PalArch's Journal of Archaeology of Egypt / Egyptology

CONSTRUCTING KANSEI ENGINEERING METHODOLOGY BASED ON CONSUMER EXPERIENCES IN CHILDREN'S LUGGAGE

Mingrun Wang[1], Nazlina Shaari[2], Velu Perumal[3]*

[1]Department of Industrial Design, Faculty of Design and Architecture, Universiti Putra Malaysia, Serdang, Malaysia

[2]Malaysian Research Institute on Aeging, Universiti Putra Malaysia, Serdang, Malaysia

[3]Department of Industrial Design, Faculty of Design and Architecture, Universiti Putra Malaysia, Serdang, Malaysia

Email: [1]mrun.wang@foxmail.com, [2*]nazlinashaari@upm.edu.my, [3]velu@upm.edu.my

Mingrun Wang, Nazlina Shaari, Velu Perumal. Constructing Kansei Engineering Methodology Based On Consumer Experiences In Children's Luggage-- Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(10), 49-69. ISSN 1567-214x

Keywords: Children's Luggage, Kansei Engineering Methodology, Consumer Experience.

ABSTRACT

Nowadays, there are many children's luggage on sale in the Chinese market. However, the proportion of children owning children's luggage is still low. The lack of correct value determination of children's luggage leads to consumers not having the desire to buy the luggage. Furthermore, understanding consumer experiences is the key to determine the value of children's luggage. Previous researches did not analyse the consumer experiences of children's luggage. The lack of understanding of the consumer experiences of children's luggage leads to the value of the luggage cannot be correctly determined. These two problems have caused children's luggage to lose their competitive advantages in the children's consumer market.Therefore, this study targets to support the sales of children's luggage and enhance the development of children's luggage industry through using Kansei Engineering methodology. The findings found that the performance and appearance of children's luggage were the two important components that parents will pay attention to when purchasing a luggage for their children. Children's luggage with more convenience, comfortableness, safety, durability, pleasure and authority have a higher competitive advantage. Design elements of simple internal structure, convenient sliding moving mode, simple pull/push moving mode, smooth and hard shell, comfortable and soft shell, flexible and stable double row wheel, comfortable U-shaped telescopic handle, comfortable button opening mode, smooth or functional shape should be selected to design a high value

children's luggage. The findings will help designers to design a children's luggage that provides more competitive advantages, thus promoting children's luggage sales and improving the children's luggage industry.

INTRODUCTION

Nowadays, children from first-tier cities in China often have to travel during the holidays. One reason is their parents often have to take them back to their hometowns to visit relatives, another reason is that their parents like to take them out to broaden their horizons. Children 6-12 years old are in a critical period of growth and learning. Every time they travel, they have a lot of belongings. These belongs include not only daily necessities but also school supplies, and even toys they usually play. Having children's luggage can not only facilitate children to manage their own belongings and cultivate their independent abilities, but also reduces the burden on parents. Therefore, it is better for children having their own luggage. During the travel, the role of children's luggage is very useful. However, the proportion of children owning children's luggage is still low until now.

This study has been conducted at airports and train stations in Guangzhou during the Spring Festival in 2019. At the airport, 50 families with children were observed, and only 9 children had their own children's luggage. At the train station, 50 families with children were observed, and only 8 children had their own children's luggage. Therefore, the proportion of children with children's luggage is very low, less than 20%.

Yue (2012) indicated that although there are many styles of children's luggage on the market, most of these luggage are not specially designed for children. Actually, these luggage are the small-sized adults' luggage. Unprofessional children's luggage cannot meet the needs of parents' high quality. The lack of correct value determination of children's luggage leads to consumers not having the desire to buy the luggage. Furthermore, understanding consumer experiences is the key to determine the value of children's luggage (Hilletofth et al., 2010; Randmaaet al., 2012; Potraet al., 2018). However, previous researches did not analyse the consumer experiences of children's luggage based on the summary of this study. Therefore, the lack of understanding of the consumer experiences of children's luggage leads to the value of the luggage cannot be correctly determined. These two problems have caused children's luggage to lose their competitive advantages in the children's consumer market. Children's luggage can have a huge market if they can meet the needs and desires of consumers in China. Because China has a huge population of children, and Chinese parents are willing to invest in growth and education for their children (Hannum& Park, 2012; Wan &Toppinen, 2016), Therefore, in order to support the sales of children's luggage and the development of the children's luggage industry, there is a need to determine the value of children's luggage in order to design a children's luggage with more competitive advantages.

LITERATURE REVIEW

In today's market, competition for children's products is very fierce, especially e-commerce products. Companies that experience mature business environments should organise themselves to understand the way customer value is created and the manner these processes may be coordinated to provide value (Kalbach, 2016). Effective value chains can generate competitive product advantages (Markopoulos, et al., 2008). Therefore, to design a children's luggage with more competitive advantages, companies need to determine the value of children's luggage to improve their product competitive advantages and support their sales. Value of a product reflects the consumers' desire to retain or obtain a product (Neap &Celik, 1999). To determine the value of products, Lokman (2010) has summarized four design methods for understanding the consumer's needs and desire, these design methods are Quality Function Deployment (QFD), Conjoint Analysis, Voice of Customer (VoC), Kansei Engineering (KE) (Lokman, 2010).

1) QFD is a powerful technique to know the customer requirements and accordingly design new products and services, and it is also useful to modify the features and designs of its existing products according to the changed requirements of the customers (Singhet al., 2018).

2) Conjoint Analysis is a method for weighting different product concepts against each other in order to identify which product attributes are preferred by a certain consumer group and the price they are willing to pay for it (Lokman, 2010). Conjoint Analysis is based on the consumers' ability to rank concepts with different content in order to make a clear decision on how desirable the concept is.

