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Research Article

Designing Wood Waste Mosaic Furniture Through Participatory Methods and Experimental Design Approaches

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Abstract.

Wood remains the preferred material for those seeking a natural look in furniture. Unfortunately, many furniture manufacturers neglect the potential of leftover wood material that could be repurposed for other products. This is due to the complicated and time-consuming process that repurposing entails, and the price often fails to reflect the effort involved. This study aims to identify the types of wood waste materials that can be most easily and quickly used in the furniture design process. It also seeks to determine the best way to showcase the beauty of various wood waste materials. A participatory experimental design approach was employed to ensure that the research process and results have a direct educational impact on woodworkers. The research findings indicate that chunks of wood have the most potential to be repurposed for new furniture as no special processing is required. Additionally, the mosaic concept is an excellent means of highlighting the unique character and natural color of each type of wood waste utilized. It is essential, however, to consider several factors to maximize the functionality and aesthetics of the furniture.

Keywords: wood waste, mosaic, design, furniture

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1. Introduction

The wooden furniture industry in Bandung Indonesia is still dominated by small-scale wood craftsmen, specifically those of the lower middle class, who work manually or with the assistance of hand tools. The expertise of most wood craftsmen is derived from their experienced backgrounds. This circumstance results in the limited processing of raw wood materials, which are only used to either create furniture products or to be processed further. The remaining raw materials are labeled as unsupportive in the production process and are deemed as waste [1].

Under certain circumstances, when the industry is unable to efficiently utilize raw wood materials in the production process, it leads to an increase in wood waste. Various

types of wood waste, including wood chips, scraps, and wood powder, are produced by the sawmill industry [2]. Occasionally, small businesses find this wood waste useful as raw material, such as charcoal-making that require wood scraps, oyster mushroom-growing that need sawdust as a planting medium, and many others [3]. However, the direct sale of wood waste often results in a low valuation.

To increase the value of wood waste in the furniture industry, a creative approach is required. Wood crafters could apply a simple method to produce furniture products with new variants based on materials from wood waste. This research is a collaboration with one of the owners of a small workshop in Bojongsoang Bandung by involving one of his wood craftsmen to produce products using wood waste from his workshop it can be reprocessed into new product without reducing the visual aesthetics. The aim is to maximize the use of materials, reduce waste, and create new variants of furniture products. The study seeks to identify the type of wood waste material that is easiest and fastest to use in the design process to produce an attractive and aesthetically pleasing piece of furniture. It also aims to determine the correct concept for showcasing the beauty of various wood waste materials.

2. Methods and Equipment

2.1. Methods

The study involved producing furniture from wood waste materials using a participatory method, which employs an experimental design approach. Participatory research involves individuals or groups in the research process, either directly or indirectly, to achieve specific goals [4]. The aim of participatory research is not only to achieve research results but also to improve the quality of resulting decisions and educate those involved in the process [5]. In this particular study, the participant was a furniture maker who participated by collaborating with researchers to collect data on types of wood waste that still have the potential to be reused. Additionally, the furniture maker participated in designing, processing, and producing new products using wood waste alongside researchers, through an experimental process.

3. Results and Discussion

The first step involved collecting the wood waste produced by furniture makers in their small businesses. Next, the wood waste was examined and sorted according to its type to determine the potential possibilities for processing it into furniture products. Several types of wood waste were identified, each with its own unique characteristics and properties. These characteristics depended on the craftsmen's treatment of the wood during furniture production, as well as the type of equipment and machines used.

In the woodworking industry, there are several types of wood waste that are classified based on their shape and size, ranging from small to large. Sawdust is the smallest dimension of wood waste, which is produced during the refinement of wood material using sandpaper. Thin wood shavings are the next category of wood waste, which have dimensions larger than sawdust and are produced during the treatment of whittled wood. Wood chips are another category, with dimensions and volumes larger than those of wood shavings produced during the sculpting process. Finally, the largest category of wood waste is lumps of wood with irregular shapes and sizes.

