



## Socialization and Training on Processing LDPE (Low-Density Polypropylene) Plastic Waste into Paving Blocks

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### Abstract

*The increasing amount of waste in Indonesia, especially in Surabaya, is a severe problem that must be resolved immediately. The amount of plastic waste in the city of Surabaya is one of the causes of damage to the environment. So that the plastic waste must be processed so that it can be reduced. Surabaya State University KKN students made this problem the basis for implementing the Socialization and Training of Plastic Waste Processing Types of LDPE (Low-Density Polypropylene) into Paving Blocks. The purpose of this activity is as an effort to reduce the amount of plastic waste and provide alternative new jobs for the community. This activity applies the lecture method, question and answer, simulation and practice. The action begins with the opening and filling out of the pre-test, then continues with filling in the material, making simulations, and the activity ends with closing and filling in the post-test. The pre-test and post-test assessments results showed that the participant's knowledge of the material was still classified as "low" with an average pre-test score of 52.40% and an increase in knowledge of the material as indicated by the post-test average score of 87.27%. The activity concludes that participants experience an increase in knowledge and understanding of handling plastic waste into paving blocks and have knowledge about tools, materials, and processing methods to be applied in everyday life.*

**Keywords:** Processing, plastic waste, paving block

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## INTRODUCTION

Plastic waste is a cause of severe environmental pollution problems in every country. The increase in plastic waste that this nation has not been able to solve certainly requires serious handling. If these plastics are allowed to continue, they can cause environmental damage because plastic is an inorganic waste that is difficult to decompose and cannot decay. The use of plastic will continue to increase as the human population increases. In addition, the large number of food and beverage industries has also increased the amount of plastic waste consumption because these industries use plastic for their product packaging. Based on data from a waste researcher from the University of Georgia, Jenna Jambeck, in 2018, Indonesia ranked second in the world for producing 187.2 million tons of plastic waste after China, which reached 262.9 million tons (Istirokhatun, 2019). Also, plastic waste in Indonesia is the primary source of enormous waste. Moreover, plastic waste is challenging to decompose in around 1000 years or more than one millennium. Specifically, in the Surabaya area, the Head of the Environmental Service (DLH), Agus Hebi Djuniantoro, said that in Surabaya, the amount of plastic waste in a year could reach 111 thousand tons (DetikJatim, 2022). Additionally, the Head of the ITS Surabaya Center for Sustainable Infrastructure Research said that waste products in the city of Surabaya reach 1,800 tons per day, and 14% is dominated by plastic waste (Supingah, 2022).

The need for more public awareness and the government's efforts to handle and manage waste is a severe problem that must be considered (Wijaya, 2019). In addition, the low public interest in implementing the habit of sorting and processing waste is also a factor in Indonesia's increased volume of plastic waste (Harun, 2017). Public awareness of the problem of waste, especially plastic waste, is not only faced by the Benowo Village. As observed (Puteri, 2022) found a waste problem in Sidosermo Village, Wonocolo District, Surabaya City, namely the need for more public awareness in reducing the use of plastics such as plastic bags, plastic straws, and other disposable packaging. This shows that residents need more understanding and knowledge about the dangers of plastic waste to the environment and a lack of education in introducing alternative single-use plastic products.

The problem of plastic waste can be reduced by processing waste. According to Law no. 18 of 2008, plastic waste processing is defined as changing the form of manure by changing the characteristics, composition, and amount of waste. Waste processing is an activity intended to reduce the amount of waste, but it also utilizes the value contained in the waste itself. Waste processing can be done by recycling, composting, burning, and others. Meanwhile, according to Government Regulation 81 of 2012, waste management is a systematic, comprehensive, and continuous activity, including waste reduction and handling. Waste reduction consists of 3R, namely reduce (reduce the use of goods), reuse (reuse), and recycle (recycling). Recycling plastic waste, besides reducing environmental pollution, can also prevent the wastage of natural resources (Indrawijaya, 2019).

On the one hand, plastic has advantages over other materials. Compared to other materials, plastic benefits include strength, lightweight, flexibility, rust resistance, not easily broken, easily colored, easily shaped, and good heat and electrical insulators. Therefore, plastic has many advantages if used as a recycled product (Indrawijaya, 2019). One of the efforts of processing plastic waste is to make plastic something that has use value and benefits, namely as paving blocks. So that the public's perspective on plastic waste can be a blessing because waste can produce material that has economic value and can reduce the amount of plastic waste.