3) VoC describes the process of capturing a consumer's requirements as a market research technique that produces a detailed set of consumer wants and needs (Lokman, 2010). These needs are then organized into a hierarchical structure, and prioritized in terms of relative importance and satisfaction with current alternatives. VoC is generally conducted at the start of any new product, process, or service design initiative in order to better understand the consumer's needs and desire.

4) KE is a technology that unites Kansei into engineering realms in order to realize product that match consumer's needs and desire (Nagamachi, et al., 2008). It collects the consumer's Kansei experience and establishes mathematical prediction models of how the Kansei is connected to product physical characteristics. KE seeks to enhance the well-being of humans by exploring physiological and psychological factors that lead to satisfaction.

Although all the methods mentioned above have the same goal of designing a product to meet the needs and desire of the customers, KE has a major difference. QFD, Conjoint Analysis and VoC are to explore the explicit needs of consumers, thereby enhancing the value of a product. While KE is to discover the implicit needs of consumers, so that a guide to design a new concept of product could be established. KE is a human-centered design method for designing new products based on understanding need of consumer's emotions and senses (Shaari, 2010). Since the correct value determination of children's luggage requires an analysis of consumer

experiences, KEmethodology is an appropriate method to be used for determining the value of children's luggage.

KE methodology was found by Nagamachi in 1974, now the KE methodology is widely used in academia and industry. There are currently eight types of Kansei Engineering. KE Type I has been intensively investigated in product development, and it can be defined as the translating technology of a customer's feeling and image for a product into design elements (Lokman, 2010). Therefore, this study targets to use KE Type I to determine the value of children's luggage.

Lokman (2010) has summarized the stages of KE Type I. Kansei Dimension consists of three stages: a) Identification of Kansei. In this stage, the Kansei Words related to the product need to be identified. Because this study aims to determine the value of children's luggage, thus the Kansei Words need to associate with the value. Furthermore, value is a subjective experience (Felleret al., 2006), companies need to create value for their customers in the form of experience (Berry, Carbone & Haeckel, 2002). As a result, to determine the children's luggage value, it should relate the value of consumer experience. Theoretically, Experience Map can support Kansei Engineering to collect Kansei Words (Lokman, 2010). Therefore, this study can collect the Kansei Words associated with consumer experience through using Experience Map. b) Measurement of Kansei. Measurement of Kansei Kansei measurement can use physiological measures and psychological measures based on the needs of the research. c) Analysis of Kansei. Analysis of Kansei gives opportunity for one study to investigate the similar meanings, structure and the concept in consumer Kansei. Kansei analysis usually uses multiple data analysis, and the analysis commonly performed to analyse the consumers' Kansei includes correlation coefficient analysis, Factor Analysis, and Principal Component Analysis.

Overall, this study can use KE methodology to manage the children's luggage value. The Experience Map can use to insist KE methodology in collecting the Kansei Words related consumer experience. In this way, a research framework was formulated to determine the value of children's luggage, as shown in Figure 1.

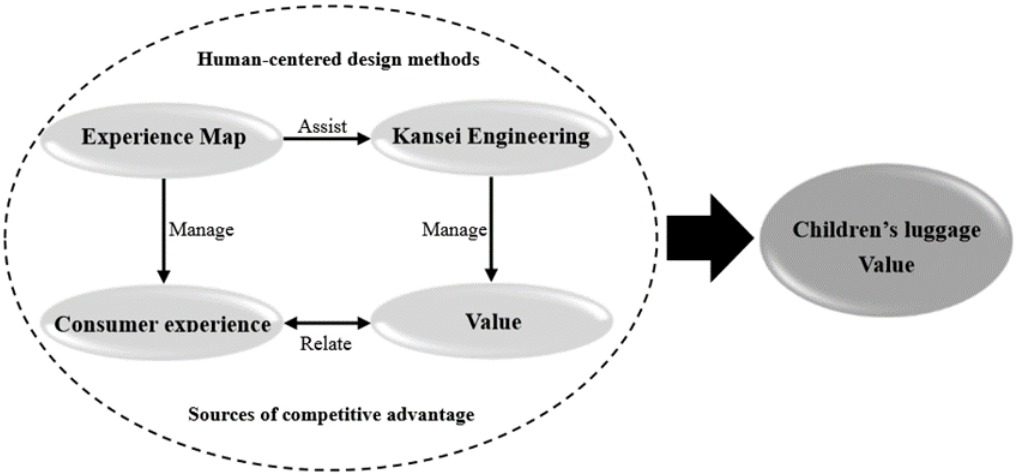

Figure 1: Research Framework

MATERIALS AND METHODS

The procedure of using KE Type I in this study was divided into four phases: a) Choice of domain. b) Identification of Kansei. c) Measurement of Kansei. d) Analysis of Kansei. The detail procedure of using KE methodology in this study is as follows:

Choice of domain

This study focuses on the product domain of children's luggage, and the consumer group of children's luggage is children from 6 to 12 years old.

Identification of Kansei

Selection of children's luggage samples

This study has conducted a research on understanding the current state of children's luggage on Tmall.com (i.e. a Chinese-language website for business-to-consumer online retailer). A total of more than 5000 children's luggage were selling on Tamll.com. Among these children's luggage, many of them were the same, these children's luggage of the same style will be removed. The remaining different types of children's luggage are mainly concentrated in 40 brands. These different styles of children's luggage are distinguished by their shapes, patterns, colors, internal structures, materials, internal structures, and functions, moving modes, opening methods, telescopic handles, wheel styles, sizes, weight, prices and brands. Thus, this study selected samples representing different categories from the children's luggage being sold on Tmall.com. Table 1 showed the partial list of the 45 items/categories classification that this study used. A total of 20 children's luggage samples have been selected, as shown in Table 2. Among these children's luggage, luggage sample 1 to 12 are ordinary children's luggage and luggage sample 13 to 20 are special children's luggage. These special

children luggage have special properties, such as remote control movement function, drawing function and so on.

