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# Processing and Utilization of Inorganic Waste into Economically Valuable Products

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**ABSTRACT**
Waste management is a complex challenge faced globally, including Indonesia. This is due to the imbalance between waste production and processing. Waste production in Indonesia reaches around 23.1 million tons of waste every year. With high inorganic waste production, effective waste handling and processing efforts are needed to reduce excess waste volume. The purpose of this study is to assess the effectiveness of the counseling and training program for processing inorganic waste into crafts by measuring the increase in knowledge of SD Negeri Kanreapia students about processing inorganic waste into crafts and assessing the sustainability of processing inorganic waste into crafts. The type of evaluation conducted is using a mixed methods research approach, which is an approach that combines quantitative and qualitative methods with a total of 31 respondents. The quantitative method uses a questionnaire as a research instrument, while qualitative is done by observation and in-depth interviews. The evaluation results based on the Friedman test showed that there was a significant difference (p-value = 0.000 <0.05) in respondents' knowledge before, after training, and after 8 months of intervention with sufficient knowledge of 70.9% or 22 respondents. The results of the activity showed a significant difference in respondents' knowledge related to inorganic waste processing before the intervention, after the intervention, and after 8 months of intervention.

**Keywords:** inorganic waste; students; waste management; waste products

**ABSTRAK**
*Masalah pengolahan limbah merupakan tantangan kompleks yang dihadapi secara global termasuk Indonesia. Hal tersebut dikarenakan ketidakseimbangan antara produksi sampah dan pengolahannya. Produksi sampah di Indonesia mencapai sekitar 23,1 juta ton sampah setiap tahunnya. Dengan produksi sampah anorganik yang tinggi, diperlukan upaya penanganan dan pengolahan sampah yang efektif guna menurunkan volume sampah yang berlebih. Tujuan studi ini yaitu menilai efektivitas program penyuluhan dan pelatihan pengolahan sampah anorganik menjadi kerajinan dengan mengukur peningkatan pengetahuan siswa-siswi SD Negeri Kanreapia mengenai pengolahan sampah anorganik menjadi kerajinan serta menilai keberlanjutan pengolahan sampah anorganik tersebut menjadi kerajinan. Jenis evaluasi yang dilakukan yaitu menggunakan pendekatan mixed methods research, yaitu pendekatan yang menggabungkan metode kuantitatif dan kualitatif dengan jumlah responden sebanyak 31 orang. Metode kuantitatif menggunakan kuesioner sebagai instrumen penelitian, sedangkan kualitatif dilakukan dengan observasi dan wawancara mendalam. Hasil evaluasi berdasarkan uji Friedman menunjukkan terdapat perbedaan signifikan (p-value = 0,000 < 0,05) pada pengetahuan responden sebelum, setelah pelatihan, dan setelah 8 bulan pemberian intervensi dengan pengetahuan cukup sebesar 70,9% atau 22 responden. Hasil kegiatan menunjukkan perbedaan yang signifikan pada pengetahuan responden terkait cara pengolahan sampah anorganik sebelum diberi intervensi, setelah intervensi, dan setelah 8 bulan diberi intervensi.*

***Kata Kunci:*** *sampah anorganik; siswa; pengelolaan sampah; produk limbah*

 

## INTRODUCTION

The problem of waste treatment is a complex challenge faced globally including Indonesia (Andini & Nur Fazria, 2022). This is due to the imbalance between waste production and treatment (Timochevskiy et al., 2022). Every year, the world produces 2.01 billion tons of waste and at least 33% of it is not managed in an environmentally friendly way. The East Asia and Pacific region produces the majority of the world's waste, at 23% (The World Bank, 2024). Based on data from the Ministry of Environment and Forestry's National Waste Management Information System (SIPSN) in 2023, Indonesia generates around 23.1 million tons of waste annually. Of this amount, 36.17% or almost a third is inorganic waste (KLHK, 2023b). And of the total waste generated in Indonesia, only about 50.27% is handled, meaning that half of the total waste produced has not been handled (KLHK, 2023a). Data from previous research obtained 66.7% of the number of households in Halahalaya Hamlet, Kanreapia Village who processed waste by burning and 33.3% were not processed so they were just thrown away.

