

ORIGINAL ARTICLE**KANSEI EVALUATION OF UNIVERSAL SERIES BUS (USB) CHARGING CABLE DESIGNS**

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ABSTRACT

Moving towards Industry 4.0, the use of Universal Serial Bus (USB) charging cable is a need among the users of smartphones whether android, iPhone, or others. Currently, many third party manufacturers produce USB charging cable with their own brand to fulfil the demand. However, the lifetime, design, and function of USB charging cable somehow may not meet user expectations. In the competitive market, it is important to know what are the user preferences regarding the existing USB charging cable design in the market especially in Malaysia. The objective of this study is to investigate affective aspect of USB charging cable perceived by the users and how they can be relating to product specifications. A survey at 30 stores around Klang Valley was conducted to find information regarding the current USB charging product in market and three selected designs were chosen based on the popularity and suggested by the store personnel. Then the Kansei online survey was done, in which respond from 111 volunteers- 65 males and 46 females- age between 18 to 30 years old [mean = 23.33; SD = 1.73] were collected using Google forms survey. The respondents were asked to rate the three-designs based on Kansei words given. The data was analyzed to find the mean scores for the three selected designs -Design A, Design B, and Design C- in this study. It was found that Design C [mean=3.62; S= 0.2511] are the most preferred design, followed by Design B [mean=3.58; SD= 0.1904] and Design A [mean=3.28; SD= 0.3213]. Then, one-way ANOVA model was utilized (SPSS Version 23), and the finding shows that the difference between the three selected designs were significant [F (23,6) = 4.211, p = 0.040]. Design C becomes most preferred compared to other design due to its futuristic appearance, lightweight to carry, and more pleasant to hold which were agreed by most respondents. As a result, the subsequent data may serve to prove informative guideline for USB charging cable manufacture to design and produce the product that meet user preferences.

Keywords: Kansei Evaluation, Kansei Word, USB Charging Cable, User Preferences, Smartphone.

INTRODUCTION

The use of smartphone nowadays become one of the requirements in daily life. According to a survey done by Malaysian Communications and Multimedia Commission (MCMC) in 2017, the statistic of smartphone user in Malaysia increased from 68.7% in 2016 to 75.9% in 2017 (Malaysian Communications and Multimedia Commission, 2017). The increasing pattern shown perhaps due to the advancement of technology and its ability to deliver various functions that comparable with computer. For instant most users use smartphone to: make voice call; anticipate the social networking - Facebook, Twitter, and Instagram; checking email; utilize the modern apps; or simply browsing the internet. These activities require more power source to support the operation which lead the user to charge their smartphone more frequently.

For Android users, the low-level battery will turn the battery icon to yellow at 30% and notification will pop up when battery left with 15% (Ferreira, Dey, & Kostakos, 2011). This may cause anxiety to the users and make them wanting to immediately charge their device. Similar

scenario is assuming to applies to other operating systems. Although the wireless charging becomes popular these day, most smartphone users prefer to use Universal Serial Bus (USB) cable to charge their device since it is more convenience and supported by most devices. From customer point of view, there are two importance factors that lead to customer satisfaction which are functional and affective (Khalid, 2001). This situation encourages many third-party companies to produce variety designs of USB charging cables to meet customer preferences. However, the lifetime, design, and function of the USB charging cable somehow may not meet user preferences. In the competitive market, it is important to know what are the user or buyer preferences regarding the existing USB charging cable design in the market in general, more specifically, in Malaysian context.

Therefore, this study was conducted to obtain user preferences about USB charging cable by using Kansei evaluation. The word Kansei means the state of knowledge, emotion, and sentiment are harmonized, and the person who is rich in emotion and sentiment, adaptive, warm and responsive also known as the people with rich Kansei (Lokman, 2010). In other words, Kansei is

the “psychological feeling” a person has with product, situations or surroundings (Nagamachi, 2018). To evaluate Kansei - in this study, the technique is to measure the subjective perception of physical properties in scale 1 until 5: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; and 5= strongly agree (Vieira, et al., 2017).

