EASILY (Easy to Use Kitchen Utilities) Designing Cutting Boards Sets for Elderly and Arthritis Sufferers with Quality Function Deployment

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Abstract. Based on the Indonesian Population Census in 2015, the number of elderly people aged over 60 years in Indonesia reached 2.1 million people. Elderly women do ADL (Activities Daily Living) is higher than the population of elderly men. One ADL that is still often done by the elderly woman is cooking while the process of manually using a cutting board. The purpose of this research is to developed cutting board set named EASILY (Easy-to-Use Kitchen Utilities) which is a set of cutting tools consisting of ergonomic knife and cutting board that comfortable to use and also it does not need much power from operator to do the cutting activities. The steps taken with the method of Quality Function Deployment, to process and interpreting consumer need for product specifications. Usability test is applied with satisfaction attribute performed to determine the level of user satisfaction through interview when subject using EASILY product. The result of this reserach show that EASILY have 4 components there are Cutting Board, Knife Holder, Food Holder, and Trash Tray. The subject feel comfortable while using EASILY after doing the usability testing. Recommendation for further reserach the product development can be done using another product design method, and the usability testing should using more respondent.

Keywords: QFD, kitchen utilities, elderly, usability

1. INTRODUCTION

According to the Indonesian population census conducted in 2015, the number of elderly people over the age of 60 who are in Indonesia reached 2.1 million people spread throughout Indonesia with the highest value for the number of elderly people in the Special Province of Yogyakarta [1]. This amount is included in the high category, considering that the percentage of elderly people in the Indonesian population is 10%. The number of elderly people in Indonesia itself is dominated by the female gender which has a comparison with the number of elderly women in the female sex that is equal to 9: 8 [2].

From the number of elderly people in Indonesia, there are several health problems suffered by the elderly, from census data, the list of diseases that are suffered by the elderly is as follows:
Table 1. Number of Elderly Patients [2]

| No. | Health Problems       | 55 – 64 Years Old | 65 – 74 Years Old | 75+ Years Old |
|-----|-----------------------|-------------------|-------------------|---------------|
| 1.  | Hypertension          | 45.9              | 57.6              | 63.8          |
| 2.  | Arthritis             | 45                | 51.9              | 54.8          |
| 3.  | Stroke                | 33                | 46.1              | 67            |
| 4.  | PPOK                  | 5.6               | 8.6               | 9.4           |
| 5.  | DM                    | 5.5               | 4.8               | 3.5           |
| 6.  | Cancer                | 3.2               | 3.9               | 5             |
| 7.  | Coronary Heart Disease| 2.8               | 3.6               | 3.2           |
| 8.  | Kidney Stones         | 1.3               | 1.2               | 1.1           |
| 9.  | Heart Failure         | 0.7               | 0.9               | 1.1           |
| 10. | Kidney Failure        | 0.5               | 0.5               | 0.6           |

When viewed from table 1.1 above, information can be obtained that arthritis is the number 2 disease most commonly suffered by elderly people in Indonesia. Gout Arthritis Disease (GA) according to the American Collage of Rheumatology is a disease and potential disability due to arthritis that has long been known, its symptoms usually consist of severe episodic from one joint inflammation pain. Gout is a form of chronic inflammation of the arthritis, swelling and the most common pain in the big joints of the big toe, but can affect other joints and can become more severe. Gout is a term used by a group of metabolic disorders characterized by increased levels of uric acid. [3]

Gout arthritis is one of the rheumatic diseases which ranks third after arthrosis and rheumatoid arthritis, rheumatic patients in Indonesia are estimated to be almost 80% of the population aged 40 years or older [4]. The World Health Organization (WHO) estimates that around 335 million people in the world suffer from rheumatic diseases. This amount corresponds to an increase in the number of elderly people. Musculoskeletal problems are the most common chronic problem occurs in the elderly, with around 49% of elderly experiencing some form of arthritis [5].

Most of the elderly in Indonesia, especially for elderly women, are still doing work that is closely related to the use of hand power, especially household work and cooking. This can increase the risk of the elderly being affected by arthritis, coupled with the strength of the elderly who have been reduced so that the elderly need tools that can help to do work, especially domestic work. Especially in this study will provide innovation 1 set of knives and ergonomic cutting boards and also can reduce the energy needed without reducing the results of cuts from the work of the elderly.

2. METHODS

2.1 Quality Function Deployment

QFD was first developed in Japan by Mitsubushi’s Kobe Shipyard in 1972, which was later adopted by Toyota. Quality function Development (QFD) is a method for product planning and development allows the team developer to set clearly customer desires and needs, and also to evaluate each product proposal or service capability systematically in relation to the impact on achieving these needs. According to Gaspersz [6] The essence of QFD is a large matrix that connects what the customer needs (What) and how a product will be designed and produced to meet the customer’s wishes (How). The most commonly used analogy to describe the structure of QFD is a matrix in the form of a house. The term often used is House of Quality (HOQ) [7].

The first method of data collection for the design of EASILY product was a questionnaire by distributing 30 respondents. Respondents are elderly people aged above 65 years old which are mainly female. There are 3 stages of questionnaires distributions. The design of this product begins with the
distribution of questionnaires to get Voice of Customer, namely identification of customer needs and then proceed with the creation of Technical Response. The next step is to disseminate the second questionnaire regarding the scale of interest, and the results of the questionnaire are tested for reliability and product design. Next, in designing this product is the dissemination of a third questionnaire on the comparison of these products with existing products (competing products) and filling in the House of Quality (HOQ).

