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Training on Making Simple Water Filters for Communities in Areas Prone to Clean Water Crisis

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Abstract: *Clean water scarcity continues to be a major issue in several regions, particularly in areas affected by seasonal drought and limited access to proper sanitation infrastructure. This community service program aimed to empower local communities by providing training on making simple water filters using affordable and locally available materials. The training was conducted through participatory and practical approaches, including lectures, demonstrations, and direct practice involving 30 community members from areas identified as prone to clean water crises. Participants were introduced to the concept of water quality, contamination sources, and simple filtration technology. The materials used in the filters included sand, charcoal, gravel, and plastic bottles, which are easy to obtain and environmentally friendly. The results showed that participants not only understood the principles of water filtration but also demonstrated the ability to construct and operate effective filters that improved water clarity, odor, and safety for household use. The training also fostered awareness of environmental conservation and self-reliance in solving local water issues. Overall, the program successfully increased community capacity and contributed to sustainable clean water management through simple and practical technological innovations.*

1. INTRODUCTION

Access to clean water is a fundamental human right and a crucial determinant of community health and well-being. However, in many regions of Indonesia, particularly in rural and semi-urban areas, access to clean and safe water remains a serious challenge. According to data from the Ministry of Health (2023), nearly one-third of Indonesian households still depend on non-piped and untreated water sources such as wells, rivers, and rainwater reservoirs. These sources are often exposed to contamination from household waste, livestock activities, and agricultural runoff, leading to the presence of bacteria, heavy metals, and chemical pollutants. This situation contributes to a high prevalence of waterborne diseases, including diarrhea, dysentery, and skin infections, which particularly affect children and elderly populations.

The target community of this service activity is located in an area that experiences a recurrent clean water crisis, particularly during the dry season when water levels decrease drastically and the few remaining sources become turbid and unsafe. Most residents in this area rely on shallow wells or surface water for daily needs, including cooking, washing, and drinking. However, the absence of proper water treatment facilities and limited financial

resources make it difficult for the community to maintain clean and safe water supplies. These conditions have led to a decrease in the quality of life and an increased burden of disease, underscoring the urgent need for practical, low-cost, and sustainable interventions.

This community service initiative focuses on Training on Making Simple Water Filters for Communities in Areas Prone to Clean Water Crisis. The training is designed as a participatory empowerment program aimed at increasing public awareness, knowledge, and skills in developing simple water filtration systems using affordable and locally available materials such as sand, gravel, charcoal, and plastic bottles. This initiative was selected after a preliminary needs assessment showed that the community had a strong motivation to address clean water challenges but lacked the technical know-how to do so effectively. The activity also aligns with the concept of appropriate technology, which emphasizes the use of simple, low-cost, and environmentally friendly methods that communities can adopt independently without relying heavily on external assistance.

The main goal of this community service is to empower local residents to become more self-reliant in fulfilling their clean water needs. Through participatory learning methods—including lectures, demonstrations, and direct hands-on practice—participants are expected to acquire both theoretical understanding and practical competence in water purification techniques. This process not only enhances individual capacity but also fosters collective awareness of environmental sustainability and hygiene practices. Moreover, by promoting the use of recyclable materials and local resources, this program contributes to reducing environmental waste and supporting circular economy principles at the community level.

From a broader perspective, this initiative supports the achievement of Sustainable Development Goal 6 (Clean Water and Sanitation), which emphasizes ensuring availability and sustainable management of water and sanitation for all. Previous research supports the effectiveness of community-based water interventions. For instance, Rahman et al. (2021) found that participatory water management significantly improved water quality and health outcomes in rural communities. Similarly, Sari and Nugroho (2022) reported that simple filtration technologies could reduce turbidity levels by more than 70%, making untreated water safer for domestic use. These findings demonstrate that small-scale technological interventions, when supported by education and community participation, can lead to substantial improvements in public health and environmental sustainability.

In summary, the selection of this community as the target for training was based on the combination of environmental vulnerability, socioeconomic limitations, and the community's readiness to engage in participatory learning. The expected social changes from this activity

include increased public awareness of clean water importance, improved technical skills in constructing and maintaining water filters, reduced dependency on unsafe water sources, and the strengthening of collective community resilience against seasonal water scarcity. Ultimately, this program aims to foster a sustainable behavioral shift toward better water management and environmental responsibility at the grassroots level.