Each type of wood waste has its own unique properties and characteristics that come with its own set of advantages and disadvantages, as well as different potencies and treatments. Wood powder, for instance, has a fine to coarse texture that depends on the size of each particle. However, sawdust cannot be directly used to create furniture with new designs. Instead, wood powder can only be used as an ornament by sticking it onto furniture to achieve a textured appearance. To become a composite material that can be used as a complete material with good construction, it requires special treatment supported by an adhesive material. These conditions are not much different from the type of wood shavings; the difference is only in the final appearance produced.

Another type is wood chips, which have small and irregular dimensions, making it difficult to put together to become a material with large volume and dimensions. It requires special treatment, such as mixing it with resin. However, the drawback is that the character of the wood is not fully exposed because the resin material dominates it.

The last type is lump material. Although it has varying sizes and shapes, it can still be shaped and combined into one so that it can be processed directly and quickly without special treatment beforehand. Besides that, the diversity of the beauty of each different type of wood becomes the main attraction in the final appearance if it is combined properly. Based on the observations and analysis results, the wood waste material will

focus on the types of wood chunks to be processed through an experimental design approach.

After determining that the type of chunks in the wood waste as an experimental design material, the conceptual design process would be based on the existing potential of the wood waste. It was observed and analyzed that the lumps in the wood waste have different color variations and appearances due to the fibers that differ with each type of wood. When combined, the diversity of the final appearance of these wood variants produces a unique aesthetic with its own charm. To maximize the combination between the wood variants, the mosaic technique was used in experimentation. This technique involves combining several pieces of similar materials of various colors by gluing them together [6 Papiu & Suciu].

There are several types of wood that are suitable for use from the collected waste in workshop. Their resulting color and brightness can be sorted from darkest to brightest, as shown in Figure 1. The first wood type is rosewood, which tends to have the darkest color (1). The second is teak, which has a distinctive wood grain pattern and a slightly lighter yellowish-brown color (2). Mahogany is the third wood type and has a reddish-brown appearance (3). Camphor wood is the fourth type, with the most fiber appearance and tightly packed in one direction (4). The fifth and lightest color belongs to pine wood (5). Diversity of the five types of wood used in the experiment.

Figure 1: The various types of wood waste used.

For the experimental study aimed at turning wood waste into a proper furniture, a stool was utilized as the design object. The reason for selecting a stool is due to its functionality and smaller dimensions, which allows for the avoidance of using a large quantity of excess wood material due to the time constraints. The design of the stool is square, with sides measuring at 45 cm and a height of 45 cm. The top of the stool will feature a mosaic, with a seat thickness of 5 cm. The holder section of the stool was selected because it is exposed and can easily grab the attention of the viewer.

To begin the experimentation process, the pieces of wood must first be sorted according to the design requirements, which include having a minimum thickness

of 5 cm by the craftsman. After it is sorted, the pieces are arranged and combined according to the number of wooden pieces available to form a seat that meets the design specifications, with a size of 45x45 cm for the upper side. The mix and match process were carried out by researchers through the ability to produce an aesthetic appearance. The color of the wood is arranged randomly by researchers to create a dynamic appearance, with the aim of exposing each unique character and color to a different type of wood so that it can attract attention, even though the design may appear simple. During the combining process by craftsman, the number of wood chips used must be considered, ensuring that the total area of the top or the part that displays the mosaic arrangement exceeds the desired area. This will simplify the shape processing process when adjusting the needs of the mosaic composition of the craftsman.

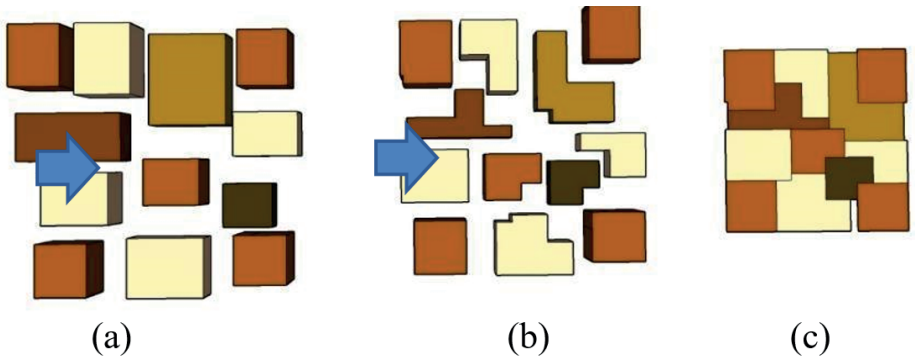

Figure 2: Stages of the wood mosaic experimentation process.

