

Socialization of Waste Management Based on the Principles of Reduce, Reuse And Recycle (3r) to Increase Community Knowledge and Skills Regarding Household Waste Management

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ABSTRACT

This activity was carried out through the Community Service program by lecturers from Solo Christian Technology University (UKTS) in Ingasrejo Hamlet, Plesungan Village, Gondangrejo District, Karanganyar, Indonesia. The methods used include a pre-test, providing socialization material, and a post-test to evaluate the increase in participants' knowledge. Participation in this activity involved 20 people consisting of Rukun Warga (RW) administrators, Rukun Tetangga (RT) administrators, women from the Family Welfare Development Management (PKK), and local Youth Organization (Karangtaruna) administrators. The pre-test results showed that only 28.75% of participants had good knowledge of the 3R principles, while 42.5% were in the poor category. After socialization, the post-test results showed a significant increase where 73.75% of participants were in the good category and no participants were in the poor category.

INTRODUCTION

Waste management is a global issue that requires serious attention from various parties, including local communities (Kalra, 2019). Based on data from the World Bank, the volume of waste produced worldwide reaches 2.01 billion tonnes per year and is expected to increase to 3.40 billion tonnes in 2050 (Kaza et al., 2018). In Indonesia, waste management is a big challenge, with around 64 million tons of waste generated every year and only around 7% being recycled (Utaminingsih & Cangara, 2020).

Lack of public knowledge and skills in waste management and environmental sanitation often causes significant environmental pollution (Pambudi & Lolo, 2021). This problem is exacerbated by inappropriate waste disposal practices, such as throwing rubbish into rivers or burning rubbish openly, which can cause water and air pollution (Mukherji et al., 2016). In addition, the accumulation of waste in final disposal sites (TPA) often causes health and environmental problems, including soil and groundwater pollution, as well as methane gas emissions which contribute to climate change (Ye et al., 2019). Therefore, outreach regarding community-based waste management is very important to increase community awareness and skills in managing waste independently and productively. The 3R principle (Reduce, Reuse, Recycle) is an effective approach to reduce the volume of waste produced and increase the reuse and recycling of waste materials (Tangwanichagapong et al., 2017). This principle not only helps in reducing the amount of waste that ends up in landfills but also reduces the use of natural resources and the energy required to produce new goods (Sanguino et al., 2020).

In this context, Community Service activities carried out by lecturers from Solo Christian Technology University (UKTS) aim to provide education to the people of Ingasrejo Hamlet, Plesungan Village, Karanganyar Regency, Indonesia in the form of outreach. This activity is designed to increase community knowledge and understanding regarding waste management using the 3R principles, as well as encourage active community participation in waste management in their environment. It is hoped that this outreach activity can be the first step in building community awareness and skills in better waste management, as well as creating a cleaner and healthier environment. By increasing community knowledge, it is hoped that they can implement more effective waste management practices in their homes and contribute to maintaining a clean environment. Almasi et al. (2019). Through this activity, it is hoped that better cooperation can be formed between the community and local government in managing waste so that the waste problem can be handled more effectively and sustainably.

IMPLEMENTATION AND METHODS

This waste management socialization activity was carried out in Ingasrejo Hamlet, Plesungan Village, Karanganyar Regency, with the participation of 20 representatives of RW, RT administrators, PKK women, and local youth groups. The activity began by giving a pre-test to participants to measure their initial knowledge about waste management. Lecturers from UKTS act as resource persons who deliver material about waste management using the 3R principle (Reduce, Reuse, Recycle). After the material was presented, a post-test was carried out to evaluate the increase in participants' knowledge. Pre-test and post-test data were analyzed to measure the effectiveness of socialization activities. Analysis was carried out using average calculations and increasing percentages of participants' knowledge.

RESULTS AND DISCUSSION

The Assessment Categories for Socialization Participants are as Follows:

Tabel.1 Assessment Categories

No	Assessment Category	Score
1	Good	70% - 100%
2	Enough	40% - 69%
3	Not enough	0% - 39%

Explanation of the Assessment Categories as follows:

Very Enough (70% - 100%)

- Participants who fall into this category demonstrate a strong understanding of the principles and practices of 3R-based waste management.
- Participants can answer most or all questions correctly.
- They have sufficient knowledge to apply waste management concepts effectively in everyday life.

Enough (40% - 69%)

- Participants who fall into this category have a moderate understanding of the principles and practices of 3R-based waste management.
- Participants were able to answer several questions correctly, but there were still several concepts that they had not fully mastered.
- They need more information or training to be able to implement waste management concepts effectively.

Not Enough (0% - 39%)

- Participants who fall into this category show a low understanding of the principles and practices of 3R-based waste management.
- Participants were only able to answer few or no questions correctly.
- They require significant knowledge enhancement and additional training to understand and apply waste management concepts.