Table 1: Item/Category Classification List

Items	Categories
Shape	1) Eggshell, 2) Rounded cuboid, 3) Vertical cuboid, 4) Horizontal cuboid, 5) Specific shape, 6) Variable shape.
Pattern	1) Cartoon character, 2) Cartoon (Free design).
Color	1) Yellow with pattern, 2) Pink/Red with pattern, 3) Blue/Green with pattern, 4) Black/white with pattern, 5) Pure color.
Material	1) Hard shell, 2) Soft shell.
Internal structure	1) 2 compartments with 0 divider pad, 2) 2 compartments with 1 divider pad, 3) 2 compartments with 2 divider pads.
Function	1) Basic function, 2) Extra function.
Moving mode	1) Pull/Push, 2) Ride, 3) Slide, 4) Remote control.
Opening method	1) Zipper, 2) Buckle.
Telescopic handle	1) T-shaped rod, 2) Inverted U-shaped rod.
Wheel style	1) Single row wheel, 2) Double row wheels.
Size	1) 14 inches, 2) 16 inches, 3) 18 inches, 4) 20 inches, 5) Others
Weight	1)1~2 kg, 2) 3~4 kg, 3) 4~6 kg.
Price	1) CNY0~200, 2) CNY200~400, 3) CNY400~600, 4) Others
Brand	1) Domestic brands, 2) Foreign brands, 3) Brand with anime characteristics.

Table 2: The Samples of Children's Luggage

No.	1	2	3	4	5
Brand	Barbie	America Tourister	Bromen	Zinza	Disney
Price	CNY 318	CNY 499	CNY 659	CNY 339	CNY 258
Material	Hard shell	Hard shell	Hard shell	Hard shell	Hard shell
Weight	1.8 kg	3.9 kg	2.9 kg	2.31 kg	1.8 kg
Size (inch)	18	25	20	18	16
Product					

No.	6	7	8	9	10
Brand	Disney	Samsonite	Zosed	Ddoto	Kindtrip
Price	CNY 198	CNY 478	CNY 198	CNY 158	CNY 175
Material	Hard shell	Hard shell	Hard shell	Hard shell	Hard shell
Weight	1.8 kg	2 kg	2.04 kg	1.8 kg	1.8 kg
Size (inch)	16	18	18	16	18
Product					
No.	11	12	13	14	15
Brand	Bouncie	Zhixing	Samsonite	Hello Kitty	E Du
Price	CNY 329	CNY 349	CNY 599	CNY 398	CNY 398
Material	Soft shell	Soft shell	Hard shell	Hard shell	Hard shell
Weight	1.56 kg	2.9 kg	2.0 kg	3 kg	3.8 kg
Size (inch)	16	17	18	20	18
Product					
No.	16	17	18	19	20
Brand	Muuhoo	Rastar	Ai Deng Bo	Zhi Xing	Ben Bat GoVinci
Price	CNY 699	CNY 385	CNY 1999	CNY 629	CNY 299
Material	Hard shell	Hard shell	Hard shell	Hard shell	Hard shell
Weight	2.5 kg	2.8 kg	5.5 kg	5.5 kg	1.2 kg
Size	18 inch	18	20	20	16
Size					

1) Selection of important consumer experiences for children's luggage

Companies need to create value for their customers in the form of experience (Berryet al., 2002). Consequently, to generate the children's luggage values, the Kansei Words should relate to consumer experience. Coincidentally, Experience Map is a tool to illustrate the consumer experience while

experiencing a product within a given domain. It can systematically analyse the actions, thoughts, emotions and potential route to reach a particular goal (Kalbach, 2016). Therefore, Experience Map can be a universal tool to assist KE Type I in collecting Kansei Words of children's luggage. Wang et al. (2020) have constructed an Experience Map to collect the Kansei Words that related to the consumer experience of children's luggage. Since the sample of the questionnaire is in the form of pictures, some Kansei Words that cannot be displayed through pictures and words will be removed. A total of 69 Kansei Words have been selected from the Experience Map of children's luggage, as shown in Table 3. These selected Kansei Words can be divided into two categories, one is the experience when buying the children's luggage, and the other is the experience when using the children's luggage.

Table 3: The Collected Kansei Words of Children's Luggage

Collection of Kansei words			
Appearance	1. Beautiful	**Brand**	28. Famous
	2. Cute		29. Good
	3. Cool		30. Trustworthy
	4. Interesting		31. Favorite
	5. Particular	**Price**	32. Cheap
	6. Fresh		33. Reasonable
	7. Popular		34. Expensive
	8. Childish	**Performance**	35.Easy to pack/unpack
	9. Meaningful		35(1). Well-organized
	10. Well-made		35(2). Comfortable
Internal structure	11. Good-looking		35(3). Safe
	12. Practical		36. Easy to move
	13. Considerate		36(1). Smooth
	14. Advanced		36(2). Controllable
	15. Creative		36(3). Labor-saving
	16. Adequate		36(4). Quiet
	17. Child-friendly		36(5). Comfortable
Material	18. Healthy		36(6). Safe
	19. Eco-friendly		36(7). Elegant
	20. Durable		37. Easy to store
	21. Lightweight		37(1). Collision-proof
	22(1) Comfortable (Telescopic handle)		37(2). Shake-proof
			37(3). Anti-lost
	22(2) Comfortable (Carry handle)		37(4). Comfortable
			37(5). Non-destructive
	22(3) Comfortable		37(6). Safe