In this study, Kansei Words were used to denote customer’s impression and feeling about USB charging cable. This study aims to investigate affective aspect of USB charging cable perceived by the users and how they can relate to product specifications using Kansei evaluation.

METHODS

Determining the popular USB charging cable designs

In order to find out the most trending and popular design of USB charging cable in Malaysia’s market nowadays, a survey was conducted at thirty stores in Klang Valley metropolitan area. Each store’s personnel were asked for their best-selling USB charging cable and its specifications were observed. The specifications considered in the survey were: (i) current capacity; (ii) length of the cable; (iii) material of the cable; and (iv) design of the wire. From the survey, the three most popular USB charging cables were chosen, namely Design A, Design B, and Design C (refer Figure 1).



Figure 1: The three selected designs with its specifications: Left: Design A (Lazada.com, 2018); Middle: Design B (Hococase, 2018); Right: Design C (REMAX Official Store, 2018)

Design A is from WK brand with model WDC-023 (Lazada.com, 2018). It is made from Polyvinyl Chloride (PVC) wire with flat design. With one-meter length, this model has current capacity of 2.4A. Design B is X22 from Hoco (Hococase, 2018). It has highest current capacity with 5A. Similar to Design A, X22 also has one-meter length of wire. The wire is made from nylon with weaved wire. Design C is Remax Zingalloy Emperor RC-054M (REMAX Official Store, 2018)

with current capacity 2.1A. It is made from eco-friendly Thermoplastic Elastomer (TPE) with common rounded wire but with L-shape connector.

Determining the Kansei Words

Kansei words were collected from product packaging, advertisements, and websites. In total, there are ten Kansei words were chosen. They are futuristic, delicate, attractive, convenience (use), convenience (holding), good quality, efficient, durable (wire), durable (connector), and anti-tangle. The simple description of each word was also accompanied the word to avoid any misunderstanding (refer to Figure 2)

- Futuristic** (modern design)
- Delicate** (lightweight to carry)
- Attractive** (eye-catching appearance)
- Convenience** (ease to use)
- Convenience** (pleasant to hold)
- Good Quality** (good grade)
- Efficient** (fast charging)
- Durable** (wire)
- Durable** (connector)
- Anti-Tangle** (not easily to twist)

Figure 2: The Ten Chosen Kansei Words

Preparing the Online Survey form

An online survey form was designed using the Google form. It involves the three selected designs (Figure 1) that will need to be evaluated by respondents by using the ten Kansei words chosen (Figure 2). The evaluation will be based on the five-point-scales, 1 until 5 which are: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; and 5= strongly agree. Figure 3 illustrates the snapshot of the online survey form created.

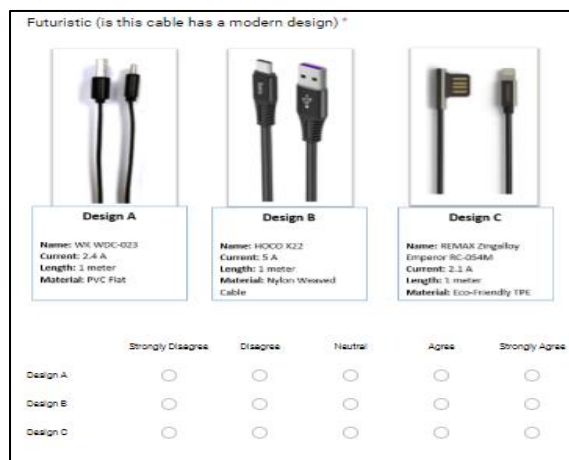


Figure 3: Snapshot of the Online Survey form

Kansei Online Survey

A Kansei online survey was conducted, in which the link to the Google form created was spread

through social medias - WhatsApp's group and Facebook.