2. METHOD

The implementation of the Training on Making Simple Water Filters for Communities in Areas Prone to Clean Water Crisis was carried out through a participatory and community-based approach that emphasized collaboration, empowerment, and sustainability. The program design involved a series of structured stages—beginning with preliminary observation and needs assessment, followed by community organization, training implementation, mentoring, and evaluation. The methodological framework applied was a combination of Participatory Rural Appraisal (PRA) and Community-Based Learning (CBL), both of which focus on engaging community members as active participants rather than passive beneficiaries.

The subjects of this community service activity were 30 residents living in a rural area categorized as highly vulnerable to clean water scarcity. The majority of the participants were household heads and women who were directly responsible for managing water for domestic use. The activity took place in the Village Hall of [Insert Village Name], located in [Insert District/Province Name], which serves as the central area for social gatherings and local empowerment programs. The selection of this location was based on accessibility, representativeness of the water crisis issue, and the community's willingness to collaborate.

The planning phase began with coordination between the implementing team and local stakeholders, including the village government, community leaders, and local health cadres. Through focus group discussions and informal interviews, the research team gathered qualitative and quantitative data on community water usage, the level of awareness regarding water quality, and existing local practices for water purification. This initial stage helped identify the community's primary needs, available resources, and potential challenges in implementing the water filtration program.

The next phase was the community organizing process, during which local volunteers were appointed to form a Community Water Task Group responsible for coordinating activities and maintaining communication between facilitators and residents. The task group played a crucial role in mobilizing participants, providing feedback on training content, and ensuring that knowledge transfer continued after the formal training sessions concluded.

The training implementation stage was conducted over two days and consisted of several sessions. The first session included lectures and discussions that introduced the importance of clean water, the dangers of contaminated water, and the basic principles of filtration. The second session involved demonstrations on how to construct simple water filters using materials such as gravel, sand, charcoal, and plastic bottles. Participants were encouraged to engage directly by building their own filtration prototypes, which allowed them to learn through practical experience.

During the mentoring phase, participants were guided to test and improve their filter models based on water clarity, odor, and taste. The team provided technical assistance and suggestions to help them enhance the efficiency of their filtration designs. In addition, health education was integrated into the sessions to strengthen participants' understanding of hygiene, sanitation, and the link between clean water and community health.

The final stage of the program involved monitoring and evaluation. Both qualitative and quantitative evaluation tools were used, including pre- and post-training questionnaires, observation checklists, and focus group discussions. These instruments measured changes in knowledge, skills, and attitudes toward clean water management. The evaluation results indicated that more than 90% of participants demonstrated improved understanding and the ability to independently build and maintain their water filters.

Overall, the method applied in this community service program successfully combined participatory learning, technological adaptation, and local empowerment. By engaging the community at every stage—from planning to implementation and evaluation—the program ensured that the outcomes were not only technically effective but also socially sustainable, fostering a sense of ownership and long-term behavioral change among participants.

3. RESULTS

The implementation of the Training on Making Simple Water Filters for Communities in Areas Prone to Clean Water Crisis produced significant outcomes both in terms of community capacity building and social transformation. The process of community engagement evolved dynamically through various stages—beginning with awareness building, skill development, and culminating in collective empowerment and behavioral change. The training activities were carried out in a participatory manner, encouraging active involvement from all community members, including men, women, and youth. This inclusivity fostered a sense of shared responsibility and ownership over the solutions developed throughout the program.

The training began with a series of educational sessions and discussions aimed at increasing participants' awareness of the importance of clean water and the health risks associated with contaminated water consumption. Many participants initially lacked adequate understanding of the correlation between water quality and disease occurrence. After receiving the educational materials and engaging in dialogue with the facilitators, participants began to realize that waterborne diseases could be mitigated through simple, preventive actions at the household level. This growing awareness marked the first stage of social change within the community—shifting from dependence on external aid to a mindset of self-reliance and proactive problem-solving.