	(Shell)		38. Easy to take in/out items
	22(4) Comfortable (Zipper/Buckle)		38(1). Comfortable
			38(2). Non-destructive
	22(5) Comfortable (Bag/Lining)		38(3). Safe
			39. Easy to maintain
Technology	23. Advanced		39(1). Comfortable
	24. Reliable		39(2). Non-destructive
Size	25. Small		39(3). Safe
	26. Suitable	**Special properties**	40. Important
	27. Big		41. Safe
			42. Fun
43. Do you want to buy a children's luggage of this style for your child?			

Measurement of Kansei

1) Design questionnaire by using Likert scale

A set of questionnaires was developed at this stage to investigate the values expressed in children's luggage samples. The questionnaire used Likert scale, 5-rating scale. The range of each Kansei word was set from 1 to 5, whereby the 1 means the minimum value for not at all, while the 2 means the value for slightly, while the 3 means the value for moderately, while the 4 means the value for very much, while the 5 means the maximum value for extremely.

Design population

For children's products, the interests of children and parents are relevant. Therefore, in order to facilitate understanding and explanation, this study defines both children and parents as users of children's luggage. Even though children are the main factors in influencing parents but parents are still function as decision maker (Perumal, 2012). Therefore, the target group decided in this study is parents with children between 6 and 12 years old, and these parents are from Guangzhou city.

Design sample size

This study calculated the sample size by using the following formula:

$ss = Z2^* p * (1 - p) / e2$

where:
ss is the sample size.

Z is the z-score associated with a level of confidence (e.g. 1.96 for 95% confidence level).
p is the sample proportion, expressed as a decimal (maximum variability of the population at 50%).
e is the margin of error, expressed as a decimal (e.g. 0.1 = ±10).

In generally, where the population is unknown, the sample size can be derived by computing the minimum sample size required for accuracy in estimating proportions by considering the standard normal deviation set at 95% confidence level (1.96), sample proportion (50% = 0.5) and the margin of error (0.05 = ±5). However, the questionnaire of this study has 1350 questions, and participants are required to spend a lot of time focusing on answering questions. Therefore, this study increased the margin of error to 10%. Finally, this study required minimum sample size will be around 96 for the population with a 95% confidence level, a 50% sample proportion and a 10% margin of error. In order to make the analysis more accurate, this study will increase the sample size to more than 96 parents.

Conduct pre-test survey

In order to ensure the reliability of the study, this study first conducted a pilot test through online survey.

Conduct main survey

After the successful implementation of the pilot test, this study conducted the main survey. A total of 151 parents, including 112 mothers and 39 fathers took part in the survey. These parents represented children of 95 girls and 56 boys, the ages of these children are between 6-12 years old. After the questionnaires were successfully recovered, this study will use SPSS 24.0 to analyseKansei value.

RESULTS AND DISCUSSION

In order to accurately determine the value of children's luggage, this study analyzed the data through using SPSS 24.0. First of all, this study performed a reliability test of the questionnaire. This test looks upon the score from Cronbach's coefficient alpha test. The obtained Cronbach's Alpha was 0.999, this value is far greater than 0.6, thus this study can continue to do the future analysis. To solve the research problem of this study, Factor Analysis (PA), Principal Component Analysis (PCA), K-means Cluster Analysis and Partial Least Square (PLS) analysis were used to determine the value of children's luggage.

Factor Analysis (FA)

Factor Analysis (FA) is commonly used to find psychological structure of Kansei that constitute the essential concept of Kansei of the domain under investigation (Lokman, 2010; Nagamachi, et al., 2008). For ordinary children's luggage, this study calculated the biggest three factors as shown in

Table 4. The three factors of ordinary children's luggage have a cumulative contribution of 90.27%. Factor 1 has a contribution of 85.87%, factor 2 has a contribution of 2.37%, and the factor 3 has a contribution of 2.02%. For Special children's luggage, this study calculated the biggest three factors as shown in the Table 5. The three factors of special children's luggage have a cumulative contribution of 91.381%. Factor 1 has a contribution of 59.34%, factor 2 has a contribution of 2.62%, and factor 3 has a contribution of 1.49%. Therefore, this study can confidently use factor 1 and factor 2 to construct the principal component sphere of Kansei Words.

Table 4: Factor Contribution table

Classification	Ordinary children's luggage			Special children's luggage		
Factors	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Eigenvalue	55.817	1.540	1.316	59.344	1.783	1.013
Variability (%)	85.872	2.369	2.024	87.270	2.622	1.489
Cumulative (%)	85.872	88.242	90.266	87.270	89.892	91.381

Table 5 and Table 6 list the top ten Kansei Words with the highest weight for the factors of ordinary children's luggage and special children's luggage. For ordinary children's luggage (in Table 5), it can see that Kansei Words associated with factor 1 such as "labor-waving", "easy to move", "smooth", "controllable" and "quiet" can be grouped together as "performance". As for factor 2, words such as "cute", "childish", "fresh", "interesting" and "beautiful" can be grouped together as "appearance". For special children's luggage (in Table 6), it can see that Kansei Words associated with factor 1 such as "easy to store", "safe", "comfortable", "smooth" and "reliable" can be grouped together as "performance". As for factor 2, words such as "childish", "interesting", "fresh", "cute" and "particular" can be grouped together as "appearance". All of these Kansei Words associated with factor 1 and factor 2 are related to the luggage design elements of telescopic handle, wheels, internal structure, shape, pattern, color and material. The results showed that whether it is a ordinary children's luggage or a special children's luggage, parents will value the performance and appearance of the children's luggage when purchasing.

