

ENHANCING SCIENTIFIC LITERACY THROUGH MAGGOT CULTIVATION AS A SOLUTION FOR WASTE MANAGEMENT IN THE DHARMA ALAM JEMBER COMMUNITY

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Abstrak: Program pengabdian masyarakat ini bertujuan untuk meningkatkan literasi sains masyarakat di Kawasan Perumahan Dharma Alam Jember melalui budidaya maggot sebagai solusi pengelolaan sampah. Dalam program ini, masyarakat memperoleh pelatihan tentang cara membudidayakan maggot yang efektif dalam menguraikan sampah organik. Metode yang digunakan dalam program ini adalah Participatory Action Research (PAR) dengan tahapan kegiatan meliputi penyampaian tentang pengelolaan sampah, teori dan konsep dasar budidaya maggot, teknik budidaya, dan penggunaan produk lanjutan maggot. Partisipan program pengabdian ini adalah 50 kepala keluarga di wilayah perumahan Dharma Alam di kota Jember. Pengumpulan data untuk evaluasi program diperoleh dari penyebaran angket dan dokumentasi produk. Hasil program pengabdian ini menunjukkan adanya peningkatan pemahaman literasi sains masyarakat tentang budidaya maggot. Program pengabdian ini berhasil mengedukasi masyarakat tentang pentingnya pengelolaan sampah rumah tangga yang ramah lingkungan dan dapat menghasilkan produk berkelanjutan. Peningkatan literasi sains dapat menumbuhkan kesadaran masyarakat dalam mengintegrasikan teknologi sederhana dalam pengelolaan sampah. Berdasarkan hasil sebaran angket terkait literasi sains pengelolaan sampah, terjadi peningkatan literasi sains masyarakat sebesar 63%. Selain itu, peningkatan literasi sains masyarakat tentang pengelolaan sampah juga menghasilkan produk sampingan berupa pakan ternak dan pupuk organik. Program ini telah memberikan kontribusi dalam meningkatkan literasi sains masyarakat dalam pengelolaan sampah dan dapat meningkatkan kesejahteraan masyarakat.

Kata Kunci: budidaya maggot, literasi sains, sampah organik

Abstract: This community service program aims to enhance the scientific literacy of the Dharma Alam Member community through maggot cultivation as a waste management solution. Dalam program ini, masyarakat dilatih untuk membudidayakan belatung yang efektif dalam mengurai sampah organik. The method used was Participatory Action Research (PAR), which included the stages of activities, including delivery of waste management, theory and basic concepts of maggot culture, cultivation techniques, and the use of maggot-advanced products. The participants were 50 households in Dharma Alam residence in Jember city. Data collection for evaluation was obtained by distributing questionnaires and product documentation. The results show an increased understanding of community science literacy about maggot cultivation. This community service program has successfully educated the community on the importance of household waste management through eco-friendly technology to produce sustainable products. Enhancing science literacy can foster community awareness by integrating simple waste management technology. Based on the questionnaire results, there was an increase in community science literacy by 63%. In addition, improving the community's scientific literacy on waste management also resulted in additional products such as animal feed and organic fertilizer. The program has contributed to improving the community's science literacy in waste management and has improved the community's welfare.

Kata Kunci: maggot cultivation, scientific literacy, organic waste

Introduction

Waste is a primary source of disease and produces unpleasant odours that jeopardize health and the environment (Abdul & Sidiq, 2020). When the waste is not appropriately managed, it can become a breeding ground for bacteria, viruses, and other pathogens, leading to various illnesses such as respiratory infections, diarrhoea, and skin diseases, as well as harming the environment (Zahra, Winarno, & Tika, 2020). In addition, the decomposition of waste generates toxic gases that contaminate the air and create unpleasant odours. Effective waste management through recycling, disposal, or prudent practices is essential to mitigate adverse effects on public health and the environment (Sari & Anggoro, 2020).

Based on field observations, it was found that, technically, waste disposal still involves a mixture of organic and inorganic waste. Mixed waste is a significant source of unpleasant odours. Interviews revealed that the Dharma Alam housing community believes household waste management is limited to disposing of rubbish in the provided bins. Waste management practices are still not fully developed. Additionally, the community's understanding of household waste management remains basic, lacking integration with simple technology.