Respondents: 111 respondents - 65 males and 46 females - between 18-30 years of age [mean = 23.33; SD = 1.73] were completed the survey. They are volunteered community from International Islamic University Malaysia, Malaysia.

Procedure: A respondent was asked to rates the three designs against each Kansei word. By looking at the picture of the three designs, the respondents require to evaluate the relationship between the designs specification against the Kansei words. Description of the design specification were also given to avoid confusion of the meaning of the Kansei words.

Dependent Variable & Hypothesis: The dependent variable is the mean score of the rating scale. The mean value was calculated in term of the overall score for each design, as well as for each Kansei word. The null hypothesis (H_0) is that the mean value for all three designs are same ($\mu_{\text{DesignA}} = \mu_{\text{DesignB}} = \mu_{\text{DesignC}}$). The alternative hypothesis (H_1) is that, at least one of the mean value is differ from the other ($\mu_{\text{DesignA}} \neq \mu_{\text{DesignB}} \neq \mu_{\text{DesignC}}$).

RESULTS AND DISCUSSION

Raw data from the 111 respondents that were obtained through the online survey were sorted in SPSS (version 23) and the overall mean score for the three designs were calculated. Figure 4 illustrates the overall mean score for the three designs - Design A, Design B, and Design C. As can be seen from Figure 4, Design C has the highest mean score with 3.62 [SD = 0.25], follows by Design B with mean score of 3.58 [SD = 0.19], while Design A has the least mean score with only 3.28 [SD = 0.32].

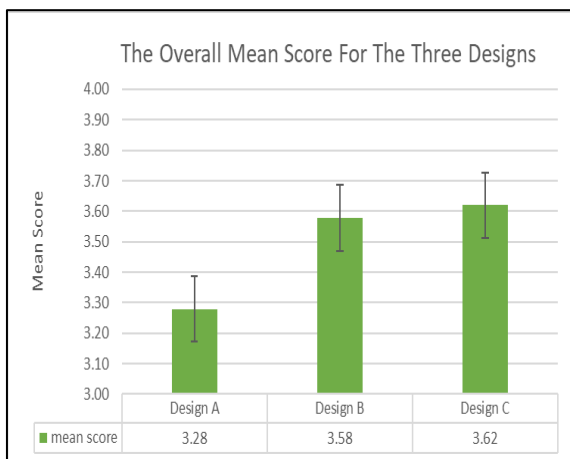


Figure 4: The overall mean score for the three designs

One-way ANOVA model was then utilized to check the significant different among the three designs being evaluated. The result reveals that

the difference between the three designs was significant [$F(23,6) = 4.211, p = 0.040$].

Further observation was done in order to discuss the score of the three designs based on each Kansei word. For this purposes, the mean score for each Kansei word for the three designs were calculated as listed in Table 1.

Table 1: Mean Score for overall and each Kansei Words for the three designs

Kansei Words (KW)	Design A	Design B	Design C
Futuristic (modern design)	2.74	3.31	3.89
Delicate (lightweight to carry)	3.67	3.57	3.85
Attractive (eye-catching appearance)	2.98	3.48	3.95
Convenience (Ease to use)	3.60	3.78	3.50
Convenience (Pleasant To hold)	3.67	3.57	3.85
Good Quality (good grade)	3.15	3.67	3.53
Efficient (Fast Charging)	3.25	3.90	3.59
Durable (Wire)	3.32	3.63	3.42
Durable (Connector)	3.44	3.59	3.42
Anti-Tangle (Not Ease To Twist)	2.97	3.28	3.20
Mean Score	3.28	3.58	3.62

From Table 1, it can be seen that Design C was preferred for its futuristic and delicate design with mean score of 3.89 and 3.85 respectively. Moreover, in term of attractiveness and convenience (more pleasant to hold), Design C also has the highest mean score with 3.95 and 3.85 each. However, Design B has the best mean score for the other six Kansei Words which are convenience - easy to use ($\mu = 3.78$), good quality ($\mu = 3.67$), efficiency ($\mu = 3.90$), durable both on wire ($\mu = 3.63$) and connector ($\mu = 3.59$) and not easily to twist ($\mu = 3.28$). None of the mean scores for Design A were top the list.