When compiling the mosaic design, the top view is prioritized which resulted in uneven top and bottom sides to the stool. This is because the dimensions of the different heights of the wood chips are not taken into account when arranging the mosaic, which only prioritizes the top side view. To fix this, the next step is to cut the top and bottom sides evenly to achieve a thickness of 5 cm. Then, a stool leg that is 40 cm high should be made according to the initial design to ensure that the mosaic remains well exposed. When the mosaic is put together between the seat and the legs, it will produce the planned height dimensions of 45 cm.

The final stage is completed with assurance that the appearance of the final product is neat, safe, and comfortable when used, such as smoothing out sharp corners by rounding each part. Once the shape is tidied up, the furniture's surface is smoothed, and the final step involves applying a transparent coating of paint to the outside of the stool to maintain and protect the original color of the wood. This product can be sold at a price of between three hundred thousand to five hundred thousand rupiah. In all

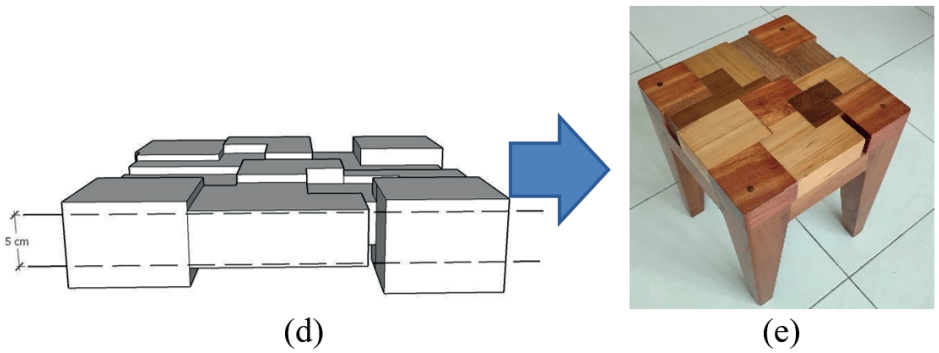

Figure 3: Cutting the thickness of the wood mosaic and photo of the final furniture.

experimental stages, the most difficult thing is sorting wood waste which sometimes does not meet the standards of needs and expectations, while the stage that takes quite a long time is the process of smoothing and forming wood chips which must be done one by one. This is what causes craftsmen to choose not to use wood waste to make new products, because the effort, energy and time are not worth the selling price.

4. Conclusion

When using wood waste to create furniture, there are several important considerations to keep in mind. It's crucial to understand the character, nature, and potential of each type of wood waste to ensure that realistic ideas can be produced during the design process. Out of the four types of wood waste (sawdust, wood shavings, wood chips, and wood lumps), wood lumps are the most easily processed and require no special treatment to become furniture. Design is a key factor in creating the desired furniture product, as the type and dimensions of the selected wood blocks will determine the forming material. By utilizing the mosaic concept, the final result of the furniture can showcase the beauty, character, and color of the various types of wood used. When arranging wood chips into a mosaic, it's important to consider the appropriate amount, ensuring that the total area of the upper side or the part that displays the mosaic arrangement exceeds the desired area. This also helps to facilitate shape processing, allowing for adjustments to be made to meet the needs of the resulting mosaic composition. The character and color appearance of various types of wood can have a significant impact on the final result, so it's important to pay attention to these factors during the design process to ensure the aesthetics of the resulting furniture are achieved.

Conflict of Interest

The authors have no conflict of interest to declare.

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