Plastic-based paving blocks have been developed in many countries, including Indonesia (Brizi et al., 2021). Paving blocks are commonly used in track areas and yards, aesthetic suitability and ease of cleaning. Using plastic materials to manufacture paving blocks can increase elasticity and durability and reduce density so that the material becomes lighter. In addition, by using plastic as a base material, paving blocks will be produced at a lower price, as well as an alternative for reducing, handling, and utilizing plastic waste to prevent environmental pollution.

Plastic waste can not only be processed into paving blocks. Plastic has a relatively high specific calorific value, almost equivalent to fuel in general, because plastic is a product derived from petroleum (Syamsiro, 2015). This is in line with research (Kartika, 2022) which proves that plastic waste types of HDPE and PET can be processed into raw materials for making alternative fuels using the pyrolysis method. PET-type plastic waste can also be processed and produce briquettes or charcoal with a mixture of natural ingredients such as coconut shells, wood sawdust, and starch adhesive (Ikhsanudin et al., 2022). In addition, PET and PVC plastic waste can be used as biofilters which are proven to reduce BOD concentrations in domestic wastewater by up to 25.2 mg/l for PVC plastic waste and 14.0 mg/l for PET plastic waste (Sari, 2022). Recycling plastic waste can produce environmentally friendly crafts and other valuable objects to reduce the increase in plastic waste in Indonesia (Batubara et al., 2022).

LDPE or Low-Density Polypropylene type plastic, commonly used as a food container, plastic packaging, bottles with a soft texture, plastic lids, plastic bags/bags, and others, has good flexibility, strength, and good resistance to materials. chemistry (Indrawijaya, 2019). So, these properties are very suitable for processing plastic waste as a raw material for making paving blocks. Among the people of Kelurahan Benowo Surabaya, it was found that there was a lot of use of LDPE-type plastic that was just thrown away. Therefore it is necessary to increase the knowledge of the community through outreach and training in processing plastic waste into paving blocks. The objectives of this community empowerment include (a) being able to reduce the amount of plastic waste, (b) producing appropriate technology to manage plastic waste into paving blocks, and (c) providing alternative new job opportunities for the community.

## METHOD

In this socialization program, several methods have been used previously (Hariyanto et al., 2020), including:

1. Lecture method. This method is used to present material that the Implementation Team has prepared.
2. Question and answer method. This method is used to determine the level of socialization participants' understanding of what has been conveyed by the speakers.
3. Simulation and Practice Methods. This method shows and trains participants in making paving blocks directly, along with the tools and materials used. With this method, practice is carried out so that participants can easily accept and implement the knowledge gained in everyday life.

The diagram of the stages of this activity is as Figure 1.

