Kansei Engineering and Multivariate Analysis Methods for Website Display Innovation

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Abstract

Multivariate Factor Analysis is a technique in statistical calculations that functions in finding the main determining factors that have a major influence in a combination of statistical facts. On the preparation of the website interface according to the usability and function and also the involvement of the user's feelings so that it will intersect with Kansei Engineering. The researcher measured the consumer feeling about the part of the website that was widely used by using the Kansei Engineering Type I method. From the specimen material that had been applied for previous research, a discussion was developed which initially focused more heavily on Kansei Engineering and was used as an alternative update in utilizing multivariate factor studies. The fact that the survey output to the user will be carried out by applying Cronbach's Alpha multivariate statistical planning, Coefficient Correlation Analysis, Principal Component Analysis, Factor Analysis and Partial Least Square which has been applied to previous observations, then the highest value part of the two result factors will be assimilated as a the latest recommendation material that has been combined with the recommendation value of the new website section compared to the results of the previous unit factor analysis.

I. Introduction

Developing a website that focuses on how users feel about website features, Kansei Engineering is the right guide in exploring the website design stage. The analysis stage that applies to the elements that users feel about the website cannot be separated from the science of human-computer interaction. Specimens that are used as observation references have different optical characteristics but have similar website benefits, namely in article content examining facts about education and children in both Indonesian and foreign languages, but the conditions are through clearer additions that can be accessed on a mobile browser.

According to Astuti et al (2019) Education is an obligation of every human being that must be pursued to hold responsibilities and try to produce progress in knowledge and experience for the lives of every individual. Education is one of the efforts to improve the ability of human intelligence, thus he is able to improve the quality of his life (Saleh and Mujahiddin, 2020). Education is expected to be able to answer all the challenges of the times and be able to foster national generations, so that people become reliable and of high quality, with strong characteristics, clear identities and able to deal with current and future problems (Azhar, 2018).

304

Kansei Engineering reformer who focuses on how to understand what users want, such as Quality Function Deployment, Conjoint Analysis systems. The method itself has one goal such as Kansei Engineering, namely to build products that are appropriate to the needs of the user's feelings, but in Kansei Engineering the aspect of consumer convenience when using the website is prioritized. Therefore, the programmers are motivated to meet the needs in terms of user convenience so that the website developed has its own characteristics. Efforts to develop the weight of a website that presents facts related to the topic of education and children so that apart from focusing on the core facts of the website itself, it is also necessary to develop a website interface that is attractive and attracts a lot of visitors.

II. Review of Literature

Website development with a focus on how users feel about website components, Kansei Engineering is one of the right references to explore the design process (Lokman & Noor, 2006). The analysis process that occurs on the elements of user feelings towards the website cannot be separated from the science of human and computer interaction (Da Silveira et al., 2022). The specimens used as research objects have different visual characteristics but with the same website function (Iigaya et al., 2021), namely article content that discusses educational information and children (Imroatun et al., 2021), both in Indonesian and in foreign languages, with additional specific requirements that can be accessed via a mobile browser (Prasetya et al., 2021). Kansei Engineering's predecessor that focused on how to understand consumer desires such as Quality Function Deployment, Conjoint Analysis methods. These methods have the same goal as Kansei Engineering, which is to design products according to the emotional needs of users (Mohd Lokman, 2009). However, Kansei Engineering prioritizes the user convenience factor in operating the designed website. Thus forcing programmers to be able to meet user convenience needs in addition to website functionality so that the product or website that is built has certain characteristics.

Since the 1990s, businesses using the internet websites and as a means of promotion and transactions have experienced a significant increase, in the real world retail traders often attract the attention of buyers by designing stores as beautiful as possible, with concepts, layouts and product presentations that can attract buyers' attention. In the online retail industry or the internet, with the visitor's interest in the website, it is illustrated by the longer time a website visitor interacts with the website and the information can be described as a potential consumer. This shows that a website may not necessarily be able to capture the wishes of visitors at first glance, so the important thing that website designers must pay attention to is how to make visitors feel at home interacting for a long time with the website that was built.