2.2 Handtool Design

In designing this product, an ergonomic guidelines for hand-tool design is considered. In designing hand tools, the level of strength and durability of a grip (grip) needs to be considered [8]. While grip endurance is the length of time a person needs to maintain a certain level of pressure.

Ergonomic guidelines for hand-tool design [9]:

a) Avoid rigid designs by giving contours to the tool in accordance with the shape of the finger. (using 50 percentile)
b) Avoid the use of tools that demand unusual movements or cannot be used effectively with normal posture and low pressure.
c) Avoid tools with sharp edges.
d) The surface of the tool must be safe, non-conductive and smooth.
e) Make sure the size of the tool used is right (not too small) because the device is not suitable for size requires more power in its use.
f) The equipment used should have the capability to be used with either the right hand or the left hand.
g) Tools should be effective for both men and women.
h) Tools should have special objectives / tools only used for certain activities.
i) Consider the grip angle and minimize excessive wrist rotation.
j) Ensure security in the use of tools.
k) Avoid using tools that have excessive vibration.

2.3 Usability

Usability is a way to find out the ease of a product used by the intended user. Satisfaction is an indicator of user satisfaction when using a product. This indicator is obtained by directly offering EASILY products for use by targeted users, in this case the elderly and people suffering from arthritis.

The usability testing is conducted after the design is prototyped. There are 5 respondents of elderly female users of daily kitchen tools. The usability factor considered in this product development is the satisfaction aspect. Usability satisfaction data retrieval is in addition to satisfaction points, users can also provide input, to the product as additional points in the hope that they can develop EASILY as a product that is truly needed and desired by the target, namely the elderly and arthritis sufferers.

3. RESULT AND DISCUSSIONS

The first method of data collection for the design of EASILY products was a questionnaire by distributing 30 respondents. The results of the data will be processed by the QFD method in identifying consumer desires. The following is the result of processing questionnaire data with the QFD method. In this figure 2 below is the result of House of Quality, to decide action that should be taken.
From the results of QFD analysis, it can be seen that there are 4 aspects that become consumer needs, namely the shape of the handle, the ease of cutting material, the level of precision in cutting and the ease of removing residue. Based on the values obtained in the row weights, these values are used for selecting actions for the relevant criteria. There are three types of actions that can be carried out for the related criteria namely action A (Improving product quality), B (Maintaining product quality and continuously innovating products), and C (Maintaining product quality). After identifying the actions that must be carried out based on the house quality, the data obtained is that the action that must be taken is the screen on the cutting board is oval and thin, then the handle of the knife that will be made adjusts to the contours of the human hand, then has a blade support with the aim that the user do not have to hold the knife with great power, then the last is the presence of a residue from the cutting. This residual place is temporary and if it is full it must be disposed of manually by the user.

**Figure 1. House of Quality**

| No | Customer’s Need                  | Important Rating | Goal 1 | Goal 2 | Goal 3 | Goal 4 | Action |
|----|----------------------------------|------------------|--------|--------|--------|--------|--------|
| 1  | The Shape of the Handle          | 7.03             | ●      | ●      | ●      | ●      | A      |
| 2  | Easy to Cut the Ingredients      | 7.54             | ●      | ●      | ●      | ●      | A      |
| 3  | Cutting Precision                | 7.01             | ●      | ●      | ●      | ●      | B      |
| 4  | To Get Rid of the Residual       | 6.73             | ●      | ●      | ●      | ●      | C      |

**Target**

- Ease of Cutting: 63.27
- Ease of Removing Residue: 131
- Shape of Blade: 63.09
- Impact of Handle: 60.75

A: Improve the Quality of the Product
B: Maintain the Quality of the Product and Apply Continuous Innovation
C: Maintain the Quality of the Product
After making the identification process for the specifications of the cutting board. The next step is the process of usability testing after the researcher has carried out the prototyping process. Attributes that will be used for usability testing are satisfaction. In usability testing, interviews will be conducted with users, namely the elderly and arthritis sufferers. Interviews are conducted by asking several questions related to user satisfaction when using cutting boards. The reusability testing process was carried out in 5 elderly people.

The results of the usability test showed that the five users felt high satisfaction during the process of product testing, especially with the residual tray feature, making it easier for users to store trash temporarily when cutting processes. However, the user provides input so that the blade support section is made more comfortable by replacing the material, and can be rotated 360° so that it can be used to cut various types of food ingredients.

4. CONCLUSION

Easily (easy-to-use kitchen utilities) is a set of kitchen equipment consisting of 3 main components. The three components are knives, cutting boards and knife supports. The three components use an anthropometric approach so that it matches the user's body dimensions and can directly increase comfort when used. The knife support is useful to facilitate users who are elderly people and arthritis sufferers who have limitations in moving the joints of the hand. This buffer functions grip and guide so that the user does not need a very tight grip when using a knife and can be more precise in cutting. Cutting boards in this set of kitchen utensils contain movable bulkheads or position. The insulation on this cutting board serves to make it easier for the user so that they do not need to hold tightly or even do not need to hold the material to be cut.
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