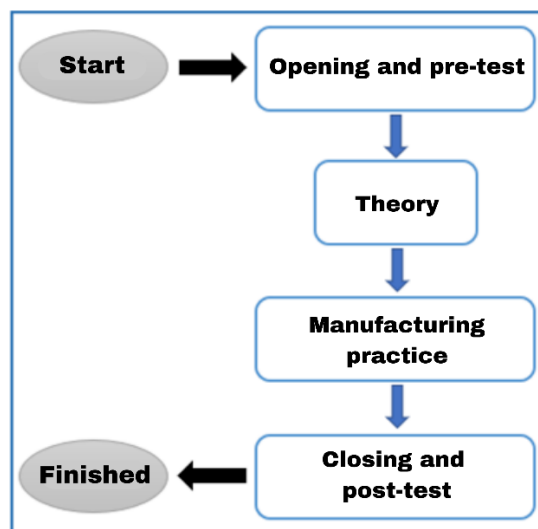


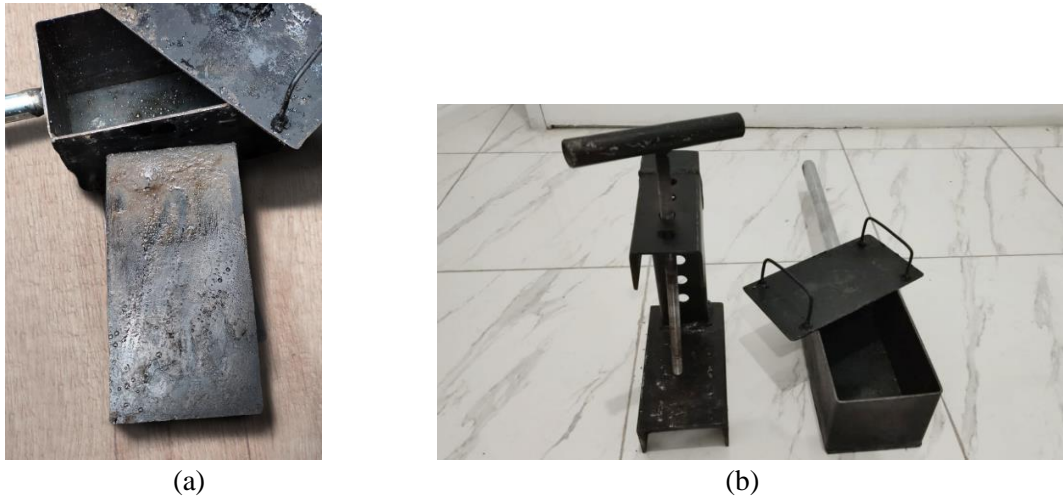
Figure 1. Diagram of activity stages

## Time and Place

This activity was held on October 30, 2022, at RT 04 RW 2, Benowo Village, Pakal District, Surabaya City, with 20 participants. The implementation of this activity is divided into four sessions which can be explained as follows:

1. The first session is the opening and pre-test.  
This session takes place from 09.00 - 09.20 WIB. After the master of ceremonies opened the event and conveyed the intent and purpose of holding this activity, each participant was given a questionnaire containing ten questions about the participants' attitudes toward processing plastic waste daily and the participants' knowledge of the socialization and training activities being held. The available answer choices are intensity options such as rarely, sometimes, quite often, often, and very often. The "rarely" option has the lowest value of 1 point, and the lowest value of the "very often" option is 5 points.
2. The second session was giving socialization material.  
The second session lasted 70 minutes, namely at 09.20 - 10.30 WIB, with a focus on socializing waste sorting and processing, especially providing knowledge that plastic waste can be processed and used as a material for making paving blocks. The plastic waste used is dominated by LDPE types such as used beverage bottles and food wrappers. The material presented in this socialization, namely an analysis of environmental problems related to waste, sorting of organic and inorganic waste, classification of plastic waste, and innovations in processing plastic waste into paving blocks along with the manufacturing procedures, were also explained clearly in this session which then ended with a question and answers session.
3. The third session of paving block-making training  
This session was held from 10.30 - 12.40 WIB. The participants carry out the process of making paving blocks directly with the instructor's assistance. The tools used in making paving blocks are simple tools which include vats of used paint, a spatula as a stirrer, and a stove along with LPG gas. A paving press and molds that will be used after the dough are ready to be printed have also been prepared. The materials

needed are plastic waste, dominated by LDPE plastic, sand, and used oil. The steps were to heat the used oil and add the plastic waste, which had been weighed in stages until it melted, and add sand. During the heating process, the barrel is closed so that the maximum heating temperature is obtained by stirring periodically every 5 minutes until the ingredients are evenly mixed. The final step is pouring the dough into the mold and pressing it to accept precise results and minimize cavities in the paving blocks that have been made. After the paving mixture has solidified, a cooling process is carried out to get excellent paving blocks and produce sturdy ones. It is dried in the sun for 24 hours.



**Figure 2.** (a) Molds and paving blocks from plastic waste. (b) Paving presses and moulds

#### 4. The fourth session is the post-test and closing

The post-test lasted for 20 minutes, starting at 12.40 WIB to 13.00 WIB, with participants answering the same questionnaire as the pre-test. Then it was closed with a photo documentation session with the participants involved in this socialization and training activity. There is one difference in the questions in this post-test: about the participants' readiness to apply and implement this socialization and training material in everyday life.

#### Plastic Waste Collection Methods

The method of collecting plastic waste is by taking plastic waste from landfills in Benowo Village. In addition, plastic waste is also managed by first socializing with residents about sorting organic and inorganic waste. After that, residents were asked to bring inorganic waste, which had been separated into plastic waste, when the training began. This aims to make residents aware of the importance of segregating waste and utilizing waste as a form of love for the environment.

## RESULTS AND DISCUSSION

### Program Implementation

This community empowerment activity is an application of research results (Brizi et al., 2021) which began with a site survey and environmental conditions in the field. The locations targeted in this community empowerment activity were Benowo Village, Pakal District, and Surabaya City residents. The results of a site survey conducted by Surabaya State University KKN students showed that the most prominent environmental problem in Benowo Village was the high increase in community waste, especially plastic waste, which reached  $\pm 12$  kg per day with almost 75% in the form of LDPE plastic waste and in the manufacture of paving blocks. It can substitute for cement (Brizi et al., 2021) and an aggregate binder in the sand (Ardiatma et al., 2021). Based on this research, paving blocks produced from processed plastic waste have been tested for their strength and are suitable for pedestrians or park pedestrians.