III. Research Method

3.1 State of The Art

The preparation of this article took several references from previous research including:

Table 1. Discussion about Journal Title

Journal Title	Discussion
Kansei Engineering Implementation in Website Interface Design for Mobile News Portal for Education and Children Health Information **Researcher** **Arief Ginanjar, Yiyi Supendi** **Location** **Bandung West Java** **Year** **2015** **Journal Name** **Journal of Unla.web.id**	Research result "The mean scores of all brand associations were evaluated. As seen in Table 1, the product brands generally had stronger mean scores (numerically lower) in all brand association rankings than the corporate brands, with two exceptions. In all cases, leadership and quality brand associations were stronger for the product brands than the corporate brands" (Kolarova, 2009, p. 78) This journal examines the brand association of quality, leadership, and public service related to product brands and corporate brands in the context of cobranding. The result is that the branding association of companies that are aligned with product brands has an impact on the strength of their company's brand and vice versa. That is, the brand association has a big effect when a company wants to sell a product compared to the branding of the company itself.

3.2 Kansei Engineering

Kansei is a Japanese language that is used to express artifacts, situations and the environment around them. In general Kansei refers to emotion, feeling, sensitivity, sensitivity (Mohd Lokman, 2009) (Deris & Noor, 2021). Research with Kansei includes emotions, feelings, sensitivity, sensitivity and is attuned to the 5 senses (Sakamoto & Epstein, 2021); smell, taste, hearing, sight, and skin sensation. kansei is then interpreted in the form of a technical system called kansei engineering (Abd KADIR et al., 2021).
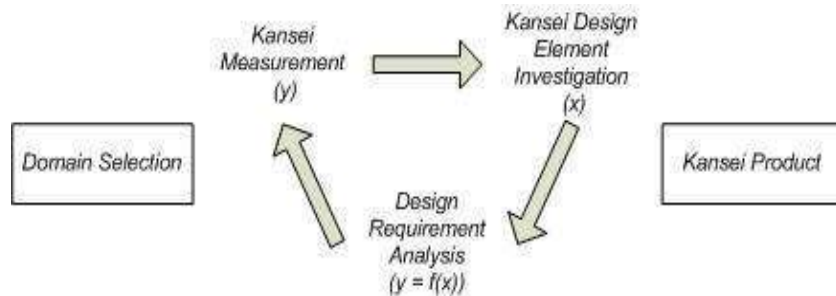
Figure 1. *The Principle of Implementation of Kansei Engineering*

Figure 1 explains how the nature of Kansei Engineering's application can be applied across the entire development cycle for a wide variety of products.

3.3 Multivariate Analysis

a. Cronbach's Alpha

Cronbach's Alpha analysis is useful in estimating the reliability of data by distinguishing respondent parameters based on gender, according to Kansei engineering parameters, the number of respondents that can be used is about 30 to 40 people in an observation.

b. Correlation Coefficient Analysis (CCA)

Correlation is a way of analyzing to find out the relationship of 2 quantitative variables that are prolonged.

c. Principal Component Analysis (PCA)

(Principal Component Analysis) is a technique that has the use of simplifying data through linear transformation, so as to create new coordinates with the largest variance.

d. Factor Analysis (FA)

The most important usability aspects of factor analysis are; 1) reduction in the number of variables and, 2) detection of the order of association between variables. Factor analysis is used as a data reduction detection method, for the first time the term factor analysis technique was introduced by Thurstone in 1931. It is necessary to develop measurements for many kinds of variables that cannot be measured directly in this study.

e. Partial Least Square (PLS) Analysis

Based on the variant criteria this system is very effective. Highly recommended for variables that have a fairly high number. PLS is a powerful analytical method because it can be used for all data. PLS is useful for building a relationship that does not have a theoretical basis.

IV. Results and Discussion

Specimen determination method is the initial process in this research and also the website component which is then assessed and used as a reference for each specimen.

Table 2 below is a website element that has a function in assessing and influencing Kansei Engineering implementation research.

Table 2. Reference Website Elements

No	Elemen Induk	Elemen Anak
1	*Badan*	*Background Style, Background Color, Font Color, Font Size*
2	*Menu atas*	*Font Size, Font Color, Background Color, Position, Style, Existance*
3	*Menu kiri*	*Font Size, Font Color, Background Color, Position, Style, Existance*
4	*kepala*	*Font Size, Font Color, Background Color. Logo*
5	*kaki*	*Font Size, Font Color, Background Color, Logo*

Furthermore, from the existing website table elements, questionnaire data was collected from respondents and then carried out with Semantic Differential and has a structure like the table below.