Process of Obtaining Value Data

Implementation of the Pre-test

- a. Before the socialization activities began, a pre-test was given to all participants. This pre-test aims to measure the participants' initial level of knowledge about 3R-based waste management.
- b. The pre-test questions consist of 5 (five) questions covering various aspects of waste management, such as the definition of 3R, organic waste management methods, and the importance of recycling.
- c. Participants answered pre-test questions without assistance or reference material.

Delivery of Socialization Materials

Post-test Implementation

- a. After the socialization material was delivered, a post-test was given to the participants. The post-test aims to measure the increase in their knowledge and understanding after participating in the socialization.
- b. The post-test questions or items are made similar to the pre-test to allow a valid comparison between the level of knowledge before and after socialization.

Data Collectio

- a. Answers from the pre-test and post-test are collected and checked. Each correct answer is given an appropriate score.
- b. The total score obtained by each participant is then converted to a percentage. For example, if a participant answers 4 out of 5 questions correctly, the score is 80%.
- c. This percentage is used to classify the results into assessment categories (Good, Fair, Poor).

Value Data Analysis

- a. The pre-test and post-test results were analyzed to see the number of participants who fell into the good, sufficient, and poor categories before and after the socialization activities were carried out.
- b. Comparison between pre-test and post-test results is used to evaluate the effectiveness of socialization in increasing participants' knowledge.

Data Calculation

Pre-test:

- a. Number of participants: 20 people
- b. There are 6 people in the Rukun Warga (RW) management with details: 2 people (30%) answered in the good category, 2 people (30%) enough, and 2 people (40%) poor
- c. There are 4 people in the Rukun Tetangga (RT) management with details: 1 person (25%) is good, 1 person (25%) is sufficient, 2 people (50%) is poor
- d. There are 5 Family Welfare Development Management (PKK) women with details: 1 person (20%) is good, 1 person (20%) is sufficient, 3 people (60%) is poor

- e. There are 5 Youth Organization Management (karangtaruna) with details: 2 people (40%) good, 2 people (40%) sufficient, 1 person (20%) poor
Data from participants' pre-test calculations are presented in table 1 below:

Table 2. Calculation of Participant Pre-Test Data

No	Category	Number of participants	Good	% Good	Enough	% Enough	Not enough	% Not enough
1	RW Manager	6	2	30	2	30	2	40
2	RT Manager	4	1	25	1	25	2	50
3	PKK Mothers	5	1	20	1	20	3	60
4	Youth organization	5	2	40	2	40	1	20
	Number of participants	20	6		6		8	
	Average Percentage			28,75		28,75		42,5

Post-Test:

1. Number of participants: 20 people
2. There are 6 people in the Rukun Warga (RW) management with details: 4 people (75%) answered in the good category, 1 person (25%) is sufficient, 1 person (0%) is poor
3. There are 4 people in the Neighborhood Association (RT) with details: 3 people (75%) are good, 1 person (25%) is sufficient, 0 people (0%) are poor
4. There are 5 Family Welfare Development (PKK) women with details: 3 people (65%) are good, 2 people (35%) are sufficient, 0 people (0%) are poor
5. There are 5 Youth Organization Management (karangtaruna) with details: 4 people (80%) good, 1 person (20%) sufficient, 0 people (0%) poor
Data from participants' post-test calculations are presented in table 2 below:

Table 3. Calculation of Participant Post-Test Data

No	Category	Number of participants	Good	% Good	Enough	% Enough	Not Enough	% Not Enough
1	RW Manager	6	4	75	1	25	1	0
2	RT Manager	4	3	75	1	25	0	0
3	PKK Mothers	5	3	65	2	35	0	0
4	Youth organization	5	4	80	1	20	0	0
	Number of participants	20	14		5		1	
	Average Percentage			73,75		26,25		0

Comparison of Average Participants' Ratings Before and After Socialization/Intervention Activities

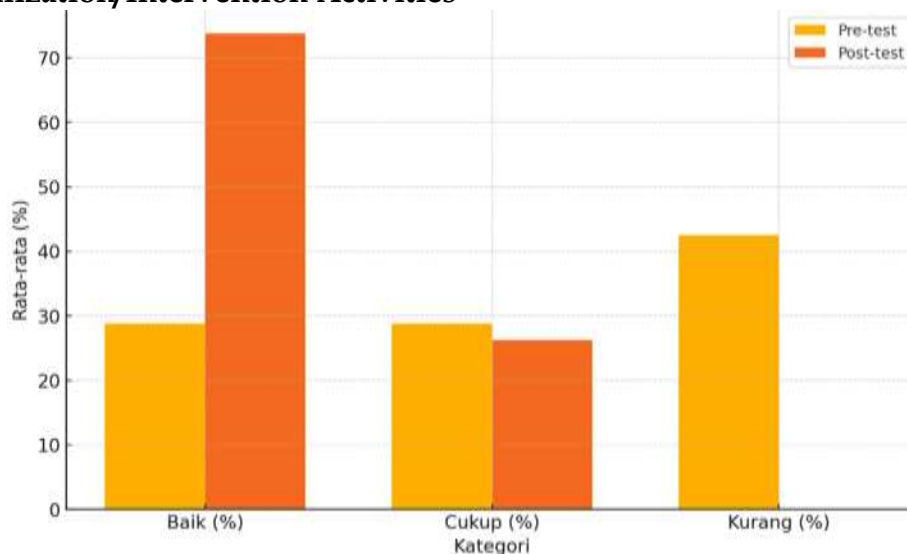


Figure.1 Grafik Comparison of Average Participants' Ratings Before and After Socialization/Intervention Activities

