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Community Empowerment through Plastic Bottle Upcycling Training in Kampung Pueh Sematan, Kuching, Sarawak

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Abstrak: *Sampah botol plastik menjadi persoalan yang terus berulang di Kampung Pueh Sematan, Kuching, Sarawak, terutama karena keterbatasan layanan pengelolaan sampah dan rendahnya literasi lingkungan yang mendorong praktik pembuangan terbuka atau pembakaran. Program pengabdian kepada masyarakat ini bertujuan meningkatkan pemahaman warga tentang dampak sampah botol plastik serta mengembangkan keterampilan upcycling untuk mengubah botol bekas menjadi produk kerajinan yang fungsional dan bernilai tambah. Kegiatan dilaksanakan pada 9 Agustus 2025 di Surau Baitul Quddus melalui kolaborasi Universitas Muhammadiyah Pontianak dan I-CATS University College, dengan melibatkan 63 peserta (10 warga lokal; 25 dari I-CATS; 28 dari Universitas Muhammadiyah Pontianak). Metode yang digunakan adalah pendekatan pemberdayaan partisipatif dengan tiga tahap: (1) sosialisasi dan edukasi mengenai dampak lingkungan dan kesehatan dari sampah plastik yang tidak terkelola, (2) pelatihan praktik upcycling meliputi pemilahan, pencucian, pemotongan, perakitan, dan dekorasi botol, serta (3) evaluasi menggunakan kuesioner terstruktur. Peserta berhasil menghasilkan produk seperti lampu dekoratif, wadah penyimpanan, dan aksesori pakai ulang. Hasil kuesioner menunjukkan respons sangat positif: 100% peserta belum pernah mengikuti pelatihan serupa; kejelasan materi dinilai 50% sangat setuju dan 50% setuju; keyakinan menerapkan keterampilan secara mandiri mencapai 33% sangat setuju dan 64% setuju; manfaat program dirasakan 100% (50% sangat setuju; 50% setuju); kepuasan keseluruhan 42% sangat setuju dan 58% setuju; serta fasilitas dinilai memadai (16% sangat setuju dan 84% setuju). Secara keseluruhan, program ini menunjukkan bahwa edukasi kontekstual yang dipadukan dengan praktik langsung dapat memperkuat kesiapan komunitas dalam pengelolaan sampah botol plastik berbasis upcycling dan membuka potensi ekonomi kreatif skala kecil.*

Kata kunci: *Botol Plastik; Ekonomi Sirkular; Pelatihan Partisipatif; Pemberdayaan Masyarakat; Pengelolaan Sampah; Sarawak; Upcycling*

Abstract: *Plastic bottle waste is a persistent problem in Kampung Pueh Sematan, Kuching, Sarawak, where limited waste services and low environmental literacy often lead to open dumping or burning. This community service program aimed to improve residents' understanding of plastic waste impacts and develop practical upcycling skills to transform used bottles into functional, value-added handicrafts. The program was conducted on 9 August 2025 at Surau Baitul Quddus through collaboration between Universitas Muhammadiyah Pontianak and I-CATS University College, involving 63 participants (10 local residents; 25 from I-CATS; 28 from Universitas Muhammadiyah Pontianak). Using a participatory empowerment approach, activities followed three stages: (1) awareness and socialization on environmental and health risks of unmanaged plastic waste, (2) hands-on training on sorting, cleaning, cutting, assembling, and decorating bottles, and (3) evaluation using a structured questionnaire. Participants produced items such as decorative lamps, storage containers, and reusable accessories. Questionnaire results were strongly positive: 100% reported no prior similar training; material clarity was rated 50% strongly agree and 50% agree; confidence to apply skills independently reached 33% strongly agree and 64% agree; perceived benefits were 100% (50% strongly agree; 50% agree); overall*

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satisfaction was 42% strongly agree and 58% agree; and facility adequacy was 16% strongly agree and 84% agree. Overall, the program indicates that combining contextual environmental education with hands-on practice can support community readiness for sustainable plastic bottle upcycling and small-scale creative economic potential

Keyword: *Plastic Bottles; Circular Economy; Participatory Training; Community Empowerment; Waste Management; Sarawak; Upcycling*

INTRODUCATION

Plastic waste has become one of the most persistent environmental challenges faced by many communities worldwide, including in Malaysia. The rapid growth in the use of single-use plastics, particularly plastic bottles, has significantly increased the volume of household waste and placed pressure on existing waste management systems. In many suburban and rural areas, limited collection facilities and low public awareness contribute to improper disposal practices, which ultimately threaten environmental quality and public health (Ng et al., 2023; Sulaiman et al., 2023).

