

Re-Engineering Arnis Sticks Bag for CTU-MC Martial Artists Using Design Thinking Principle

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Abstract

This study aimed to evaluate the old and new designs of the Arnis sticks bag and identify areas of improvement. The investigation was conducted in two phases, utilizing qualitative and quantitative methods. Findings from the one-tailed independent samples T-test showed a significant difference between the performance of old and new designs of the Arnis sticks bag under the considered FEA criteria. The heuristics evaluation results also indicated that the new design was well-organized, consistent, comfortable, durable, secure, and satisfying. The Kano Model Analysis identified several features that provide customer satisfaction and dissatisfaction. Specifically, results showed that users like having and dislike not having compartment padding, cover, strap padding, and adjustable strap in the Arnis stick bag. However, attractive features like the expandable compartments, durable material, modern aesthetics, hanging loop, and buckle lock were not required but are highly appreciated. Based on the findings, the study recommended reducing complexity and improving the ease of use of the Arnis sticks bag. Incorporating features also classified as performance and continuously improving attractive features can add value to the product. Ultimately, the study provides valuable insights for future designers and researchers to improve the design of Arnis stick bags.

Keywords

Arnis Sticks Bag, Design Thinking Principle, Heuristics Analysis, Kano Analysis, One-tailed Samples t-Test

1. Introduction

Arnis sticks are the main components that distinguish Arnis from other sports. Keeping these sticks in a safe, durable, lightweight, and large-capacity bag prolongs their life and strength. Therefore, an Arnis bag is an essential part of an Arnis practitioner's equipment since it helps protect and organize their sticks when transporting or storing. However, these designs differ primarily in capacity, material, and ergonomics. Many Arnis stick bags have already existed on the market over the years, and even though they provide advantages over the Arnis sticks, most of these bags have also caused problems such as discomfort, especially for student-athletes. In developing the product design of the Arnis bag, it is critical to comprehend the fundamental requirements and standard processes. With those requirements, design thinking emphasizes the significance of comprehending the demands and preferences of the user. Hence, the study

aims to re-engineer an Arnis stick bag using the Design Thinking Method to provide a better product for ten (10) Arnis stick athletes at CTU-Main Campus.

1.1 Objectives

The objective of this study is to re-engineer an improved design for the Arnis stick bag that meets the needs and preferences of athletes. It aims to identify features in the existing design that require improvements, evaluate the relationship between old and new designs, assess the performance of the new design under various usability heuristics, and evaluate specific features based on their impact. The goal is to provide athletes with an enhanced and user-centric Arnis stick bag design.

2. Literature Review

Arnis

Arnis, also known as Eskrima, Kali, and Garrote, is among of the world's oldest and most practical martial arts, distinguished by using weapons such as sticks, knives, and other bladed weapons and open-hand techniques. Despite its unclear origins, many believed Arnis originated around Mactan, Cebu, where Lapu-Lapu and his troops battled Spanish invaders headed by explorer Ferdinand Magellan in 1521 (UNESCO - International Centre of Martial Arts for Youth Development and Engagement, 2020). In 2009, Arnis became the national martial art and sport of the Philippines by virtue of Republic Act No. 9850. It also mentioned the different names of Arnis in various dialects in the country, such as Pananandata in Tagalog, Pagkalikali in Ibanag, Kabaraon and Kalirongan in Pangasinan, Kaliradman in Bisaya, and Didja in Ilokano. Nevertheless, they were all characterized by the utilization of swinging and twirling movements and striking, thrusting, and parrying methods for defense and offense. It is commonly done with one (1) or two (2) sticks or similar tools or with bare hands and feet used for hitting, blocking, locking, and grappling, using the same concept as canes (Official Gazettem 2009).