Table 5: Factor Loading Table for Ordinary Children's Luggage

No.	Factor 1-Performance		Factor 2-Appearance	
1	36(3). Labor-saving	0.093	2. Cute	0.247
2	36. Easy to move	0.092	8. Childish	0.241
3	36(1). Smooth	0.087	6. Fresh	0.223
4	36(2). Controllable	0.083	4. Interesting	0.216
5	36(4). Quiet	0.082	1. Beautiful	0.208

6	37. Easy to store	0.080	5. Particular	0.205
7	22(5) Comfortable-Bag/Lining	0.077	3. Cool	0.153
8	20. Durable	0.077	10. Well-made	0.145
9	22(3) Controllable-Shell	0.075	7. Popular	0.145
10	36(6). Safe	0.074	11. Good-looking	0.120

Table 6: Factor Loading Table for Special Children's Luggage

No.	Factor 1-Performance		Factor 2-Appearance	
1	37. Easy to store	0.970	8. Childish	0.407
2	35(3). Safe	0.969	4. Interesting	0.374
3	35(2). Comfortable	0.965	6. Fresh	0.369
4	39(1). Comfortable	0.964	2. Cute	0.358
5	36(1). Smooth	0.964	5. Particular	0.354
6	24. Reliable	0.964	3. Cool	0.282
7	22(3) Shell	0.963	10. Well-made	0.276
8	20. Durable	0.962	1. Beautiful	0.244
9	36(5). Comfortable	0.961	9. Meaningful	0.239
10	38(1). Comfortable	0.961	15. Creative	0.210

Principal Component Analysis (PCA)

Principal Component Analysis (PAC) is commonly used to find semantic space of Kansei and specimens (Lokman, 2010; Nagamachi, et al., 2008). The cumulative contribution of PCA is almost the same as the results of our FA. Figure 2 showed the results of ordinary children's luggage, and Figure 3 showed the results of special children's luggage. The first axis is factor 1 about the performance of children's luggage. The second axis is factor 2 about the appearance of children's luggage. Figure 2 and Figure 3 showed Kansei Words vectors which indicate the strength and directions of each Kansei Words. The specimens' relative positioning is overlaid as dots. The figure illustrates the position of the specimens relative to the Kansei Words direction.

K-means cluster analysis

K-means Cluster Analysis is used to select the strategic Kansei Words and the good design samples for children's luggage. Good children's luggage design could be reached if we choose to transfer design element associated with the Kansei Words that contributes positively to both "performance" and "appearance" components. Based on the results of K-means Cluster analysis, a total of 34 Kansei Words located in the shaded region in Figure 2 and Figure 3 fulfill the criterion. According to the source of Kansei Words that explained in the Experience Map of children's luggage, the design elements associated with the strategic Kansei words can be identified. As a result, this study picked 18 candidates Kansei Words with numbers: "13. Considerate", "17. Child-friendly", "20. Durable", "21. Lightweight", "35(1). Well-organized", "36. Easy to move", "37. Easy to store", "35(2). Comfortable", "36(5).

Comfortable", 37(4). Comfortable", "38(1). Comfortable", "39(1). Comfortable", "36(6). Safe", "37(6). Safe", "38(3). Safe", "39(3). Safe", "20. Durable", "42. Fun" and "29. Good" that we think will best describes the two components simultaneously.

By sorting out these 18 strategic Kansei Words, this study found that these strategic Kansei Words can be classified into 6 categories, which are divided into convenience, comfortableness, safety, durability, pleasure and authority. That means the consumer experiences of convenience, comfortableness, safety, durability, pleasure and authority are the important value of children's luggage, thus designers need to translate these positive consumer experiences into the design elements of children's luggage. The items/categories associated with the selected Kansei Words were sorted out based on the attribution of the Kansei Words, as shown in Table 7.

For understanding the advantages and disadvantages of the selected children's luggage samples, the good children's luggage samples can be identified by referring to the results of K-means Cluster Analysis. Figure 2 and Figure 3 showed luggage sample 12, 4, 5, 3, 18 and 16 were the good samples that contribute positively to both "performance" and "appearance" components. It found that all these popular children's luggage have their own characteristics. The luggage sample 12 has the characteristics that the buckle of the luggage can be easily opened. The luggage sample 4, 5 and 3 have the characteristics of special pattern patterns. The luggage sample 18 has the characteristics of being remotely movable and rideable. The luggage sample 16 has the characteristics of deformable multi-function. The children's entire luggage mentioned above exhibit strong design features, thus in order to stimulate parents to buy children's luggage, distinctive selling points need to be designed on the children's luggage.