In Kampung Pueh Sematan, Kuching, Sarawak, plastic bottle waste is commonly generated from daily household activities and small-scale commercial use. However, the community has not been supported by structured waste management programs or skill-based training that enable residents to manage plastic waste productively. As a result, most plastic bottles are either discarded, burned, or accumulated in open spaces, creating environmental concerns while simultaneously representing untapped economic potential.

Although plastic waste poses serious ecological risks, plastic bottles possess physical characteristics such as durability, flexibility, and ease of processing that make them suitable for reuse and upcycling. When supported by appropriate training and guidance, plastic bottle waste can be transformed into functional and decorative handicraft products, including household containers, decorative lamps, and other marketable items. Previous studies have shown that community-based recycling and upcycling initiatives can reduce environmental pollution while providing alternative income opportunities and strengthening local creative economies (Irdiana et al., 2020; Zakirman et al., 2022).

Community empowerment through practical skills training plays a critical role in encouraging sustainable waste management behavior. Empowerment-oriented programs not only improve environmental awareness but also build community capacity by enhancing technical skills, self-confidence, and collaborative participation. Such approaches align closely with the principles of the circular economy, where waste materials are viewed as valuable resources rather than disposable products (Zhang dkk., 2021).

This initiative is also consistent with the United Nations Sustainable Development Goals (SDGs), particularly Goal 11 on Sustainable Cities and Communities, Goal 12 on Responsible Consumption and Production, and Goal 13 on Climate Action. Community-level engagement has been widely recognized as an effective pathway for achieving these goals, especially when environmental education is integrated with hands-on activities that generate tangible social and economic benefits (Sachs et al., 2019; Winih et al., 2024)

Based on these considerations, this community service program was designed to empower residents of Kampung Pueh Sematan through plastic bottle waste upcycling training. The program aims to increase environmental awareness, develop practical skills in waste transformation, and encourage the creation of economically valuable products from recycled materials. Through participatory education and hands-on practice, the program is expected to contribute to sustainable waste management practices while supporting the growth of small-scale community-based creative enterprises.

METHOD

This community service program employed a participatory empowerment approach, emphasizing active involvement of community members throughout all stages of implementation. The approach was designed to encourage learning by doing, strengthen local ownership, and ensure that the skills transferred during the program could be sustainably applied within the community. The program integrated environmental education with hands-on upcycling practice to address both awareness and technical skill gaps in plastic bottle waste management

Time and Location

The program was conducted on 9 August 2025 in Kampung Pueh Sematan, Kuching, Sarawak, Malaysia, through collaboration between Universitas Muhammadiyah Pontianak and I-CATS University College. Participants included 10 local residents of Kampung Pueh Sematan, 15 students and 10 lecturers from I-CATS University College, and 20 students with 8 lecturers from Universitas Muhammadiyah Pontianak. The selected location represents a coastal community where plastic bottle waste is commonly generated from household and daily consumption activities

Prosedur

The implementation of the program consisted of three main stages, structured to ensure gradual knowledge transfer, skill development, and outcome evaluation.

1. **Awareness and Socialization Session**
   The first stage focused on increasing participants' understanding of plastic bottle waste issues. Educational sessions were delivered through interactive presentations and group discussions covering the environmental and health impacts of unmanaged plastic waste, local waste management challenges, and the potential of plastic bottles as recyclable and economically valuable materials. Case examples from other community-based waste transformation initiatives were also introduced to strengthen participants' motivation and environmental responsibility.
2. **Hands-on Training on Plastic Bottle Waste Upcycling**
   The second stage emphasized practical skill development through direct training and mentoring. Participants were guided step by step in sorting, cleaning, cutting, assembling, and decorating used plastic bottles into handicraft products. Group-based workshops encouraged collaboration, creativity, and peer learning. During this phase, participants successfully produced various items such as decorative lamps, eco-friendly bags, and storage containers, demonstrating the applicability of upcycling techniques for household use and small-scale economic activities.
3. **Evaluation and Feedback**
   The final stage involved program evaluation using a structured questionnaire distributed to all participants. The evaluation assessed six key indicators: prior experience with similar training, clarity of the material delivered, ease of applying the acquired skills, perceived benefits of the program, overall participant satisfaction, and adequacy of supporting facilities. In addition, open-ended questions were included to collect feedback and suggestions for future improvement. The evaluation results were analyzed descriptively to identify changes in participants' knowledge, attitudes, and readiness to implement plastic waste upcycling practices independently.

RESULT DAN DISCUSSION

RESULT

The community service program was implemented on 9 August 2025 at Surau Baitul Quddus, Kampung Pueh Sematan, Kuching, Sarawak, Malaysia. Participants consisted of local residents, university students, and academic staff from both partner institutions. The activities were conducted through integrated educational sessions, practical training, and program evaluation.

1. **Improvement of Environmental Awareness**

   The awareness and socialization session significantly enhanced participants' understanding of plastic bottle waste issues. Prior to the activity, most participants had limited knowledge regarding the environmental and health impacts of unmanaged plastic waste. Following the educational session, participants demonstrated improved comprehension of plastic pollution pathways, environmental risks, and the importance of waste reduction practices.