In Final Disposal Sites (TPA) and process them into valuable products. Based on the survey results obtained, Surabaya State University KKN students work with the head of RW 02 Benowo Village to invite

and invite Low-Income Communities (MBR) to attend socialization and training activities. This outreach and training activity will be held on October 30, 2022, starting at 09.00 to 13.00 WIB. This is in line with the statement (Teguh et al., 2020) that the community is the primary producer of daily waste, so efforts are needed to deal with the increase in day-to-day household waste, one of which is by processing plastic waste into paving blocks which are expected to reduce the mountain of plastic waste.



Figure 3. (a) Submission of socialization materials (b) Training on making paving blocks

**Assessment of Socialization and Training Outcomes**

Assessment is carried out through questionnaires that socialization and training participants in the pre-test and post-test sessions must answer. Each question consists of five answer options in the form of intensity options 1 to 5. The greater the participant's knowledge or shows a high-intensity option, the higher the value obtained. This assessment was carried out to know and measure the increase in the target community's understanding of the material that has been provided as well as changes in the attitude of the target community towards the problem of plastic waste in everyday life.

Test the participants' initial knowledge and understanding before being given the material packaged in the form of a pre-test which is presented in Figure 4.

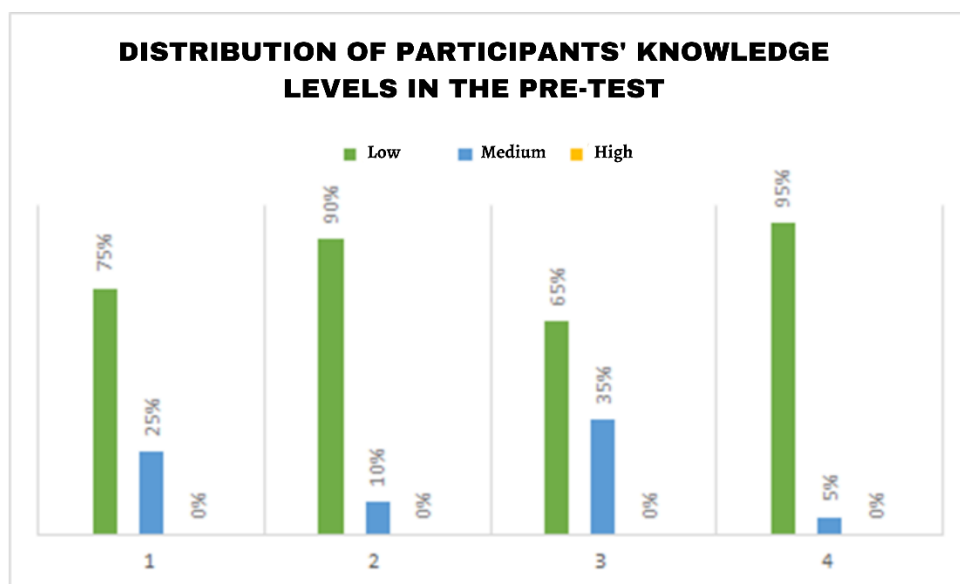
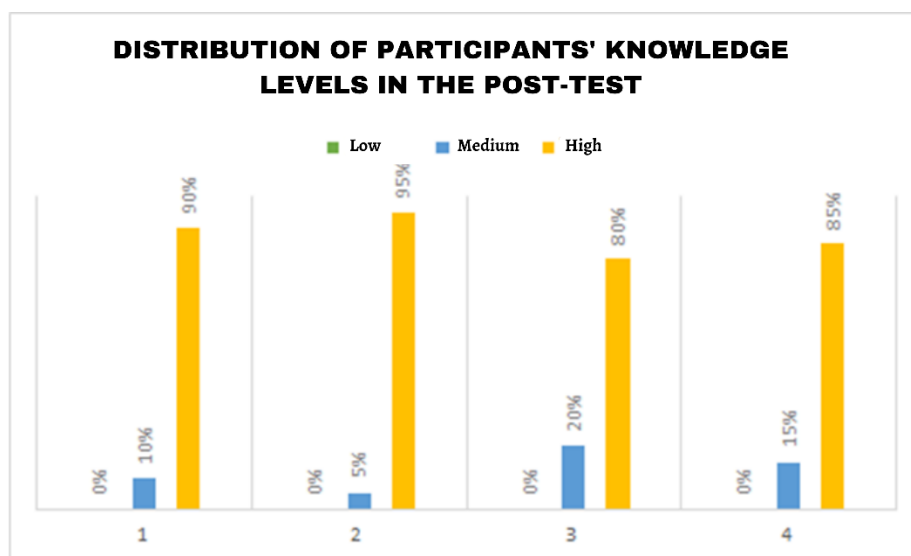