Waste management techniques are crucial in preserving environmental cleanliness and safeguarding public health (Nurani, 2023). Waste management techniques are vital for maintaining environmental cleanliness and public health. A structured approach that includes waste sorting, recycling, and efficient waste management can significantly reduce the negative impact of waste on the environment (Nainggolan, Lodan, & Salsabila, 2023). The application of modern technology in waste management, including composting and converting organic waste into energy, aids in minimizing the volume of waste sent to landfills. Public education about the significance of waste management is crucial for fostering active participation and raising awareness of environmental cleanliness (Irsyadi et al., 2023). By implementing appropriate waste management techniques, society can create a cleaner, healthier, and more sustainable environment (Putranto, 2023).

Effective waste management necessitates a comprehensive array of solutions (Noviana & Sukwika, 2020). Recycling is a crucial step in decreasing the amount of waste that goes into landfills (Moridu et al., 2023). In addition, utilizing simple, eco-friendly technology like composting to convert organic waste into organic fertilizer (Komarudin, Rosmajudi, & Hilman, 2023). Waste management through education and raising public awareness about the significance of recycling and minimizing single-use plastic waste (Widyastuti & Sardin, 2021). Collaboration among the government, private sector, and society in implementing policies that promote sustainable waste management is essential for maintaining a cleaner and healthier environment (Sari et al., 2023).

Maggot cultivation presents an innovative alternative for waste management. Black Soldier Fly (BSF) larvae can decompose organic waste, such as food scraps, into high-quality fertilizer (Syahrudin & Putri, 2022). In addition to decreasing waste, maggots can serve as a protein-rich animal feed, minimizing the reliance on conventional feed (Gita et al., 2023). An eco-friendly system can reduce pollution and generate products with economic value

(Sukmareni et al., 2023). Through maggot cultivation, people can transform waste into valuable resources, enabling society to promote sustainable waste management and support food sustainability (Gazali & Ilhamiyah, 2023).

Maggot cultivation holds significant potential for waste management; however, public understanding and scientific literacy regarding this topic remain low (Ashari & Islam, 2023). Many individuals have not received comprehensive education regarding the advantages of maggots in organic waste management. The scarcity of information on the maggot cultivation process and its value as a source of nutrition or fertilizer contributes to the ongoing lack of awareness about this potential (Sukmareni et al., 2023). The public's perception of Dharma Alam Housing regarding maggot cultivation remains negative. Many believe that flies are responsible for spreading diseases and creating unpleasant odours. This misconception contributes to the low scientific literacy within the Dharma Alam housing community, particularly concerning maggot cultivation.

Furthermore, this lack of scientific understanding hinders people's grasp of how maggots can effectively recycle waste. There is a pressing need for broader outreach, education, and campaign initiatives to enhance public awareness of the potential benefits of maggots as an innovative solution for waste management (Syahrudin & Putri, 2022). Integrating clear communication with scientific literacy can enhance understanding and acceptance of the advantages of maggots in the environment and agriculture.

Education on maggot cultivation as a waste management technique is crucial for raising awareness about its urgency and benefits (Widyastuti & Sardin, 2021). With a comprehensive approach, this service educates on waste management through maggot cultivation. Field observations indicate that most of the waste in the Dharma Alam residential area is organic. Maggot cultivation is the most effective waste management strategy and offers numerous benefits. These efforts foster awareness of innovative and environmentally friendly solutions for a more sustainable future. This service aims to enhance the community's scientific literacy in waste management through maggot cultivation in the Dharma Alam Member housing area. Additionally, this service presents several options for developing effective and beneficial alternative waste management practices.

Method

This Community Service employed a Participatory Action Research (PAR) approach, an effective method for fostering community engagement in the research and action process. PAR emphasizes collaboration among researchers, practitioners, and communities to identify, plan, and implement pertinent and advantageous steps for the community (Afandi et al., 2022). PAR acknowledges local knowledge and community experience as vital components in addressing issues. This process entails active involvement from the community at every stage, from identifying problems and planning solutions to implementing programs. This fosters a deeper understanding of local conditions, needs, and the potential for more suitable and sustainable solutions.