Arnis Stick Bag Development

Arnis bags are designed to carry Arnis sticks and other equipment, offering different sizes and designs based on stick quantity, length, and user preference. They are made of sturdy materials like canvas, nylon, or leather and feature multiple sections, straps or handles, and additional compartments for smaller items. Arnis bags protect and organize sticks during transportation, extending their lifespan (Arnisador, 2021; Maharlika Martial Arts, 2019). The bags can be constructed using tear-resistant and water-resistant fabrics, including those used in military bags, to ensure durability and protection. The choice of materials depends on the need for energy absorption, making them suitable for martial arts tools like Arnis sticks. Protective textiles, including those used in PPE, provide safety against various hazards, while antimicrobial textiles offer odor control and hygiene benefits (Paul, 2019; Hasan, 2020; Ahmad Ibrahim 2021; Rehan Gulati, 2021). Different bonding techniques are used to attach antimicrobial agents to textiles (Ahmad Ibrahim, 2021).

In developing the product design of the Arnis bag, it is essential to comprehend the fundamental requirements and standard processes. According to (Chang & Taylor, 2016), product development refers to the process of transforming a market opportunity and a set of assumptions about product technology into a marketable product. Babich (2018), on the other hand, described product design as the process of recognizing a market opportunity, accurately defining the problem, developing an appropriate solution, and testing the solution with real consumers.

Furthermore, Gobble (as cited in Yao & Li, 2014, 2022) stated that design thinking involves various tools and frameworks, and other disciplines driven by human-centered experience. Yao & Li (2022) also indicated that this methodology is a creative discovery process, which includes empathic understanding, problem defining, ideation, creation of prototype, testing, and evaluation. Babich (2018) states that empathizing is where researchers learn more from the target users through different instruments. Defining the problem is where they determine the needs and insights of the product's intended users. Moreover, ideation is the phase of brainstorming and freely generating a range of potential solutions, which can be done individually or as a group. Next is the prototyping phase, where designers create a model or set of models to test their hypotheses. Ultimately, testing and evaluation are where users try the new product design and give some feedback. In summary, the design principle thinking conceptual framework for evaluating the designs for the Arnis sticks bag emphasizes the significance of comprehending the demands and preferences of the user as well as the cultural and historical background of the practice of Arnis. Designers can produce a bag that not only fulfills a functional need but also sustains the users' requirements, experience, and other aspects of product design.

Donoghue (2023) determined some practical tools and techniques in the empathizing phase or user research. First on the list is the identification and understanding of the users and their needs, which can be accomplished through interviews or direct conversation. Direct observation of the users' behaviors where a certain product or item is used also provides proponents with an in-depth perception of how a product is used in a particular context. As per Gupta (2023), observation allows researchers to witness the interaction between the product and its environment.

Al-Shamrani & Mohamed (2020) identified comfort, ease of use, functionality, aesthetics, safety, productivity, and ease of movement as essential ergonomic factors in designing pilgrims' bags. They used a self-made questionnaire to gather data and analyzed it through information tables. Peruzzini, Grandi, & Pellicciari (2017) highlighted feedback and interaction support as important UX metrics, which can be measured through techniques like eye-tracking, heuristic evaluation, and interviews. Heuristic evaluation, a technique used by professionals to assess usability, relies on general guidelines and heuristics. Johner (2019) outlined Norman Nielsen's ten heuristics for user interface design. Viray (2018) described heuristic evaluation as an empirical method for measuring usability, while Khajouei, Gohari, & Mirzaee (2018) emphasized the effectiveness of checklist heuristic evaluation in uncovering problems. Ranked response analysis and appropriate statistical treatments are used depending on the data and research topic.

The Kano Model, as suggested by Ishak (2020), is a widely used tool in product design and development for identifying customer demands and measuring their impact on customer satisfaction. It prioritizes features based on their ability to satisfy consumers. The model categorizes customer needs into five types: fundamental, performance/satisfiers, excitement/delighters, neutral qualities, and reversal attributes. Fundamental needs are basic requirements, and their absence leads to dissatisfaction. Performance/satisfiers directly contribute to customer satisfaction, while excitement/delighters exceed expectations and result in high satisfaction. Indifferent qualities have no significant impact on satisfaction, and reversal attributes cause unhappiness when present and satisfaction when absent. Designers can use the Kano Model to evaluate the Arnis bag design by surveying customer expectations, identifying features that increase satisfaction, and prioritizing aspects that will positively impact consumer satisfaction (Hessing 2023; Greger 2020).