   During group discussions, participants actively shared local waste-related challenges and expressed increased awareness of their role in reducing plastic waste. The high level of engagement observed during the session indicates that the educational component successfully stimulated environmental awareness and community participation (Figure 1).

Figure 1. Awareness and Socialization Session on Plastic Bottle Waste

2. **Development of Practical Upcycling Skills**

   The hands-on training session resulted in measurable improvement in participants' technical abilities to transform plastic bottle waste into functional products. Participants were able to independently perform key upcycling steps, including material sorting, cleaning, cutting, assembling, and decorative finishing.

   Through guided practice, participants successfully produced various handicraft items such as decorative lamps, storage containers, and reusable accessories (Figure 2 and Figure 3).

   Active participation and collaborative work patterns reflected strong learning motivation and effective skill transfer. This practical outcome demonstrates that plastic bottle waste can be transformed into economically valuable products using simple tools and locally available materials.

Figure 2. Hands-on Assistance and Training on Waste Transformation

Figure 3. Handicraft-making practice by participants

3. Participant Evaluation Results

Program evaluation was conducted using a structured questionnaire covering six assessment indicators. The results indicate highly positive participant responses across all aspects. All participants (100%) reported that they had never previously attended similar plastic waste upcycling training activities. Regarding the clarity and comprehensibility of the training material, 50% of participants strongly agreed and 50% agreed that the material was clearly delivered. Confidence in independently applying the acquired skills was also high, with 33% strongly agreeing and 64% agreeing.

Perceived benefits of the program reached 100%, with equal proportions of participants indicating strong agreement and agreement. Overall satisfaction with the program implementation showed 42% strongly agreeing and 58% agreeing. In terms of supporting facilities and infrastructure, 16% of participants strongly agreed and 84% agreed that the provided facilities were adequate (Figure 4a–4f).

Figure 4 (a)

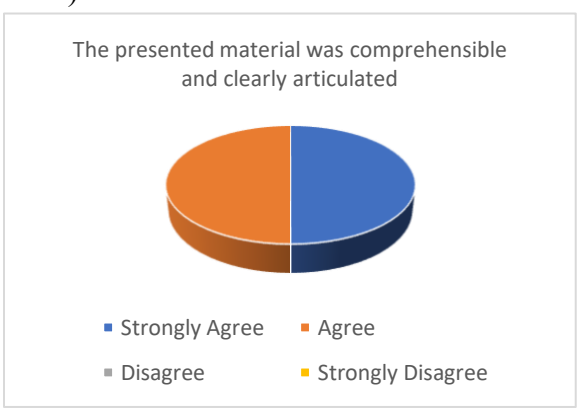

Figure 4 (b)

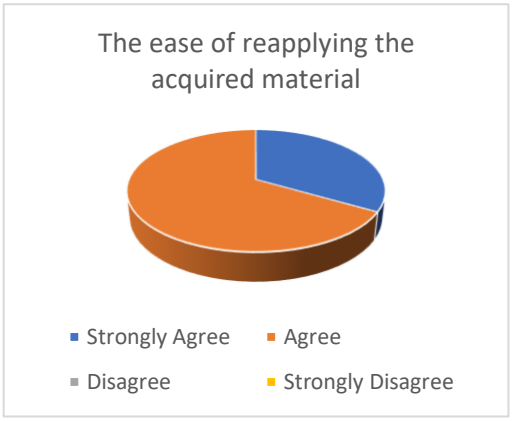

Figure 4 (c)

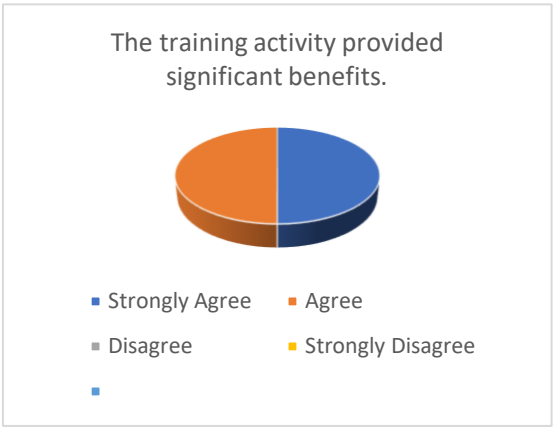

Figure 4 (d)

Figure 4 (e)

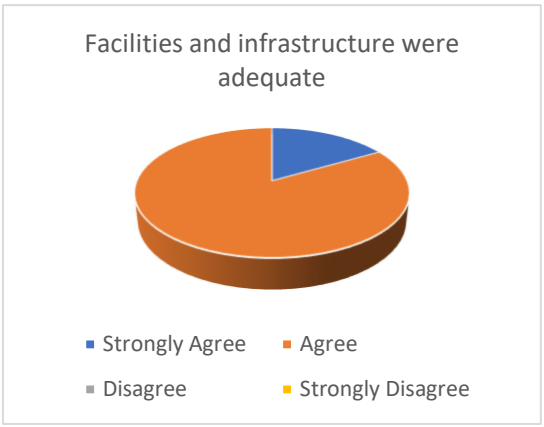

Figure 4 (f)

Collectively, these results indicate that the program effectively improved participants' environmental literacy, practical upcycling skills, and readiness to implement sustainable plastic waste management practices at the community level.