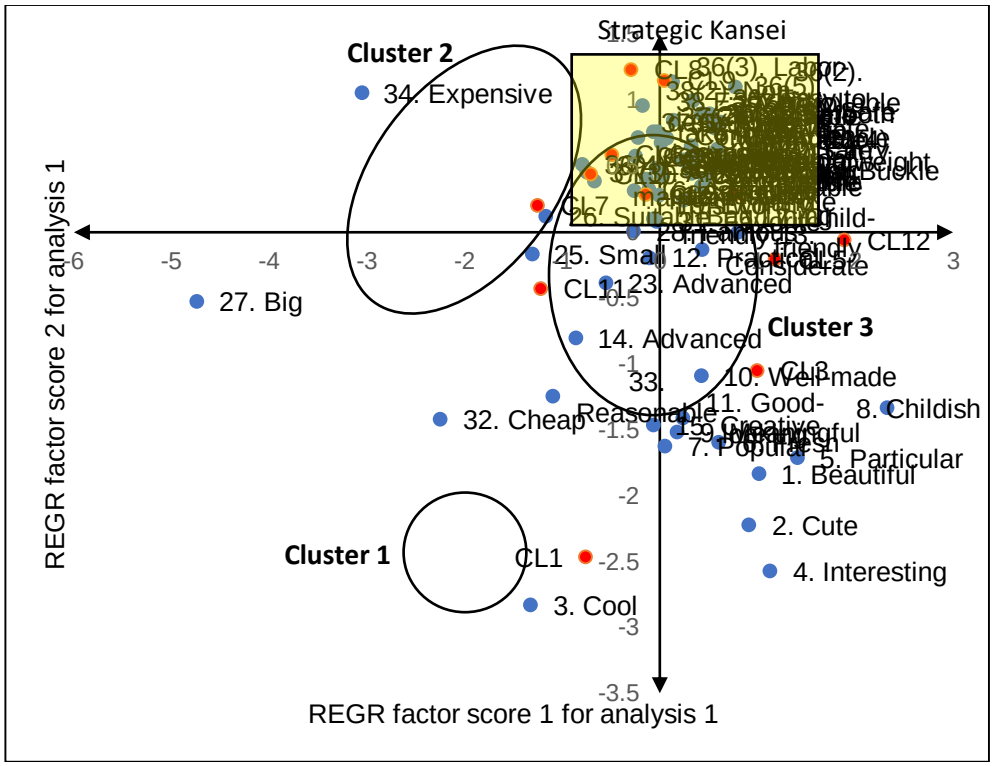

Figure 2: Regression Factor Scores 1-2 Position for Ordinary Children's Luggage

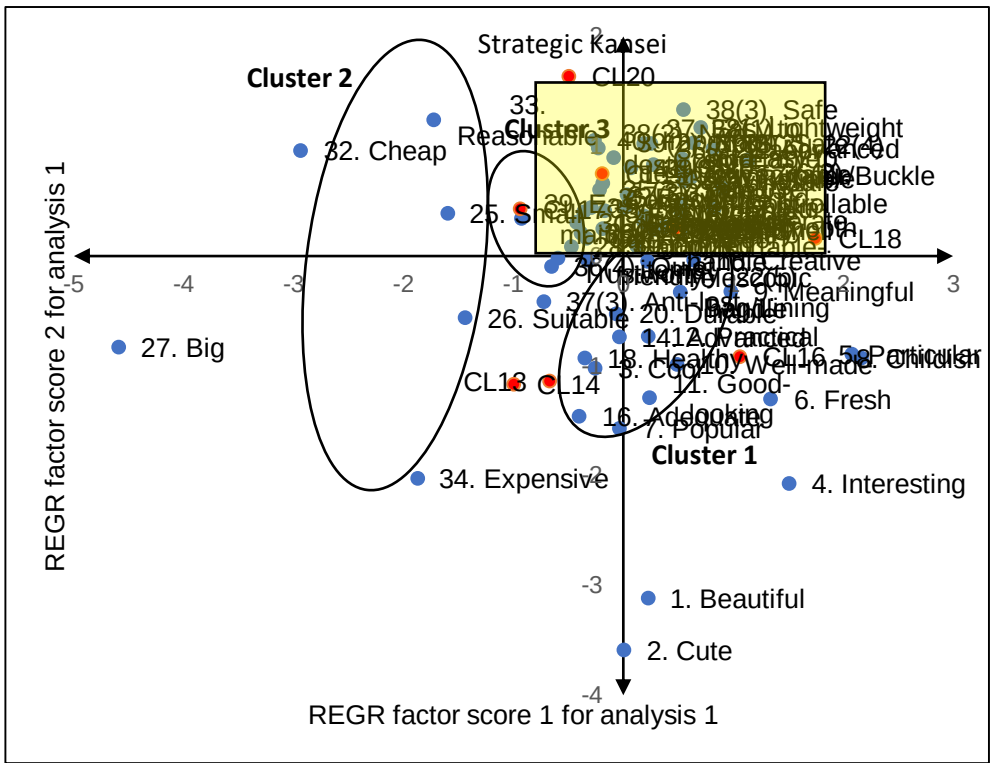

Figure 3: Regression Factor Scores 1-2 Position for Special Children's Luggage

Table 7: The Selected Design Elements of Children's Luggage

Kansei value		**Design elements**	
Selected strategic Kansei Words	**Kansei Word attributes**	**Item**	**Category**
13. Considerate 17. Child-friendly 21. Lightweight 35(1). Well-organized 36. Easy to move 37. Easy to store	Convenience	Internal structure	1) 2 compartments with 0 divider pad 2) 2 compartments with 1 divider pad 3) 2 compartments with 2 divider pads
		Moving mode	1) Pull/Push 2) Ride 3) Slide 4) Remote control
35(2). Comfortable 36(5). Comfortable 37(4). Comfortable 38(1). Comfortable 39(1). Comfortable	Comfortablen ess	Material	1) Hard shell 2) Soft shell
		Wheel style	1) Single row wheel 2) Double row wheel
		Telesco pic handle	1) T-shaped rod 2) Inverted U-shaped rod
		Opening method	1) Zipper 2) Buckle
		Shape	1) Eggshell 2) Rounded cuboid 3) Vertical cuboid 4) Horizontal cuboid 5) Specific shape 6) Variable shape
36(6). Safe 37(6). Safe 38(3). Safe 39(3). Safe	Safety	Moving mode	1) Pull/Push 2) Ride 3) Slide 4) Remote control
20. Durable	Durability	Material	1) Hard shell 2) Soft shell
42. Fun	Pleasure	Function	1) Ride 2) Slide 3) Remote control 4) Draw
29. Good	Authority	Brand	1) Domestic brands 2) foreign brands 3) Brands with anime characteristics