Through PKM with a PAR approach, there is a reciprocal exchange of knowledge between researchers and the community, enabling the implementation of more targeted and relevant solutions. This process also strengthens communities' capacity to solve problems, increases self-reliance, and promotes sustainable development. With strong collaboration, the PAR approach in PKM becomes an adequate basis for improving community welfare and bringing about sustainable positive change (Afandi et al., 2022). This program used the Participatory Action Research (PAR) approach, which has several steps, as shown in Figure 1 below.



Figure 1. The steps of *Participatory Action Research* (PAR) approach

The program was carried out for six months in the Dharma Alam Housing area. The subjects of this research were housewives in the Dharma Alam Housing area. The sample used in this service was from the Dharma Alam housing community on RT 08 with 50 heads of families. The research team consists of lecturers and students from FKIP University of Jember. The activity will take place in 2022.

The goal of this community service program is to increase the scientific literacy of the community in managing the nature dharma community through maggot cultivation. This increase in scientific literacy is marked by several indicators as follows:

1. Understand waste management by separating household waste from organic and inorganic elements.
2. Community understanding of the dharma of nature with the integration of simple technology through maggot cultivation.
3. Well-managed maggots can produce useful advanced products.

Results and Discussion

The results obtained from this activity are some data related to community scientific literacy regarding waste management through maggot cultivation. This process begins with field observations based on the results of interviews regarding the community's understanding of waste management. These results indicate that there is a negative understanding of a solution in waste management through maggot cultivation. The stages of this service are outlined in detail.

Step to Know (Knowing the Real Condition)

A literature analysis was conducted on waste management data from various activities. One approach to managing waste is the 3R principle (Putranto, 2023). In waste management, focusing on building resilience from the outset is essential. Self-care is crucial in this process. When you are strong and connected with yourself, you can spread enthusiasm and make a broad impact. At this stage, a literature review is conducted to gather information on waste management activities. There are various techniques for waste management, with one of the fundamental principles being the 3R principle (Irsyadi et al., 2023).

The community and participants in this study are residents of the Dharma Alam Housing Society. The diverse professions and education levels influence each resident's mindset and perspectives. Most residents at Dharma Alam Housing are from various professional backgrounds, and the data can be found in Figure 2 below.

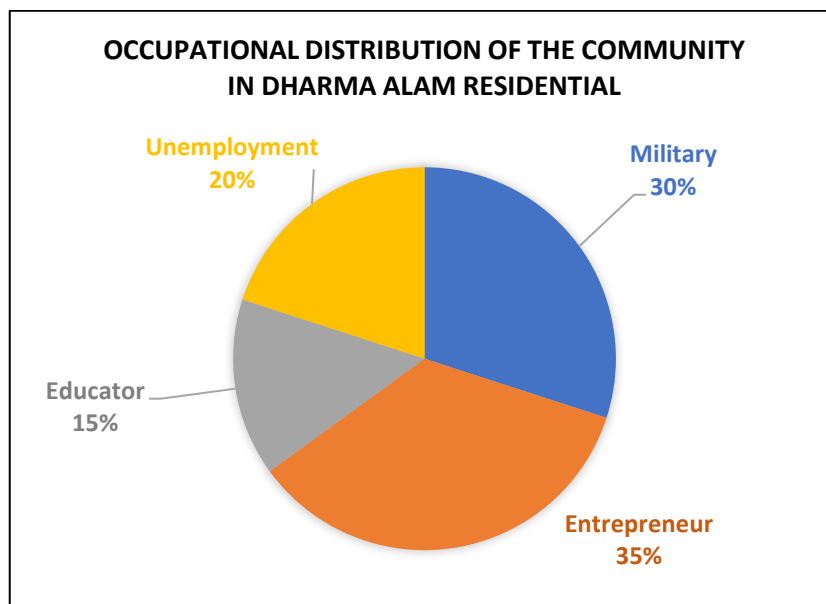


Figure 2. Percentage of Residents in Dharma Alam (Sources: BPS Wilayah Kelurahan Sempusari Kabupaten Jember)

The type of profession people have is closely linked to their level of education (Nurriqli & Karsudjono, 2020). Additionally, the level of education also affects how local waste is managed (Putra, Taufiq, & Juliani, 2013). This suggests that waste management in households is currently focused only on cleanliness. Overall, it indicates that the natural dharma housing community still lacks scientific literacy regarding waste management.