3. Methods

In the qualitative phase, a pre-assessment survey was conducted with 10 arnis stick athletes to gather information about their experiences with existing arnis bags. The results are analyzed and used to generate ideas for the new design. The qualitative methods focused on assessing the existing Arnis stick bags in the market, while the quantitative methods focused on a comparative evaluation of the existing and newly produced Arnis stick bags.

According to Philips (2017), 5 to 8 evaluators are recommended for identifying the majority of usability problems in Heuristics Analysis, with more than 10 evaluators not significantly improving results. Zach (2021) noted that there is no specific minimum number of participants required for conducting a t-test, but if assumptions are not met, reliability issues may arise, including participant numbers. Dhiman (2023) suggested that typically 15 to 20 participants are sufficient for analyzing data using the Kano model, providing manageable yet substantial data. Despite a limited number of willing participants, the study included 10 respondents, which accounted for more than half the population of arnis athletes (15). The survey was deemed reliable, with the qualitative phase focusing on comparing two designs and the heuristics analysis enhancing product usability during early development stages. These phases were effective in establishing the new design's effectiveness, while the Kano Analysis assessed features contributing to user satisfaction.

In the quantitative phase, a prototype of the new design is created and tested with 10 participants, who also evaluate the old design for comparison. Data is gathered through comparative analysis, heuristics analysis, and Kano analysis.

4. Data Collection

The study began by conducting a literature review to identify relevant processes and methods to be applied in the study. With sufficient information, the researchers processed their approval letter to conduct their data gathering survey. The survey had two phases: the pre-assessment evaluation, which was conducted based on the old design of the Arnis sticks bag, and the post-prototype data collection, which was done after creating a new design of the Arnis sticks bag where it consisted of three surveys: the comparative survey, heuristics survey, and Kano survey. However, the pairwise comparison method was also part of the process to identify the consistency ratio of the responses of the

participants. Using the analysis tools, the final output was generated to address customer satisfaction with the newly designed Arnis sticks bag.

Table 1. Kano Model five-point scale matrix

| | | DYSFUNCTIONAL (Feature Absent) | | | | | |
|---------------------------------|--------------|-----------------------------------|--------------|--------------|--------------|--------------|------------------|
| | | Like it | Expect it | Neutral | Live with it | Dislike it | |
| | | 1 | 2 | 3 | 4 | 5 | |
| FUNCTIONAL (Feature Present) | Like it | 1 | Questionable | Attractive | Attractive | Attractive | Performance |
| | Expect it | 2 | Reverse | Questionable | Indifferent | Indifferent | Must-be Features |
| | Neutral | 3 | Reverse | Indifferent | Indifferent | Indifferent | Must-be Features |
| | Live with it | 4 | Reverse | Indifferent | Indifferent | Questionable | Must-be Features |
| | Dislike it | 5 | Reverse | Reverse | Reverse | Reverse | Questionable |

5. Results and Discussion

5.1 Numerical Results

This section delineates the results and discussion of the three analytical tools used to develop the necessary results of the particular objectives in the study. Thus, it illustrates the Pairwise Comparison to rank the categories, One tailed Independent Sample t-Test to learn the possibility that the new design is better than the old one, the Heuristics Analysis to identify which aspect has the most usability issue, and lastly, Kano Analysis which prioritizes users' needs.

Table 2 comprised the calculations of priorities with regards to the pairwise comparison which was done through AHP Online System. The pairwise comparison data provides insights into the importance of different garment design categories as perceived by the participants. The data shows that user protection and fit were the most important categories, followed by ease of putting on and taking off. This suggests that when designing a garment, designers should prioritize these categories to meet the users' needs. On the other hand, values and role were the least important categories, indicating that they may not significantly impact the users' perception of the garment. The consistency ratio of 3.5% suggests that the participants' responses were reasonably consistent. Therefore, the data can be considered reliable, and the interpretation can be used as a basis for designing garments that meet the users' expectations. As per the claim of Xu et.al. (2008), the consistency rule suggested that it should be less than or equal to 0.1 or 10%.