Partial Least Square (PLS) analysis

Partial Least Square (PLS) Analysis is used to identify the influential design elements. Based on the selected strategic Kansei Words and the good children's luggage samples from K-means Cluster Analysis, this study picked the design elements that have the highest influence to the Kansei words as our recommended design requirements list. Some of the design elements (i.e., pattern, color, size, weight and price) and were not included in the list because doing so would severely restrict the number of children's luggage this study can recommend later. In the end, PLS Analysis was done using the data from Kansei Words survey and the item/category classification. Relationship between the 18 chosen Kansei Words and the design element describe in the item/category is obtained. Table 8 showed some of the PLS analysis results. PLS table showed that the biggest positive value in each column means the design item which should be selected and that the biggest negative value leads to the bad design. Most of the values are positive this means that these design elements are within the range acceptable to parents. Therefore, in order to select better design elements, this can refer to the superior ranking of each design element, as shown in Table 9.

Table 8: Partial Least Square Results for Kansei Value

Kansei value	Item	Category	13. Considerate	17. Child-friendly	…
Convenience		Intercept	0.438	0.414	…
	Internal structure	1) 2 compartments with 0 divider pad	0.187	0.208	…
		2) 2 compartments with 1 divider pad	0.138	0.134	…
		3) 2 compartments with 2 divider pads	0.08	0.084	…
	Moving mode	1) Pull/Push	0.09	0.12	…
		2) Ride	0.126	0.101	…
		3) Slide	0.199	0.199	…
		4) Remote control.	0.036	0.02	…
Comfortableness		Intercept	0.38	0.425	…
	Material	1) Hard shell	0.047	0.076	…
		2) Soft shell	0.242	0.222	…
	Wheel style	1) Single row wheel	-0	0.003	…
		2) Double row wheel	0.027	0.011	…

	Telescopic handle	1) T-shaped rod	-0	0.003	…
		2) Inverted U-shaped rod	0.047	-0.001	…
	Opening method	1) Zipper	0.051	0.03	…
		2) Buckle	0.047	0.076	…
	Shape	1) Eggshell	0.132	0.102	…
		2) Rounded cuboid	0.034	0.043	…
		3) Vertical cuboid	0	0.053	…
		4) Horizontal cuboid	0.034	0.043	…
		5) Specific shape	0.094	0.103	…
		6) Variable shape	0.135	0.114	…
Safety		Intercept	0.86	0.885	…
	Moving mode	1) Pull/Push	0.163	0.203	…
		2) Ride	0.187	0.184	…
		3) Slide	0.216	0.188	…
		4) Remote control.	0.185	0.172	…
Durability		Intercept	1.211	1.263	…
	Material	1) Hard shell	0.267	0.266	…
		2) Soft shell	0.387	0.377	…
Pleasure		Intercept	1.099	1.112	…
	Function	1) Ride	0.209	0.203	…
		2) Slide	0.139	0.11	…
		3) Remote control	0.183	0.212	…
		4) Draw	0.155	0.16	…
Authority		Intercept	0.927	0.919	…
	Brand	1) Domestic brands	0.333	0.325	…
		2) Foreign brands	0.323	0.312	…
		3) Brands with anime characteristic	0.076	0.102	…

Table 9 showed the ranking of each design element category. Whereby the 1 in each item means the best category which should be selected. A good combination of design elements of children's luggage can be obtained by referring to the ranking of each influential design element. At the same time, it is also necessary to refer to the component contribution rate of each Kansei value the Kansei value with a large contribution rate is preferentially selected. In addition, because the various design elements of the children's luggage are

related, when selecting a combination of design elements, the rationality of each design element combination must be considered.

Based on the result of all Kansei analysis, it is best to select the design elements of simple internal structure, convenient sliding moving mode, simple pull/push moving mode, smooth and hard shell, comfortable and soft shell, flexible and stable double row wheel, comfortable U-shaped telescopic handle, comfortable button opening mode, smooth or functional shape for a good design element combination. Special attention should be paid to the combination of these design elements to ensure the safety of children and improve the life cycle of children's luggage. Moreover, some design elements with learning features and entertainment features can be designed into the children's luggage. This can increase the value of children's luggage and improve the user's pleasure, thereby increasing the attractiveness of the children's luggage and the desire of the parents to purchase the children's luggage. This study selected 2 series of children's luggage for the example of good design element combination, as shown in Table 10. The reason for choosing the series is that children of different genders and ages will like different styles of children's luggage. Therefore, the series of children's luggage with different styles can better meet the individual needs of children. Designers can refer to the design features of these two series of children's luggage when designing children's luggage.