Table 3. Semantic Differential Structure

Tanggal	....	Nomor Spesimen	....
Umur	....	Jenis Kelamin	L / P

No	Kansei Words	Skor Penilaian					Kansei Words
1	Menarik	5	4	3	2	1	Tidak Menarik
2	Tenang	5	4	3	2	1	Tidak Tenang
3	Kekanak-kanakan	5	4	3	2	1	Tidak Kekanak-kanakan
4	Klasik	5	4	3	2	1	Tidak Klasik
5	Nyaman	5	4	3	2	1	Tidak Nyaman
6	Keren	5	4	3	2	1	Tidak Keren
7	Kreatif	5	4	3	2	1	Tidak Kreatif
8	Penuh Sesak	5	4	3	2	1	Tidak Penuh Sesak
9	Lucu	5	4	3	2	1	Tidak Lucu
10	Anggun	5	4	3	2	1	Tidak Anggun

Furthermore, the three facts will be carried out with a multivariate analysis stage, the population of the research object can be mutated if it includes thousands of data that is adapted to the purpose of the search object and the tools used.

So that in this observation, the total number of respondents was between 20 to 40 people who filled out the questionnaire. Then the research was successful in producing a group of respondents who have an age as shown in the table below.

Table 4. Group of respondents by age and gender

No	Jenis Kelamin	Kelompok Umur			
		20 - 30	31 - 40	41 - 50	> 50
1	Pria	5	6	3	4
2	Wanita	9	3	0	0

All multivariate statistical analysis processes refer to the data that has been there before, so the next step is to look for the latest innovations and assimilate the highest value from the analysis factor.

4.1 Correlation of Statistical Data to Website Elements

PLS analysis functions in the translation of statistical data where the reference of the calculation process is based on the kansei words design elements that are related to each other. Elements and experiments are the desired outputs from the PLS stage from the specimens that have been determined with the highest value.

Before carrying out the process of calculating the PLS data elements that are tick and unchecked, the previous data is changed to numbers one and zero then produces 65 dummy variable columns.

Table 5. The Website Element Data is converted into a Dummy Variable

Nomor Spesimen	Body BG Color Grey	Body BG Color White	Body BG Color More	Body BG Style Solid	Body Font Color White	Body Font Color Blue	Body Font Color Black	Body Font Color Grey	
1	1	0	0	1	1	0	0	0	...
2	0	1	0	1	0	0	0	1	
3	0	1	0	1	0	0	1	0	...
4	0	1	0	1	0	0	1	0	...
5	0	0	1	0	0	0	1	0	
6	0	1	0	1	0	1	0	0	...
7	1	0	0	0	0	0	1	0	...
8	0	0	1	0	0	0	1	0	
9	0	1	0	1	0	0	1	0	...
10	0	1	0	1	0	0	1	0	...

PLS can be used as a measuring tool in developing facts that do not have a strong theoretical basis and also function as theoretical propositions.

Data from the results of the principal component analysis and factor analysis stages in this study will be combined using kansei words and then produce website design element values that can be used as a reference from PLS. The reference can be seen in Table 6.

Table 6. PLS Output in Finding The Highest Value in The Website Section For Male Respondents With The Kensei Word 'Easy To Use'

No	Kategori	Mudah Digunakan		Range
		Variabel	*Coeff*	**0.058**
1	Footer Background Color	Footer BG Color Blue	0.022	
		Footer BG Color Grey	0.053	0.160
		Footer BG Color White	0.020	
		Footer BG Color Black	-0.107	
		Footer BG Color None	0.012	

No	Kategori	Mudah Digunakan		Range
		Variabel	*Coeff*	**0.058**
2	Header Font Size	Header Font Size Small	0.066	0.132
		Header Font Size Medium	-0.066	
3	Header Font Color	Header Font Color White	0.055	
		Header Font Color Blue	0.020	
		Header Font Color Purple	0.060	0.118
		Header Font Color Black	-0.058	
		Header Font Color Grey	-0.038	