Table 2. Priorities with Regards to Pairwise Comparison

| Categories | Priority | Rank | (+) | (-) |
|-----------------------------|----------|------|------|------|
| 1 User Protection | 26.5% | 1 | 9.3% | 9.3% |
| 2 Fit | 19.0% | 2 | 5.5% | 5.5% |
| 3 Ease of Putting On | 13.1% | 3 | 3.3% | 3.3% |
| 4 Ease of Taking Off | 13.1% | 3 | 3.3% | 3.3% |
| 5 Ease of Movement | 9.0% | 5 | 2.6% | 2.6% |
| 6 Comfortability | 6.3% | 6 | 2.0% | 2.0% |
| 7 Body Garment Relationship | 4.4% | 7 | 1.4% | 1.4% |

| | | | | | |
|------------------------------|--------------|------|----|------|------|
| 8 | Aesthetics | 3.1% | 8 | 1.0% | 1.0% |
| 9 | Art Elements | 2.3% | 9 | 0.9% | 0.9% |
| 10 | Role | 1.6% | 10 | 0.6% | 0.6% |
| 11 | Values | 1.6% | 11 | 0.6% | 0.6% |
| Number of Comparisons | | 55 | | | |
| Consistency Ratio | | 3.5% | | | |

Table 3 presented the decision matrix under the pairwise comparison method of the two Arnis sticks bags' design. The data represents the results of a pairwise comparison of 11 different options using a decision matrix. The values in the matrix show the relative importance of each option compared to every other option as per (Manliguez et al., 2023). The values on the diagonal represent the importance of each option compared to itself, which is 1. Using the matrix, it is possible to identify the most preferred option by calculating the weighted sum of each row. The option with the highest weighted sum is considered the most preferred. Nonetheless, the matrix shows that the preferences are relatively consistent, with values decreasing as the options become less preferred. This suggests that the participants' responses are reasonably consistent.

Table 3. Decision Matrix Under Pairwise Comparison

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 1 | 2.00 | 3.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 9.00 |
| 2 | 0.50 | 1 | 2.00 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 8.00 |
| 3 | 0.33 | 0.50 | 1 | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 7.00 |
| 4 | 0.33 | 0.50 | 1.00 | 1 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 7.00 |
| 5 | 0.25 | 0.33 | 0.50 | 0.50 | 1 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 6.00 |
| 6 | 0.20 | 0.25 | 0.33 | 0.33 | 0.50 | 1 | 2.00 | 3.00 | 4.00 | 5.00 | 5.00 |
| 7 | 0.17 | 0.20 | 0.25 | 0.25 | 0.33 | 0.50 | 1 | 2.00 | 3.00 | 4.00 | 4.00 |
| 8 | 0.14 | 0.17 | 0.20 | 0.20 | 0.25 | 0.33 | 0.50 | 1 | 2.00 | 3.00 | 3.00 |
| 9 | 0.12 | 0.14 | 0.17 | 0.17 | 0.20 | 0.25 | 0.33 | 0.50 | 1 | 2.00 | 3.00 |
| 10 | 0.11 | 0.12 | 0.14 | 0.14 | 0.17 | 0.20 | 0.25 | 0.33 | 0.50 | 1 | 1.00 |
| 11 | 0.11 | 0.12 | 0.14 | 0.14 | 0.17 | 0.20 | 0.25 | 0.33 | 0.33 | 1.00 | 1 |

To identify the common usability feature of the new design of the Arnis Stick Bag, Table 4 presented the heuristics evaluation results from the survey under the quantitative phase of the study. As per the Interaction Design Foundation (2021), heuristic evaluation involves experts using established rules to evaluate the usability of user interfaces in independent walkthroughs and report issues. This process can help design teams improve product usability early in development. As tabulated in the table, the first row in the table indicated the different heuristics used to evaluate the new design of the Arnis sticks bag. The mean of the results indicated that the strength of the product was on the comfortability of the user during usage. Meanwhile, the complexity of the product was the least part of the product with the value of 3.9. Based on the provided data, the heuristics evaluation for the product is generally positive. Thus, the mean scores for all the heuristics are above 4.0, indicating that users find the product easy to use, well-organized, consistent, comfortable, durable, secure, and satisfying. The heuristics of space and weight received the highest mean scores of 4.9 and 5.0, respectively, suggesting that users find the product spacious and lightweight. On the other hand,

complexity and easy to use received the lowest mean scores of 3.9 and 4.4, respectively, which suggests that some users find the product relatively complex and less easy to use. The matter might indicate that the product is foreign, therefore, the product's features might be stranger to the knowledge of the users. However, the median and mode scores are high for all the heuristics, indicating that most users agree on the positive evaluation. Overall, the product met the heuristics evaluation criteria of usability and user satisfaction.