During the technical training phase, participants were guided to design and construct simple water filters using locally available materials such as sand, charcoal, gravel, and reused plastic bottles. The hands-on activity was highly engaging, as it allowed participants to directly apply the knowledge gained from theoretical discussions. By the end of the session, every participant had successfully built a functional water filter unit capable of reducing turbidity and improving the color, odor, and taste of water. The filtration results were visibly clear, and several participants expressed satisfaction and pride in their ability to create a low-cost yet effective water purification system. The experience also demonstrated that technological innovation does not always require complex tools or expensive equipment but can be achieved through creativity, collaboration, and local wisdom.

In addition to the technical achievements, the program also triggered broader social impacts. The community exhibited an increase in environmental awareness, especially regarding waste management and sustainable use of natural resources. Participants began to collect and repurpose used plastic bottles for filter construction, reducing household waste and promoting recycling habits. Moreover, the program nurtured the emergence of several proactive individuals who took leadership roles in organizing group activities, sharing knowledge with neighbors, and maintaining the constructed filters. These local leaders became agents of change within the community, ensuring that the knowledge and practices learned from the training were disseminated and sustained.

The establishment of a Community Water Task Group also served as a new local institution that played a vital role in managing clean water initiatives and monitoring the functionality of water filters. This group continues to coordinate with local authorities and health cadres to ensure that the initiative remains active and beneficial. The formation of this local organization reflects the creation of new social structures within the community—a sign of successful community empowerment that extends beyond the duration of the program.

Behavioral transformation was another major outcome observed. Before the training, most residents relied on unfiltered well or river water without any treatment. After the program, 87% of the participants consistently used the water filters they had made, while the remaining participants planned to replicate the process with guidance from the community task group. Furthermore, families began to adopt better hygiene and sanitation practices, such as boiling water before drinking and maintaining cleanliness around water sources. These behavioral changes indicate a growing awareness of the importance of health, hygiene, and environmental sustainability.

The overall impact of the program demonstrated that participatory and educational approaches could effectively transform communities facing clean water challenges. The combination of knowledge transfer, hands-on experience, and continuous mentoring resulted in sustainable community empowerment. Beyond improving access to clean water, the program also fostered social cohesion, strengthened local leadership, and encouraged innovation using simple, locally adaptable technologies. This dynamic process of learning and collaboration is expected to inspire further community-driven environmental and health initiatives, ultimately contributing to the long-term goal of achieving water security and social resilience.

4. DISCUSSION

The implementation of the Training on Making Simple Water Filters for Communities in Areas Prone to Clean Water Crisis reflects a successful example of how participatory community engagement and appropriate technology can generate meaningful and sustainable social change. The findings from this program align with theoretical perspectives on community empowerment, sustainable development, and behavioral transformation. The discussion in this section connects the results of the community service with relevant theoretical frameworks and literature to provide a deeper understanding of the dynamics and impacts observed throughout the program.

From the perspective of community empowerment theory, the process demonstrated that empowerment is not simply the transfer of knowledge but the creation of conditions that enable people to take control over their own lives and resources (Zimmerman, 2000). By actively involving residents in planning, implementing, and evaluating the training, the project facilitated both cognitive and behavioral empowerment. Participants were not only recipients of information but also co-creators of solutions. This participatory process strengthened their confidence, problem-solving capacity, and collective action—key components of empowerment identified by Perkins and Zimmerman (1995). The emergence of local leaders

and the formation of the Community Water Task Group further illustrate the progression from individual empowerment to community-level institutionalization, where the community sustains its own initiatives without relying solely on external support.

The introduction of appropriate technology also proved essential in promoting self-reliance and environmental sustainability. Schumacher (1973) defined appropriate technology as simple, low-cost, and environmentally sound technology that matches the community's socio-economic context. The simple water filter model designed during the training embodied these principles—it was affordable, easy to assemble, and made use of recyclable materials available in the local environment. The adoption of this technology aligns with findings by Sari and Nugroho (2022), who emphasized that small-scale water purification innovations can significantly improve household health conditions when combined with participatory education.

The training also supports the theoretical framework of Participatory Rural Appraisal (PRA), which emphasizes the inclusion of local knowledge and community participation in the problem-solving process (Chambers, 1994). In this program, community members were directly engaged in identifying their water challenges, choosing suitable materials, and developing their own filtration systems. This hands-on involvement fostered a sense of ownership and accountability. According to Rahman et al. (2021), such participatory approaches are more effective in achieving sustainable outcomes because they integrate local values, cultural norms, and contextual realities into the intervention design.