4	Footer Font Color	Footer Font Color White	0.001	0.106
		Footer Font Color Blue	-0.046	
		Footer Font Color Black	0.012	
		Footer Font Color Green	U.U6U	
		Footer Font Color Grey	-0.038	
5	Top Menu Position	Top Menu Position Left	-0.050	0.106
		Top Menu Position Center	-0.010	
		Top Menu Position Right	0.056	
6	Header Background Color	Header BG Color Blue	0.055	0.100
		Header BG Color White	-0.045	
		Header BG Color None	0.012	
7	Body Font Size	Body Font Size Small	-0.050	0.099
		Body Font Size Medium	0.050	
8	Top Menu Background Color	Top Menu BG Color Blue	-0.023	0.091
		Top Menu BG Color Grey	-0.024	

311

No	Kategori	Mudah Digunakan		Range
		Variabel	Coeff	0.058
		Top Menu BG Color White	0.028	
		Top Menu BG Color None	0.068	
9	Footer Font Size	Footer Font Size Small	-0.045	0.090
		Footer Font Size Medium	0.045	
10	Body Font Color	Body Font Color White	0.050	0.086
		Body Font Color Blue	-0.010	
		Body Font Color Black	-0.036	
		Body Font Color Grey	0.045	
11	Top Menu Font Color	Top Menu Font Color White	-0.023	0.082
		Top Menu Font Color Blue	-0.005	
		Top Menu Font Color Black	0.044	
		Top Menu Font Color Grey	-0.038	
12	Top Menu Font Size	Top Menu Font Size Small	-0.030	0.060
		Top Menu Font Size Medium	0.030	

The next step is to determine the average value in one group of kansei words. Then the value of the range can be used as a reference in increasing the influence of each category of kansei words. Values in the low category will have no effect on kansei words and those low value categories can be deleted. Next, sort the largest range to the smallest range in each kansei words, the data is taken from the respondent. For the highest value, namely the data of female and male respondents and ignore the higher value so that the output of the sorting can be seen in Table 7.

Table 7. Table Category and Range Values after Sorting

No	Nyaman		Mudah Digunakan	
	Kategori	Range 0.078	Kategori	Range 0.058
1	Body Font Size	0.220	Footer Background Color	0.160
2	Body Font Color	0.187	Header Font Size	0.132
3	Footer Background Color	0.156	Header Font Color	0.118
4	Top Menu Position	0.149	Footer Font Color	0.106
5	Footer Font Color	0.141	Top Menu Position	0.106
6	Footer Font Size	0.129	Header Background Color	0.100
7	Header Font Color	0.113	Body Font Size	0.099
8	Top Menu Font Color	0.112	Top Menu Background Color	0.091
9	Body Background Color	0.109	Footer Font Size	0.090
10	Header Font Size	0.107	Body Font Color	0.086
11	Footer Logo Position	0.098	Top Menu Font Color	0.082
12	Top Menu Background Color	0.092	Top Menu Font Size	0.060
13	Left Menu Background Color	0.068	Body Background Color	0.032
14	Left Menu Font Color	0.068	Left Menu Background Color	0.028
15	Left Menu	0.042	Left Menu	0.028

No	Nyaman		Mudah Digunakan	
	Kategori	Range 0.078	Kategori	Range 0.058
	Style		Style	
19	Header Logo Position	0.009	Header Logo Position	0.004
20	Top Menu Font Size	0.006	Left Menu Font Size	0.003
21	Body Background Style	0.005	Body Background Style	0.002

4.2 Proposed Analysis Matrix

From the results of the PLS calculation, the next process is to recommend a display design by making a recommendation matrix. The above-average range values for the design elements will be used for recommendations. Based on the results of the analysis of the design elements will give the influence of kensei words to the website.

In the process of designing the Kansei words matrix, it is used as a reference, then the arrangement of the matrix will be done manually by applying the results of the PLS analysis. We can see in Table 8 which will be collected with PLS data which has coefficient data.