Table 4. Heuristics Evaluation Descriptive Statistics

| | Mean | Standard Error | Median | Mode | Standard Deviation | Sample Variance | Range | Minimum | Maximum | Sum | Count |
|-----------------------|------|----------------|--------|------|--------------------|-----------------|-------|---------|---------|-----|-------|
| Easy to Use | 4.4 | 0.2 | 4.5 | 5.0 | 0.7 | 0.5 | 2.0 | 3.0 | 5.0 | 44 | 10 |
| Space | 4.9 | 0.1 | 5.0 | 5.0 | 0.3 | 0.1 | 1.0 | 4.0 | 5.0 | 49 | 10 |
| Organization | 4.8 | 0.1 | 5.0 | 5.0 | 0.4 | 0.2 | 1.0 | 4.0 | 5.0 | 48 | 10 |
| Consistency | 4.6 | 0.2 | 5.0 | 5.0 | 0.5 | 0.3 | 1.0 | 4.0 | 5.0 | 46 | 10 |
| Comfortability | 5.0 | 0.0 | 5.0 | 5.0 | 0.0 | 0.0 | 0.0 | 5.0 | 5.0 | 50 | 10 |
| Weight | 4.7 | 0.2 | 5.0 | 5.0 | 0.7 | 0.5 | 2.0 | 3.0 | 5.0 | 47 | 10 |
| Complexity | 3.9 | 0.4 | 4.0 | 5.0 | 1.2 | 1.4 | 3.0 | 2.0 | 5.0 | 39 | 10 |
| Durability | 4.5 | 0.2 | 5.0 | 5.0 | 0.7 | 0.5 | 2.0 | 3.0 | 5.0 | 45 | 10 |
| Scarcity | 4.6 | 0.2 | 5.0 | 5.0 | 0.5 | 0.3 | 1.0 | 4.0 | 5.0 | 46 | 10 |
| Satisfaction | 4.8 | 0.1 | 5.0 | 5.0 | 0.4 | 0.2 | 1.0 | 4.0 | 5.0 | 48 | 10 |

For the final process of the research, the Kano Analysis were used to identify the priorities and needs of the user with regards to the new design of the Arnis Stick Bag. Among the several methods in product design and development, Ishak (2020) suggested that Kano Model is extensively used as a beneficial tool for identifying customer demands and measuring the impact of addressing customer wants on levels of customer satisfaction. Based on the Kano model analysis, the features are classified into six categories: Attractive, Performance, Indifferent, Must-be, Reverse and Questionable. Table 7 showed that the expandable compartment, durable material, modern aesthetics, hanging loop, and buckle lock were classified as attractive features, meaning they provided satisfaction when present but do not result in dissatisfaction when absent. The compartment padding, cover, strap padding, and adjustable strap were classified as performance features, meaning they provide satisfaction when present and dissatisfaction when absent. The Kano model analysis did not find any feature to be classified as a reverse feature, meaning that its presence resulted in dissatisfaction and its absence resulted in satisfaction. However, the model did identify some features as indifferent, meaning that their presence or absence did not significantly affect customer satisfaction or dissatisfaction. Finally, the model identified the existence of a questionable feature, which was the feature with a quality level of zero or low-quality level, in this case, the padding of the compartment.