With high inorganic waste production, effective waste handling and processing efforts are needed to reduce excess waste volume (Safi'il et al., 2023). Socialization and training in waste management can be an effective alternative so that the form of waste management has started from the household level (Yanti & Awalina, 2021). One of them is training in processing inorganic waste into handicrafts that produce economically valuable products (Ambar et al., 2021; Gusdevi et al., 2024; Nurhasanah & Listyandini, 2022). Studies conducted in Ukraine show that domestic plastic waste can be used as a secondary material in the technology of making encapsulated mineral fertilizers that are environmentally friendly (Nahursky et al., 2022).

In the previous data collection, it was found that the main problem that occurred in Halahalaya Hamlet, Kanreapia Village, Gowa Regency, namely the absence of a final disposal site resulted in the community burning waste to get rid of it, which can cause air pollution. So that 2 interventions were determined to overcome the problem of inorganic waste processing, namely physical intervention through demonstration of making handicrafts from inorganic waste materials and non-physical intervention in the form of counseling related to processing waste into products that have economic value. Both interventions were carried out to foster awareness and increase the basic knowledge of school children as early as possible about the importance of maintaining cleanliness and utilizing inorganic waste and processed into useful handicrafts.

Training programs, such as those described by Supinganto et al. (2022), play a crucial role in empowering communities to manage organic and inorganic waste effectively, including processing organic waste into compost and recycling inorganic waste into reusable tools. Such initiatives not only contribute to waste reduction but also promote the creation of valuable products. Similarly, emphasizes the importance of waste sorting and processing training, encouraging participants to independently create eco-enzymes and utilize organic and inorganic waste efficiently (Aristyasari, 2023).

In addition, demonstrate how creative industries can be developed through techniques like Sospeso, which repurpose cloth remnants into valuable handicrafts (Winasih et al., 2023). This highlights the innovative ways in which waste materials can be transformed into marketable products. Moreover, 's work on upcycling fabric waste using Islamic art approaches showcases the integration of sustainability and cultural elements in waste management practices, adding artistic value to recycled materials (Pramono et al., 2022).

 

Hopefully, these interventions will be able to demonstrate the success of the inorganic waste processing program into economically valuable products. With this intervention, this empowerment activity aims to assess the effectiveness of the counseling and training program for processing inorganic waste into crafts by measuring the increase in knowledge of Kanreapia State Elementary School students about processing inorganic waste into crafts and assessing the sustainability of processing inorganic waste into crafts.

## METHODS

The evaluation conducted to analyze the effectiveness and sustainability of the program used a mixed method approach. The quantitative evaluation used a questionnaire as a research instrument, while the qualitative was conducted by observation and in-depth interviews.

Quantitative evaluation aims to measure the increase in respondents' knowledge carried out by giving the second post-test to research respondents, namely 5th grade students of SD Negeri Kanreapia, Gowa Regency as many as 31 people. Which then later the results of the second post-test will be compared with the results of the pre-test and the first post-test which was conducted 8 months ago after the provision of non-physical interventions in the form of counseling. The qualitative evaluation aims to assess the sustainability of the handicraft making program from inorganic waste. The qualitative evaluation was conducted through in-depth interviews and observations of the respondents' handicraft making.

The use of quantitative and qualitative evaluation can be very effective when integrated with the ABCD (Asset-Based Community Development) empowerment method. The ABCD approach ensures that the evaluation focuses not only on program outcomes, but also on empowering the community to utilize their assets in creating sustainable change in processing inorganic waste into economically valuable products.

## RESULTS AND DISCUSSION

This evaluation was conducted at SDN Kanreapia in Kanreapia village, Tombolo Pao sub-district, Gowa district, on May 25, 2024. The purpose of this evaluation is to see the increase in knowledge of inorganic waste processing at SDN Kanreapia. This evaluation activity is carried out to assess the success or failure of the program or intervention that was carried out 8 months ago.