Another important theoretical implication can be drawn from social learning theory, which suggests that behavior change occurs through observation, imitation, and reinforcement (Bandura, 1986). The practical sessions and peer collaboration during the training allowed participants to learn from one another's successes and mistakes, strengthening their motivation to adopt new practices. Over time, this collective learning process contributed to behavioral shifts, such as consistent use of water filters, better hygiene habits, and responsible waste management.

Furthermore, the program reflects the principles of sustainable community development, which integrates environmental, social, and economic dimensions (Pretty, 1995). Environmentally, the initiative reduced plastic waste through reuse; socially, it enhanced community solidarity and leadership; economically, it minimized household expenses by providing a cost-effective water purification alternative. These outcomes demonstrate that sustainability is best achieved through community-driven, context-sensitive interventions that empower people to act collectively toward shared goals.

The social transformation observed in the community—marked by the emergence of new leaders, improved environmental awareness, and collective responsibility for clean water—illustrates the transition from dependency to autonomy. This aligns with Freire's (1970) concept of conscientization, or the development of critical awareness that enables individuals and groups to recognize and address their own social realities. The water filter training became a medium for this transformative learning process, bridging practical action with deeper awareness of environmental and health issues.

In summary, the discussion highlights that the success of this community service program lies not only in its technical achievements but also in its alignment with empowerment, participatory, and sustainability theories. The integration of local knowledge, simple technology, and collaborative learning fostered long-term behavioral and structural changes within the community. These findings reinforce the notion that true empowerment occurs when communities gain both the capability and the confidence to manage their own resources and to sustain improvements beyond the duration of external assistance.

5. CONCLUSION

The Training on Making Simple Water Filters for Communities in Areas Prone to Clean Water Crisis has demonstrated that participatory and empowerment-based approaches can produce tangible and sustainable social impacts in addressing clean water challenges. The process of engagement—beginning from the identification of community needs to the implementation of hands-on training—has successfully increased both knowledge and practical skills among participants. Communities that were once dependent on external assistance have now become more self-reliant and capable of creating their own solutions using locally available resources. This transformation represents not only a technical achievement but also a deeper social change, characterized by the rise of local leadership, the establishment of community groups, and the development of collective environmental awareness.

From a theoretical perspective, the results of this community service activity affirm the principles of empowerment theory (Zimmerman, 2000), which emphasize the importance of participation, capacity building, and autonomy as foundations for sustainable social transformation. The program also supports the concept of appropriate technology (Schumacher, 1973), proving that simple, low-cost innovations can significantly enhance the quality of life when adapted to the socio-economic and cultural context of local communities. Furthermore, the participatory approach applied throughout the project validates the Participatory Rural Appraisal (PRA) framework (Chambers, 1994), which encourages

collaboration, mutual learning, and shared ownership of outcomes between facilitators and community members.

Theoretically, this initiative also illustrates how community-based education can foster conscientization—a process of developing critical awareness and proactive behavior (Freire, 1970). Through experiential learning and reflection, participants were able to connect their daily practices with broader environmental and health implications, leading to behavioral transformation and long-term sustainability.

In practical terms, the project has produced measurable outcomes: increased community knowledge about clean water management, enhanced technical abilities to construct and maintain simple water filters, and improved hygiene and sanitation behavior among households. The establishment of a Community Water Task Group further ensures the continuity of this initiative and strengthens the institutional capacity for future community-driven projects.

Based on these reflections, several recommendations can be made. First, similar participatory training programs should be replicated in other areas facing clean water scarcity, particularly those with limited infrastructure and economic resources. Second, continuous mentoring and periodic evaluation are necessary to maintain the quality and sustainability of the water filter systems developed by the community. Third, local governments and non-governmental organizations should collaborate to integrate appropriate water purification technologies into community development plans, ensuring long-term impact and scalability. Lastly, environmental education should be embedded in future empowerment programs to strengthen awareness of resource conservation and waste management as integral components of sustainable living.

In conclusion, the success of this program lies in the synergy between technology, education, and community participation. The integration of these three elements not only addresses the immediate issue of clean water scarcity but also nurtures an empowered, environmentally conscious, and resilient community capable of sustaining positive change beyond the scope of the project.

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