Table 5. Kano Evaluation Results

| Features | A | P | M | I | R | Q | Total | Category |
|--------------------------|---|---|---|---|---|---|-------|-------------|
| 1 Expandable Compartment | 4 | 2 | 0 | 2 | 0 | 2 | 10 | Attractive |
| 2 Compartment Padding | 2 | 4 | 1 | 1 | 0 | 2 | 10 | Performance |
| 3 Cover | 4 | 5 | 0 | 1 | 0 | 0 | 10 | Performance |
| 4 Strap Padding | 4 | 5 | 1 | 0 | 0 | 0 | 10 | Performance |
| 5 Adjustable Strap | 4 | 6 | 0 | 0 | 0 | 0 | 10 | Performance |
| 6 Durable material | 5 | 4 | 0 | 1 | 0 | 0 | 10 | Attractive |
| 7 Modern aesthetics | 5 | 3 | 0 | 2 | 0 | 0 | 10 | Attractive |
| 8 Hanging Loop | 5 | 3 | 0 | 2 | 0 | 0 | 10 | Attractive |
| 9 Buckle lock | 5 | 4 | 0 | 1 | 0 | 0 | 10 | Attractive |

5.2. Graphical Results

Associated with Table 5, Figure 1 illustrates the results from the Kano Analysis. Performance features, which provide high positive customer satisfaction and high negative customer satisfaction, include compartment padding, cover, strap padding, and adjustable strap. Meanwhile, durable materials, modern aesthetics, hanging loop, buckle lock, and expandable compartment, belong to the attractive features of the Arnis stick bag. These features provide high positive customer satisfaction and low negative customer satisfaction. The bag design does not have any indifferent and must-be features, at least from the results of the study.

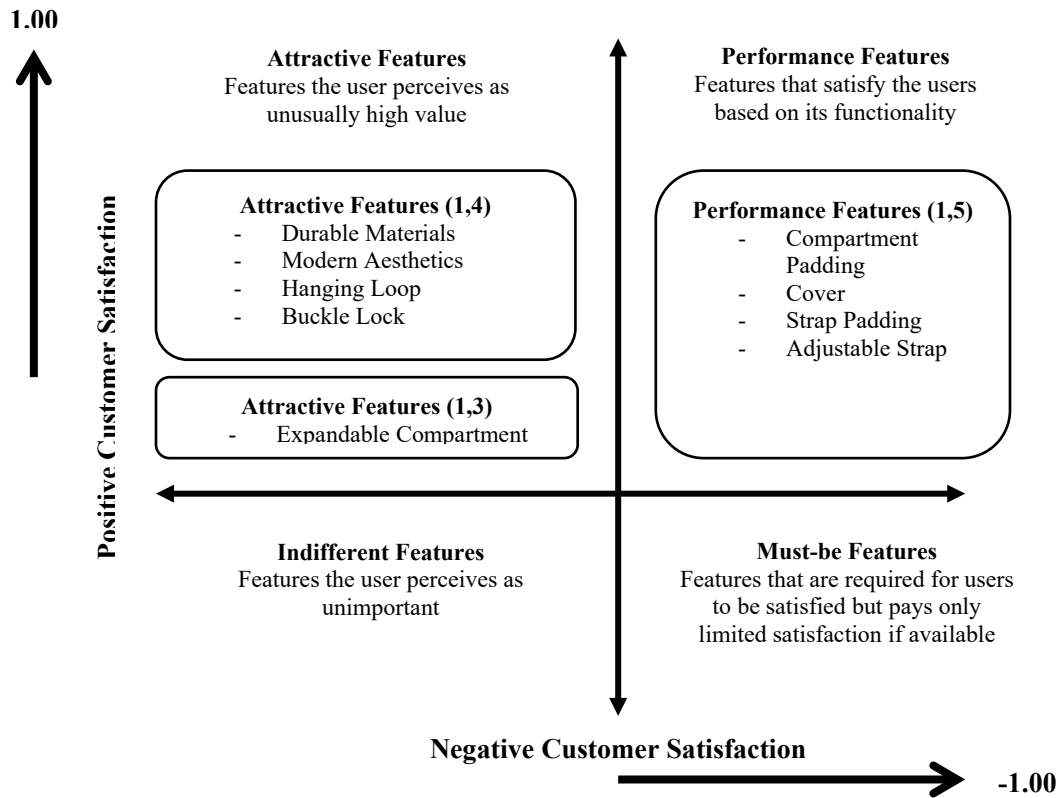


Figure 1. Kano Analysis Results

5.3 Proposed Improvements

Based on the analyses of the heuristic evaluation and Kano Model, it is recommended that future designers or researchers focus on two key aspects for the new design of the Arnis stick bag. Firstly, efforts should be made to reduce complexity and improve the bag's ease of use. This involves streamlining the design and ensuring a user-friendly experience. Secondly, incorporating features categorized as performance, which impact both positive and negative customer satisfaction, and continuously enhancing attractive features can significantly enhance the product's value. By following these recommendations, the Arnis stick bag can be optimized to provide a more intuitive and satisfying user experience, ultimately adding value and increasing market competitiveness.