Step to Understand (Understanding Community Problems)

Waste management is a serious issue in many societal problems that significantly affects the environment and public health. One of the main challenges is the lack of proper waste management infrastructure. Many areas lack efficient waste collection, sorting, and recycling systems. This leads to the buildup of garbage in public places, rivers, or open land, resulting in environmental pollution and health problems.

At Dharma Alam Housing, waste management is centralized at the waste disposal site in the housing area. The accumulated waste generated every day ranges from 3-4 tons. This waste is collected 3-4 times a week. It is common for wet organic waste to emit an unpleasant odour while waiting for waste collection by the Environmental Service. Figure 3 shows the conditions in the waste disposal area at Dharma Alam Housing Complex resemble.



Figure 3. Location of Dharma Alam Housing Waste Disposal Site

Many people still lack proper education on how to sort waste, which makes the recycling process less effective. This is because waste is often mixed, making it difficult to recycle or leading to it being sent to landfills. Furthermore, there is a lack of public policy on waste segregation. To address this issue, we need to take concrete steps, including educating the public on the importance of waste segregation and building adequate infrastructure such as well-managed landfills, efficient collection systems, and recycling plants.

Based on the results of the interview with RT 08 Housing Dharma Alam, he explained that:

There has been no education regarding waste. Garbage is still mixed in one disposal bucket. The waste collector directly mixes the waste collector into the cart. From here, there must be a particular emphasis and understanding regarding the source of the odour from the waste. Apart from that, it is an alternative to the public's understanding that waste smells.

The interviews revealed that there is a limited understanding of waste sorting and management. This highlights the need for education on waste management in this case. Additionally, there is a need to implement policies that promote sustainable and environmentally friendly waste management practices. Collaborative efforts involving the government, non-profit organizations, and civil society can address this issue comprehensively.

Step to Plan (Planning Community Problem Solving)

The planning process for increasing community scientific literacy through maggot cultivation in waste management involves several strategic steps.

1. We surveyed to understand the literacy and waste management issues in the Dharma Alam housing community in RT 08.
2. Our goal for this program is to increase community scientific literacy in waste management through creative ideas that have a positive impact.
3. We prepared educational materials on waste management and maggot cultivation to provide a comprehensive understanding to the public.
4. We implemented socialization activities to educate the housing community about waste management through maggot cultivation. We also showcased the output products from maggot cultivation and discussed the business potential.
5. We coordinated with the resident administrators of RT 08 to ensure that the community is knowledgeable about the economic potential of maggot cultivation for the Dharma Alam housing community.

Step to Act (Do Action)

The strategy to tackle the waste issue involves multiple stages, such as:

1. During the waste sorting socialization event, experts spoke about the 3R technique (Reuse, Reduce, Recycle) and the benefits of maggot cultivation (Figure 4). Residents learned about waste sorting and processing (Figure 5) and were given questionnaires to assess their scientific literacy on waste management and maggot cultivation. After counselling and discussion, they were given the same questionnaires again to measure the increase in their scientific literacy regarding maggot cultivation.



Figure 4. Sosialitation of 3R Technique (*Reuse, Reduce dan Recycle*)



Figure 5. Sorting organic and inorganic waste

The instrument provided to the public consisted of ten items with indicator questions regarding maggot cultivation as a waste management solution. This was designed to assess the community's level of scientific literacy in waste management.