DISCUSSION

The findings of this community service program demonstrate that integrating environmental education with hands-on upcycling training is an effective strategy for strengthening community capacity in plastic waste management. The improvement in participants' understanding observed during the awareness session indicates that limited environmental literacy remains a key barrier in addressing plastic pollution at the community level. This result supports previous studies emphasizing that awareness-based interventions significantly influence community attitudes and behavioral intentions toward sustainable waste practices (Ng dkk., 2023; Ram & Bhagat, 2025).

The strong engagement shown during the socialization phase suggests that environmental issues related to plastic waste are closely connected to participants' daily experiences. When environmental education is delivered using locally relevant examples and interactive discussions, communities are more likely to internalize the urgency of waste reduction. This finding aligns with Xia et al. (2023); Zhang et al. (2021),who highlight that

community-based environmental initiatives are more effective when they are grounded in local contexts rather than relying solely on top-down policy approaches.

The hands-on training component played a central role in translating environmental awareness into practical action. Participants' ability to independently process and transform plastic bottles into functional handicraft products demonstrates that skill-based learning is essential in community empowerment programs. Similar outcomes were reported by Irdiana et al. (2020), who found that technical training significantly enhances community confidence and encourages sustainable recycling practices. The present program confirms that experiential learning not only improves technical competence but also strengthens participants' motivation to adopt environmentally responsible behavior.

Beyond environmental benefits, the production of handicraft items highlights the economic potential of plastic bottle upcycling. The ability to convert waste materials into value-added products offers opportunities for small-scale income generation and supports the development of community-based creative economies. This finding reinforces the argument that waste management initiatives can simultaneously address environmental challenges and socio-economic resilience, particularly in rural and coastal communities with limited employment diversification (Winih et al., 2024).

The evaluation results further indicate that participant satisfaction and perceived usefulness were consistently high across all assessment indicators. High satisfaction levels are often associated with effective facilitation, appropriate learning methods, and the relevance of program content to community needs. According to (Sachs et al., 2019), community empowerment programs are more likely to achieve sustainable outcomes when participants perceive tangible benefits and possess the confidence to apply acquired skills independently.

Moreover, the collaborative implementation involving universities, students, and local residents contributed positively to the program's success. Such multi-stakeholder collaboration supports knowledge exchange, strengthens social capital, and enhances the sustainability of community service initiatives. This collaborative model aligns with the principles of the Sustainable Development Goals (SDGs), particularly Responsible Consumption and Production, Sustainable Cities and Communities, and Climate Action.

Overall, the discussion indicates that community empowerment through plastic bottle waste upcycling is most effective when it combines environmental awareness, practical skill development, and participatory engagement. While this program demonstrated positive short-term outcomes, long-term sustainability will depend on continued mentoring, market access support, and integration with local waste management systems. Future programs may benefit from incorporating product design innovation, basic entrepreneurship training, and digital marketing assistance to further enhance the economic viability of recycled products.

CONCLUSION

The community service program conducted in Kampung Pueh Sematan, Kuching, Sarawak, successfully strengthened community awareness and practical competencies related to plastic bottle waste management. Through a structured approach combining environmental education, hands-on upcycling training, and participatory evaluation, participants gained a clearer understanding of the environmental impacts of plastic waste and the potential of recycling as a sustainable solution.

The results demonstrate that practical training activities played a crucial role in improving participants' confidence and ability to independently transform plastic bottle waste into functional and economically valuable handicraft products. High levels of participant satisfaction, positive perceptions of program benefits, and strong engagement throughout the activities indicate that the program was effectively implemented and well received by the community.

Overall, the collaboration between higher education institutions and local residents proved to be an effective model for community empowerment. The program not only contributed to improved environmental literacy but also supported the development of small-scale creative economic opportunities based on waste upcycling. These findings suggest that similar community-based initiatives have strong potential to promote sustainable waste management practices while simultaneously enhancing local economic resilience. Future programs may expand this approach by integrating product marketing training and long-term mentoring to ensure sustainability and broader community impact.

AUTHOR STATEMENT

The authors hereby declare that this manuscript has not been published and is not under consideration for publication in any other journal.

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