Design C has the best mean score for futuristic and attractive. It perhaps that Design C with L-shape connector is more likeable in comparison to the others. In term of delicate, Design C also has the highest mean score due to the material used, Thermoplastic Elastomer (TPE) which has the lowest density compared to other materials - Polyvinyl Chloride (PVC) and Nylon that are used in Design A and B respectively (Stelray.com, 2016) (Amin & Amin, 2011)

Design B is observed to be more convenient (ease of use) with the best mean score of 3.78. This is perhaps because the design and shape of connector of Design B is easier to be use instead of L-shape connector in Design C as the gliding comfort and performance of personal care and wellness products strongly influenced by sliding friction behavior of human skin (Hendriks & Franklin, 2010). From the survey, Design B also has the highest mean score for the quality. The contribution factor for this score perhaps was

due to the material of nylon that is used in the most wire application because its abrasion, cut-through, excellent resistance to hydraulic fluid, and most inert to fungus of TPE (United State Army Material Command, 1969).

Smartphone battery is charging when a current pass through them and higher current charge battery faster, but there's a limit to what they can take (Hill, 2018). With 5A current capacity, Design B has the fastest charging rate in comparison to Design A and Design C with current capacity of 2.4A and 2.1A respectively. With the best mean value goes to Design C, it shows that the users prefer a USB charging cable that is able to recharge the smartphone the fastest. Design B with nylon weaved cable has the highest mean score for durable wire and the connector. This is perhaps because Design B (with a good material and shape of connector) can withstand in a longer period in comparison to Design A and C, which makes it was preferred.

Despite that Design B scored highest in six categories, in overall, Design C is the most preferred. This is perhaps due to the respondents' age factor, who were between 18-20 years of age [mean = 23.33; SD = 1.73] which can be considered as "youth generation" and will readily grasp any new changes in their life (Syed Mohamed & Ooi, 2016).

CONCLUSION

As a conclusion, the most preferable design for this study is Design C with the overall mean score of 3.62/5.00 scale in comparison to Design A and Design B with mean score of 3.28 and 3.58 respectively. Design C has been rated as the best design in several Kansei words. It was rated to be the most futuristic and attractive design as it has L-shaped connector type which is unique from the standard shape. From the type of material point of view, Design C which use TPE in the product is rated as the most delicate (lightweight). The use of TPE as the material also contributed to comfortability of user to hold the cable.

Although Design C is the most favourable design, there were several aspects in Design B that preferred by the respondents which were ease to use, good quality, efficient, anti-tangle and durable in term of connector and wire. These preferred maybe caused by the nylon weaved cable and the ability to charge faster with 5A current capacity.

As for the recommendation for future design of USB charging cable, there were several characteristics of Design B that can be imply on Design C so that more preferred design can be produced. The nylon material can be used for wire material for as it contributes to the high

score in good quality and anti-tangle Kansei words. For more efficient, Design C current capacity should be increase as it causes USB cable more reliable and shorten charging time. Design C also need charge the connector as connector in design B more durable and convenient to used compare to current connector in Design C.

DISCLAIMER

It is important to note that, this study is not to evaluate and compare a particular brand of USB charging cable, but rather to evaluate user preferences on the USB charging cable design criteria in general, based on the Kansei words selected. Thus, the results and discussion of this study should not reflect a particular brand of USB charging cable.

ACKNOWLEDGMENTS

The study was supported by the Department of Manufacturing and Materials Engineering, International Islamic University Malaysia, through the Special Topic in Engineering Manufacturing course.

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