5.4 Validation

Furthermore, to see if the new design is better than the old one, Table 7 presented the data results of the total rating per user of the old and new design of the Arnis stick bags. The results were treated using the one-tailed independent samples of t-test which basically compared the two different designs of the bag to determine the existence of significant difference between the two designs. Each respondent was able to provide their experience of the two designs and were able to generate their experiences into data that the researchers needed in order to arrive at a particular conclusion. According to LaMorte (2021), a one-tailed hypothesis is a research hypothesis that specifies the direction of the expected difference between two groups. It predicts that the mean of a sample group will be either less than or greater than the mean of a comparison group.

Table 6. Total Rating per user (Old vs. New)

| Respondent No. | OLD | NEW |
|----------------|-------|-------|
| 1 | 3.175 | 4.496 |
| 2 | 3.588 | 4.541 |
| 3 | 2.294 | 5.000 |
| 4 | 2.199 | 4.525 |
| 5 | 4.452 | 4.887 |
| 6 | 4.400 | 4.969 |
| 7 | 2.970 | 4.152 |
| 8 | 2.862 | 4.221 |
| 9 | 3.482 | 4.548 |
| 10 | 2.321 | 4.513 |

From the data provided by the total rating per user, the researchers were able to perform one-tailed independent samples T-test to determine if there was a significant difference between the old and new design of the Arnis sticks bags. Table 8, on the other hand, showed that the null hypothesis stated that there was no significant difference between the mean ratings of the two bags, while the alternative hypothesis stated that the mean rating of the new bag was significantly higher than the mean rating of the old bag.

The present study conducted an analysis involving the calculation of the t-statistic ($t\text{-Stat} = 5.1538$), degrees of freedom ($df = 11$), and p-value ($p\text{ one-tail} = 0.0002$) based on the available sample data. The t-test results provided evidence supporting a significant disparity between the mean ratings of the old and new Arnis stick bags. Specifically, the mean rating of the new bag was found to be significantly higher compared to the old bag, as indicated by the t-statistic value of 5.1538 and a p-value of less than 0.001. It is worth noting that a standard α level of 0.05 was employed, whereby a lower α level increases the difficulty of rejecting the null hypothesis, while a higher α level renders it easier (Loftus, 2022). Consequently, the null hypothesis was unequivocally rejected, leading to the conclusion that a significant difference exists between the mean ratings of the old and new Arnis stick bags. More specifically, the new Arnis stick bag received significantly higher ratings compared to its predecessor. It highlighted the positive impact of the design changes implemented in the new bag, as it resulted in improved customer satisfaction and perception of the product.

Table 7. t-Test Two-Sample Assuming Unequal Variances Results

| | <i>New</i> | <i>Old</i> |
|------------------------------|------------|------------|
| Mean | 4.5852 | 3.1743 |
| Variance | 0.0834 | 0.6660 |
| Observations | 10.0000 | 10.0000 |
| Hypothesized Mean Difference | 0.0000 | |
| df | 11.0000 | |
| t Stat | 5.1538 | |
| P(T<=t) one-tail | 0.0002 | |
| t Critical one-tail | 1.7959 | |

6. Conclusion

Based on the findings presented, it can be concluded that the new design of the Arnis sticks bag is significantly different from the old design and has been well-received by users. The heuristics evaluation results show that the product meets the criteria for usability and user satisfaction. Additionally, the Kano model analysis provides insight into the features that are important to users, with some features providing satisfaction when present and not causing dissatisfaction when absent, while others are performance features that provide satisfaction when present and dissatisfaction when absent. No feature was identified as a reverse feature, and some features were indifferent. The analysis also highlights a potential issue with the padding of the compartment, which received a low quality level score. Overall, the findings suggest that the new design of the Arnis sticks bag has the potential to improve the user experience, although some improvements may be necessary to optimize certain features.

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