Graph 1 displays a comparison of the average percentage of assessments in three main categories, namely "Good", "Adequate", and "Poor" before and after socialization or intervention activities. This graph provides a visual representation of the changes that occur in a participant's assessment after being given a particular intervention or training. This graph shows a comparison of the average percentage of assessments in the 'Good', 'Enough', and 'Poor' categories

between the pre-test and post-test. The data illustrates significant changes in participants' knowledge or performance following the intervention program, with large improvements in the 'Good' category and significant reductions in the 'Poor' category. Although there was a slight decrease in the 'Fair' category, this change shows a shift in participants to the 'Good' category. The following are the results of the graphic analysis:

Good Category (%)

- a. **Pre-test:** At the pre-test stage, the average number of participants in the good category was 28.75%.
- b. **Post-test:** After the intervention, this average increased sharply to 73.75%.
- c. **Improvement:** There was an increase of 45% in the good category. This shows that the program or intervention carried out is very effective in increasing the number of participants who receive good ratings. This increase reflects a significant increase in the participant's knowledge or performance after participating in the program.

Sufficient Category (%)

- a. **Pre-test:** At the pre-test stage, the average of participants in the sufficient category was 28.75%.
- b. **Post-test:** After the intervention, this average decreased slightly to 26.25%.
- c. **Decrease:** There was a decrease of 2.5% in the sufficient category. This decrease indicates that some participants who were previously in the fair category have increased their ratings to the good category, which is a positive indication of the program's effectiveness.

Less Category (%)

- a. **Pre-test:** At the pre-test stage, the average number of participants in the poor category was 42.5%.
- b. **Post-test:** After the intervention, no participants were in the poor category, with the average score being 0%.
- c. **Improvement:** There was a decrease of 42.5% in the less category. The complete elimination of participants in the deficient category indicates that the program was very successful in helping participants improve their knowledge or performance to the point of leaving the deficient category.

Socialization activities on waste management based on 3R principles carried out by lecturers from the Environmental Engineering Study Program, Faculty of Engineering, Solo Christian Technology University (UKTS) showed a significant increase in participants' knowledge and understanding regarding waste management.



Figure 2. Delivery of Socialization Material by Resource Persons

The greatest improvement was seen in the Karangtaruna group, with an increase from 40% in the pre-test to 80% in the post-test for the good category. This shows that young groups have higher enthusiasm and readiness to receive new information regarding waste management (Shen et al., 2019). One of the main factors that contribute to the effectiveness of this outreach is the participatory and interactive approach used in delivering the material. Participants not only listened to lectures but were also involved in discussions and direct practice regarding waste management using the 3R principles. This is in line with previous research findings which show that a participatory approach is more effective in increasing public awareness and knowledge regarding environmental issues (Öhman & Öhman, 2013).

A study conducted in Yogyakarta, Indonesia, revealed that a public health-based waste management program can increase people's knowledge, attitudes, and behavior toward waste management, and improve the community's economic conditions (Sulistyawati et al., 2019). These results support our findings that education and outreach regarding waste management can significantly increase community knowledge and skills. Community-Based Waste Management (CBWM) has great potential to reduce the amount of waste disposed of in final disposal sites (TPA) and increase community participation in

recycling activities (Ifansyah et al., 2023). This is in line with the results of our outreach in Ingasrejo Hamlet, which showed a significant increase in participants' knowledge and understanding regarding waste management.

In addition, research in Thailand shows that implementing the Waste Bank program can effectively divert most recyclable materials from landfills and provide economic benefits to the community (Challcharoenwattana & Pharino, 2015). In the context of our outreach, increasing knowledge regarding the 3R principles is also expected to encourage the community to be more active in recycling activities and better waste management.

CONCLUSIONS AND RECOMMENDATIONS

Comparative pre-test and post-test data show that the socialization or intervention activities carried out succeeded in increasing participants' knowledge or performance significantly. The large increase in the good category and the complete elimination of participants in the poor category indicate that this intervention was highly effective. The small decrease in the fair category also indicates that some participants succeeded in moving to the good category after participating in the socialization activities. Community Service Activities regarding waste management based on 3R principles in Ingasrejo Hamlet succeeded in increasing the knowledge and understanding of the local community. It is recommended that similar activities be carried out regularly to maintain and increase public awareness about the importance of good and correct waste management. Apart from that, there needs to be cooperation between the community and local government in implementing community-based waste management.

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