**Figure 1**. Evaluation Process and Craft Demonstration

 

**Table 1**. Statistical Test Results of Inorganic Waste Processing

| Knowledge Score | n | Min | Maks | Mean±SD |
|---|---|---|---|---|
| Pre test | 31 | 20 | 90 | 56.77±18.688 |
| Post test I | 31 | 40 | 100 | 76.45±16.031 |
| Post test II | 31 | 40 | 100 | 82.26±17.834 |

Figure 1 demonstrates the process the evaluation was carried out by observation, in-depth interviews with respondents and administering questionnaires similar to the first post test. The results of the observations made found several handicrafts made by respondents in the classroom such as pencil cases, class decorations and trash cans. Meanwhile, based on the results of in-depth interviews that have been conducted with several students, it is found that inorganic waste processing is well utilized.

An 11-year-old student said that she always collects plastic waste that can be used as handicraft materials, because she has an interest in making these crafts. Another 12-year-old student added that the teacher at school also supports the activity of making crafts from plastic waste materials.

Table 1 shows the increase in knowledge from pre-test (average 56.77) to post-test I (average 76.45) and post-test II (average 82.26) after the provision of inorganic waste processing counseling in grade 5 students of SDN Kanreapia. Friedman test results showed that there was a significant difference (p-value = 0.000 <0.05) in respondents' knowledge before, after training, and after 8 months of intervention.

Figure 2 shows that the category of respondents' knowledge related to organic waste processing counseling consists of 2 categories, namely less and enough. The knowledge of respondents with sufficient categories in the pre-test was 58.1% or as many as 18 respondents, then increased in post test 1, namely 64.5% or as many as 20 respondents and increased again in post test 2, namely 70.9% or as many as 22 respondents. So it can be concluded that the counseling of inorganic waste processing into crafts that has been done shows a significant increase in knowledge in research respondents.

**Figure 2.** Diagram of Respondents' Knowledge Level

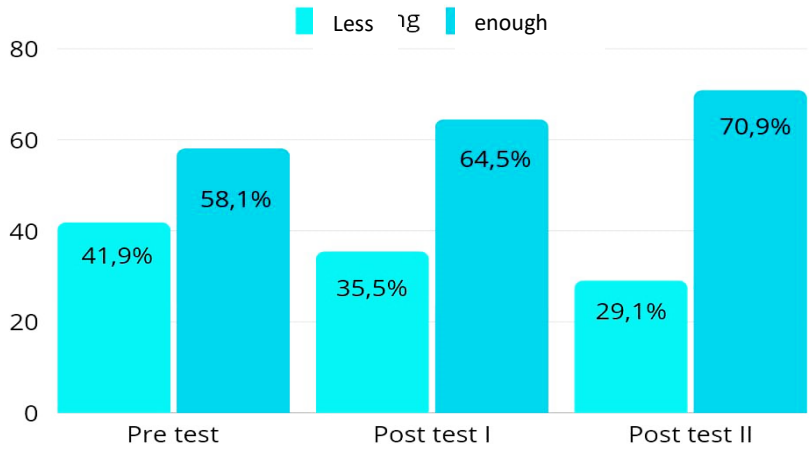


 

