants acquired new motor skills to transform solid waste into functional and aesthetic craft goods. Empirical outcomes confirmed that all participants successfully produced keychains under integrated facilitation, yielding approximately 30 units during the session. Participant creativity was reflected in varied color gradients and unique product geometries, with some products immediately put to daily use. This confirms that practical training

effectively accelerates functional skills and community independence in plastic waste recycling. However, physical achievements cannot yet be evaluated as direct indicators of household income growth, as the scope did not encompass revenue calculations or profit margin assessments. From a sustainability perspective, program outcomes hold strategic prospects for downstream commercialization into productive micro-enterprises through design diversification, material quality standardization, packaging innovation, and targeted market penetration. Promotional layout education using posters, flyers, and digital channels serves as an initial stepping stone for introducing local craft products to potential consumers. Sustaining program impacts will require periodic supervision and communication via WhatsApp groups to ensure skill retention past the KKN period. Thus, this initiative serves as a concrete foundation for developing a self-reliant, competitive recycled-craft creative center in Pandanmulyo Village.

ACKNOWLEDGMENTS

The authors express their deepest appreciation and gratitude to Universitas PGRI Kanjuruhan Malang for institutional support and facilitation throughout the KKN program, to the Field Supervisor for sincere guidance and strategic advice, to the Pandanmulyo Village Government for permits and facility support, and to the entire community of Pandanmulyo Village, especially the active PKK members who contributed to the success of this workshop. The authors also thank all parties who dedicated their effort, time, ideas, and moral support to ensure the successful execution of this community service program and publication manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article. No potential conflicts of interest, financial or otherwise, were reported by the authors.

DECLARATION OF AI USE

During the preparation of this work, the authors used AI tools solely to assist with language translation, grammar refinement, and formatting improvements. The underlying concepts, community service activities, data collection, analysis, and conclusions were entirely conducted and developed by the authors. The authors have thoroughly reviewed and edited the content as necessary and take full responsibility for the final content of the published article.

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