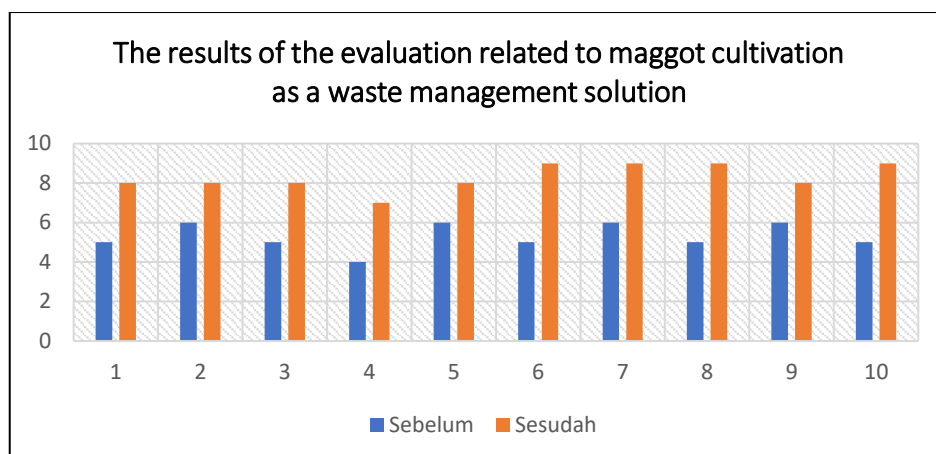


Figure 6. Data on increasing community scientific literacy regarding maggot cultivation as a waste management solution.

Based on the provided instruments and analysis as shown in [Figure 6](#), public scientific literacy increased by 63%, indicating a significant improvement in scientific literacy related to maggot cultivation as a waste management solution.

2. Discussion with maggot cultivation experts was held to explore the potential of using maggot cultivation to manage household waste ([Figure 7](#)). The aim was to gather information to inform the Dharma Alam housing community about the benefits of maggot cultivation. The community often views maggot cultivation negatively due to a lack of understanding of its benefits. Interviews with various sources revealed the following results.

Maggot is often referred to as uget-uget, even though this is different. The larvae produced by BSF flies differ in size and type. This fly does not just land and chooses several places as its host. When the male BSF fly mates, this fly will die. This occurs in the life cycle of male BSF flies. After laying eggs, these flies will hatch in approximately

seven days, after which the larvae grow and need food for approximately 20 days. The food for these larvae comes from rubbish that has been pulverized and fermented. The organic waste eaten by maggots does not produce a bad smell. The feed comparison is 1 kg of maggot larvae; the amount of feed is 300 grams. (Herdik, 28 June 2022)



Figure 7. Management Through Maggot Cultivation

3. Development of maggot cultivation as a potential economic improvement based on a clean and healthy life. The maggot cultivation developer stated the following:

Maggot has great potential. The larvae of BSF flies can be used as an alternative animal feed, as they contain lots of protein (Figure 8). Some animals that can be fed maggots include koi fish and catfish. The role of maggots in koi fish can provide contrasting colour contours in the koi's body. Meanwhile, for catfish, maggots function to speed up and fatten the catfish's body. Several things that can be done to reduce the cost of pellets can be replaced with maggots. Apart from being cheap, the price of maggots can speed up the harvest time for catfish. (Herdik, 3 July 2022)

The potential for maggot cultivation is not only the production of maggots. Another product is KasGot (Food waste released by maggots). This cassava can be used as compost to fertilize plants. One example is the cultivation of Brazilian spinach (Figure 9). This Brazilian spinach grows fresh and grows big.



Figure 8. Cultivating dipper catfish with maggot feed



Figure 9. Cultivation of Brazilian Spinach

Step to Change (Building Awareness for Change and Sustainability)

In the previous stages of our project, we achieved several results:

1. Increased understanding and management of waste: To maintain progress in understanding waste management and maggot cultivation, it is essential to continue consistent activities. It is recommended that a socialization program be conducted at least once a semester.
2. Change in perception of maggots: Initially, maggots were viewed as unpleasant. However, through socialization and counseling, there has been a shift in perspective, with maggots now recognized as having significant economic potential.
3. Potential for economic development through maggot cultivation: Discussions with maggot cultivation developers revealed that maggots can serve as a viable alternative to pellets and be used as compost fertilizer to support organic farming.
4. Creation of a waste management institution: It is essential to establish an institution like a community waste bank to facilitate efficient waste management. Furthermore, there is potential to develop waste bank assistance as a community service program.

Conclusion

Based on the evaluation results, the community service program has increased the scientific literacy regarding waste management by 63%. This is supported by the public's understanding of the integration of simple technology that can bring widespread benefits. Maggot cultivation is identified as one of the waste management solutions that can yield high-value products. In addition, maggot cultivation also generates additional products that can improve the welfare of the Dharma Alam community.

Acknowledgement

The authors would like to thank the Lembaga Penelitian dan Pengabdian Masyarakat at the University of Jember for supporting and facilitating the implementation of this service program.

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