**Figure 3**. Crafts made from inorganic waste

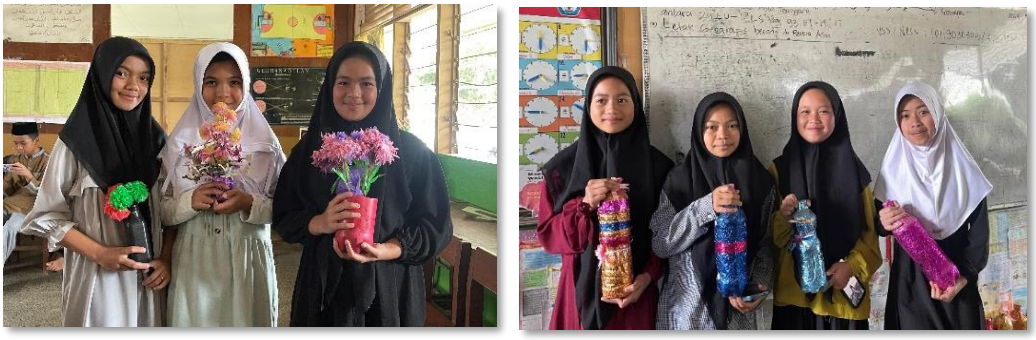

Figure 3 shows the results of handicrafts from organaic waste into valuable waste. According to Amin et al. (2022), training in processing inorganic waste into handicraft products is very useful for reducing plastic waste, one of which is in elementary school children (Amin et al., 2022). Training students on handicrafts is very important to increase their knowledge and foster creative new ideas in making handicrafts that can be used according to their respective needs (Budiarti et al., 2023; Mukti & Fadhilah, 2024). So that inorganic waste in the school environment can be handled properly (Heeng et al., 2023).

Waste is referred to as discarded goods or residual human activities that are no longer used by the owner (Nindya Ovitasari et al., 2022). Inorganic waste is waste that comes from the rest of human activities that are difficult to decompose by bacteria and take place quickly, so it is considered as waste that is not environmentally friendly (Batubara et al., 2022). With the presence of waste in the environment, it has several negative impacts such as causing flooding and decreasing public health if it does not get good processing (Mahmashony Harimurti et al., 2020). In addition, waste can damage the aesthetics of the environment because it causes a foul odor if not treated properly (Chrismawati, 2023).

Schools have a strategic role in increasing the younger generation's knowledge about the environment and fostering them to act wisely towards the surrounding environment (Manyullei et al., 2022). Education in elementary school children is able to develop the character of students as early as possible (Kholifah, 2020). To grow up with a character that saves natural resources and is environmentally friendly, there needs to be habituation that starts from childhood (Permana et al., 2023; Yonanda et al., 2022). Schools that are designed to function as natural laboratories will serve as a useful learning vehicle in the process of forming this culture (Trisni et al., 2023).

The success of the waste management program in schools is inseparable from several factors including the availability of supporting human resources, supporting funding sources and supporting facilities and infrastructure (Evangelyne & Hardini, 2024). In addition, the level of awareness is a major factor in the implementation of the program to preserve the school environment (Putra et al., 2022), therefore elementary school students really need assistance in the implementation of proper inorganic waste processing so as to form the behavior of environmentally friendly students (Sabrina et al., 2023).

In addition to the success of the program, it is also hoped that the sustainability of the inorganic waste processing program will be an economically valuable product. An alternative to the sustainability of the program for students of SDN Kanreapia is by utilizing existing resource assets at school such as empowering teachers in terms of routine assistance in processing inorganic waste into products of economic value and making the program a school routine or additional curriculum related to local content. In addition to

 

resource assets, it can also utilize infrastructure assets from the students themselves in the form of gadgets that can be used to improve students' skills in processing inorganic waste.

## CONCLUSIONS

There was an increase in knowledge before and after counseling and training on inorganic waste processing at Kanreapia Elementary School. In addition, there was also a significant difference between respondents' knowledge about inorganic waste and how to process inorganic waste before the intervention (pre-test), after the intervention (post-test I) and after eight months of intervention (post-test II). Students are expected to continue to increase awareness and knowledge about inorganic waste processing. Practice the knowledge that has been obtained at home and the school environment. Students are also expected to share the knowledge gained with friends who have not participated in the training so that more people care about waste management. Teachers can integrate material about inorganic waste management into teaching and learning activities so that students' understanding is deeper. In addition, the teacher's role in regular monitoring and evaluation is needed to ensure that students' knowledge continues to develop and be implemented properly.

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