Table 9: The Influential Design Elements for Children's Luggage

Kansei value	Item	Category	Ranking
Convenience	Internal structure	1) 2 compartments with 0 divider pad	1
		2) 2 compartments with 1 divider pad	2
		3) 2 compartments with 2 divider pads	3
	Moving mode	1) Pull/Push	2
		2) Ride	3
		3) Slide	1
		4) Remote control	4
Comfortableness	Material	1) Hard shell	2
		2) Soft shell	1
	Wheel style	1) Single row wheel	2
		2) Double row wheel	1
	Telescopic handle	1) T-shaped rod	2
		2) Inverted U-shaped rod	1
	Opening method	1) Zipper	2
		2) Buckle	1
	Shape	1) Eggshell	2
		2) Rounded cuboid	6
		3) Vertical cuboid	5
		4) Horizontal cuboid	4

		5) Specific shape	3
		6) Variable shape	1
Safety	Moving mode	1) Pull/Push	3
		2) Ride	4
		3) Slide	1
		4) Remote control	2
Durability	Material	1) Hard shell	2
		2) Soft shell	1
Pleasure	Function	1) Ride	2
		2) Slide	4
		3) Remote control	1
		4) Draw	3
Authority	Brand	1) Domestic brands	1
		2) Foreign brands	2
		3) Brands with anime characteristic	3

Figure 4: Example of Good Children's Luggage Design

CONCLUSION

This study used Kansei Engineering to determine the value of children's luggage that could generate competitive advantage for children's luggage based on consumer experience. By implementing Kansei Engineering Type I procedure, 69 Kansei Words related to the children's luggage descriptions with 20 sample products was analysed using multivariate statistical analysis. The strategic Kansei Words have been chosen by using FA, PCA and K-means cluster analysis, while the influential design elements that correlates to the chosen Kansei Words is determined by PLS analysis. Successfully it indicates that the emotional values in product assessment are important in understanding consumer preferences when selecting their products.

In conclusion, the results showed that the performance and appearance of children's luggage were the two important components that parents will pay attention to when purchasing a luggage for their children. The performance of children's luggage is the first consideration, and the appearance of children's luggage is the second consideration. The findings found that children's luggage with more convenience, comfortableness, safety, durability, pleasure and authority have a higher competitive advantage. Design elements of simple internal structure, convenient sliding moving mode, simple pull/push moving mode, smooth and hard shell, comfortable and soft shell, flexible and stable double row wheel, comfortable U-shaped telescopic handle, comfortable

button opening mode, smooth or functional shape should be selected to design a high value children's luggage. In addition, distinctive selling points need to be designed on the children's luggage. Because children's luggage with selling points are more likely to attract consumers.

For children's products, although the children and parents are common interests, the criteria for parents and children to choose products will be different. Hence, to enable children's luggage to cater to the needs of both parents and children, this study recommended that future research should take into account the perspectives of children to determine the value of children's luggage. Significant improvement of the emotional consumer experience with luggage can be expected after implementation of design recommendations.

ACKNOWLEDGMENT

The authors gratefully acknowledge the support of Faculty of Design and Architecture, Universiti Putra Malaysia. The authors gratefully acknowledge the support of all the participants.

REFERENCES

Berry, L. L., Carbone, L.P. & Haeckel, S.H. (2002). Managing The Total Customer Experience. MIT Sloan Management Review, 43(3), 85-89.

Feller, A., Shunk, D., &Callarman, T. (2006). Value Chains Versus Supply Chains. BPT Trends, Www.Bpttrends.Com.

Hannum, E. & Park, A. (2012). Education And Reform In China. Routledge, England.

Hilletofth, P., Ericsson, D., &Lumsden, K. (2010). Coordinating New PD And Supply Chain Management. International Journal Of Value Chain Management, 4(1/2), 170-192.

Kalbach, J. (2016). Mapping Experiences: A Complete Guide To Creating Value Through Journeys, Blueprints, And Diagrams. O'Reilly Media, Inc., Sebastopol, California.

Lokman, A. M. (2010). Design & Emotion: The KE Methodology. Malaysian Journal Of Computing, 1(1), 1-11.

Markopoulos, P., Read, J., Macfarlane, S. And Hoysniemi, J. (2008). Evaluating Children's Interactive Products: Principles And Practices For Interaction Designers. Elsevier, London.

Nagamachi, M., Tachikawa, M., Imanishi, N., Ishizawa, T. & Yano, S. (2008). A Successful Statistical Procedure On Kansei Engineering Products. 11th Quality Management And Organizational Developmentconference.

Neap, H. S., &Celik, T. (1999). Value Of A Product: A Definition. International Journal Of Value-Based Management, 12, 181–191.

Perumal, V. (2012). User Preference For Seating Objects In Malaysian Public Park. Master Thesis, Multimedia University Malaysia.

Potra, S., Pugna, A., Negreaa, R., &Izverciana, M. (2018). Customer Perspective Of Value For Innovative Products And Services. Procedia - Social And Behavioral Sciences, 238, 207-213.

Randmaa, M., Howard, T. J., & Otto, T. (2012, April 19-21). From Product Centered Design To Value Centered Design: Understanding The

Value-System. 8th International DAAAM Baltic Conference "Industrial Engineering".

Shaari, N. (2010). Haptic Assessment In Fabrics With Kansei Evaluation. International Conference On User Science And Engineering, Pp. 44-48.

Singh, R. K., Rajput, V. & Sahay, A. (2018). A Literature Review On Quality Function Deployment (QFD). IAETSD Journal For Advanced Research In Applied Sciences, 5(8), 245-250.

Wan, M. L. &Toppinen, A. (2016). Effects Of Perceived Product Quality And Lifestyles Of Health And Sustainability (LOHAS) On Consumer Price Preferences For Children's Furniture In China. Journal Of Forest Economics, 22, 52-67.

Wang, M. R. Shaari, N. &Perumal, V. (2020). Using Experience Map To Assist Kansei Engineering In Collecting Kansei Words: A Study Of Value Chain Management In Children's Luggage. TEST Engineering & Management, 83, 1108-1120.

Yue, X. (2012). Investigation On The Design Of Children's Luggage. Journal Of Huaibei Normal University, 33(3), 195.