Figure 4. Distribution of the knowledge level of the socialization and training participants in processing plastic waste into paving blocks in the pre-test

Based on the results of the pre-test assessment analysis, it shows that as many as 75% of respondents have insufficient knowledge in the assessment aspect 1, namely efforts to deal with the problem of increasing plastic waste and as many as 25% of other respondents have the ability in the moderate category. In addition, 90% of respondents had low awareness and only 10% of respondents were classified as in the medium class

in aspect 2 of the assessment, namely awareness of recycling plastic waste. This shows a need for socialization or counseling activities on the importance of raising awareness for recycling plastic waste to deal with the problem of plastic waste in Benowo Village. In addition, based on the pre-test results, 65% of respondents needed more knowledge of the 3rd aspect of the assessment, namely about paving blocks and 35% of other respondents were in the medium category. As well as in aspect 4, as many as 95% of respondents had common knowledge that plastic waste could be processed into paving blocks. In comparison, only 5% of respondents knew the moderate category.

Some respondents with low knowledge do not have the habit of recycling plastic waste and only think that plastic waste can only be recycled into a craft. In addition, some of the participants needed to learn that plastic waste could be processed into paving blocks. With socialization activities and training on processing plastic waste into paving blocks, participants can gain new knowledge and information that plastic waste can not only be recycled into crafts but can also be processed into valuable objects, such as paving blocks that can be used in pedestrian parks. These benchmarks can be achieved by observing the results of the post-test assessment analysis shown in Figure 5.



**Figure 5.** Distribution of the knowledge level of the participants in the socialization and training in processing plastic waste into paving blocks in the post-test

Based on the results of the post-test assessment analysis shows the effectiveness of the activity that as many as 10% of respondents are knowledgeable in the aspect of assessment 1, namely efforts to deal with the problem of increasing plastic waste and as many as 90% of other respondents know in the high category. In addition, 95% of respondents had heightened awareness and only 5% of respondents were classified as in the intermediate class in aspect 2 of the assessment, namely awareness of recycling plastic waste. This shows that the socialization material provided can increase awareness of the target community to recycle plastic waste to deal with the problem of plastic waste in Benowo village. The training activities that have been provided can increase knowledge and provide additional information to the target community, as indicated by 80% of respondents having high expertise in the aspect of assessment 3, namely about paving blocks and 20% of other respondents in the medium category. In addition, the socialization and training activities that have been provided can offer new habits to the target community to be able to process plastic waste into paving blocks, as shown in aspect 4, namely that 85% of respondents have high knowledge about processing plastic waste into paving blocks including knowledge about tools. Materials needed and procedures

Based on the results of the pre-test and post-test assessments, it was shown that all socialization and training participants in processing plastic waste into paving blocks experienced increased knowledge and understanding. This is indicated by an average pre-test score of 52.40% and an average post-test score of 87.27%, so it can be concluded that there is an effect of effectiveness in increasing the average value of participants' understanding after carrying out the pre-test and post-test of 34.87%.

The existence of tests of knowledge and understanding of participants through pre-test and post-test can be an indicator of assessment to determine and measure the activity's success in increasing participants' knowledge of the material that has been given. Similar research revealed that the pre-test and post-test significantly improved the participants' understanding of training activities, with an intermediate pre-test score before counseling of 34.20% and an average post-test score of 80.36% (Zainuri et al., 2021). This is also in line with research (Lating, 2022) which stated that there was an increase in respondents' understanding of waste and the processing of plastic waste into paving blocks in Negeri Lima Village with an average pre-test score before socialization of 55% and an average post-test score. Test after socialization by 79%.

## CONCLUSION

From the research through the pre-test that has been carried out, it can be concluded that before holding the socialization and simulation of processing plastic waste into paving blocks, most Benowo Village residents needed more knowledge about efforts to deal with the problem of increasing plastic waste. In addition, most residents of Benowo Kelurahan need higher awareness regarding waste recycling. This causes most residents of Benowo Village to need more knowledge that plastic waste can be processed into paving blocks.

From the research through the post-test, it can be concluded that after conducting the socialization and simulation, the residents of Benowo Village experienced an increase in their knowledge and understanding of handling plastic waste and recycling waste. In addition, residents also know tools, materials, and how to process plastic waste into paving blocks so that they can be applied in their daily lives. This can prove that the activity runs smoothly and the objectives of this activity are achieved.

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