Table 8. PLS Output will be processed so that the highest variable value is the Kansei words 'Easy to Use'

No	Kategori	Mudah Digunakan		Range
		Variabel	Coeff	0.058
1	Footer Background Color	Footer BG Color Blue	0.022	0.160
		Footer BG Color Grey	0.053	
		Footer BG Color White	0.020	
		Footer BG Color Black	-0.107	
		Footer BG Color None	0.012	
2	Header Font Size	Header Font Size Small	0.066	0.132
		Header Font Size Medium	-0.066	

No	Kategori	Mudah Digunakan		Range
		Variabel	Coeff	0.058
3	Header Font Color	Header Font Color White	0.055	0.118
		Header Font Color Blue	0.020	
		Header Font Color Purple	0.060	
		Header Font Color Black	-0.058	
		Header Font Color Grey	-0.038	
4	Footer Font Color	Footer Font Color White	0.001	0.106
		Footer Font Color Blue	-0.046	
		Footer Font Color Black	0.012	
		Footer Font Color Green	0.060	
		Footer Font Color Grey	-0.038	
5	Top Menu Position	Left		0.106
		Top Menu Position Center	-0.010	
		Top Menu Position Right	0.056	
6	Header Background Color	Header BG Color Blue	0.055	0.100
		Header BG Color White	-0.045	
		Header BG Color None	0.012	
7	Body Font Size	Body Font Size Small	-0.050	0.099
		Body Font Size Medium	0.050	
		Top Menu BG Color Blue	-0.023	

315

No	Kategori	Mudah Digunakan		Range
		Variabel	Coeff	**0.058**
9	Footer Font Size	Footer Font Size Small	-0.045	0.090
		Footer Font Size Medium	0.045	
10	Body Font Color	Body Font Color White	0.050	0.086
		Body Font Color Blue	-0.010	
		Body Font Color Black	-0.036	
		Body Font Color Grey	0.045	
11	Top Menu Font Color	Top Menu Font Color White	-0.023	0.082
		Top Menu Font Color Blue	-0.005	
		Top Menu Font Color Black	0.044	
		Top Menu Font Color Grey	-0.038	
12	Top Menu Font Size	Top Menu Font Size Small	-0.030	0.060
		Top Menu Font Size Medium	0.030	

In Table 8 for the footer background color section in the kansei words 'easy to use' the largest value of this type is the gray footer background color 0.053 then the gray color is used for the footer background reference. And so it is with other categories.

Table 9. Recommendation matrix for website elements for the 'footer' type

No	Konsep Desain	Kansei Words	Footer			
			Logo Position	Background Color	Font Color	Font Size
1	Cozy	Nyaman	Left	Blue	Green	Fair
2	Easy	Mudah	NS	Grey	Green	Fair
3	Creatif	kreatif	left	white	Black	NS

Below is the design concept of 'Easiness' which makes the following interpretation:
a. In the freestyle body background, the font size is medium, the font color is white.
b. The top menu is placed on the right of the page, has no background color, medium size font.
c. In the left menu, all element values with 'not significant' values can be ignored.

d. In the header, the font color is purple and the font size is small.

e. In the footer, the background wran is gray, the font color is green, the font size is medium.

But the estimation above is still focused on one kind of kansei words without assimilation between two or more groups of kansei words.

4.3 Innovation Combines the Results of Multiariate Factor Analysis

The results of the 1st and 2nd factors from each kansei words group are compared with the reference for the new website design material, namely the view results and the resulting combined design ideas as in the table below.

Table 10. The design of the assimilation of kansei words factor one and factor two

No	Responden	Hasil Analisis Multivariat Gabungan
1	Seluruh Responden	Cosiness diasimilasi Uniqueness
2	Pria	Easiness diasimilasi Luxurious
3	Wanita	Creative diasimilasi Calmness

There is a slight difference from combining kansei words that have innovation and apply the results of multivariate factor analysis to produce a new sample.

Table 11. Modification of the 'Body' Section of the Website Interface Recommendation Matrix for Male Respondents

No	Konsep Desain	Kansei Words	Body			
			Background Color	Background Style	Font Color	Font Size
1	Easy	Mudah	NS	NS	White	Fair
2	Luxury	Mewah	None	Pict	NS	NS

Table 12. Modification of the Recommendation Matrix for the 'Top Menu' Section of the Website Interface for Male Respondents

No	Konsep Desain	Kansei Words	Top Menu				
			Style	Position	Background Color	Font Color	Font Size
1	Easy	Mudah	NS	Right	None	Black	Fair
2	Luxury	Mewah	NS	NS	None	NS	Fair

Table 13. Table modification of the 'left menu' section of the website interface recommendation matrix for male respondents

No	Konsep Desain	Kansei Words	Left Menu				
			Style	Position	Background Color	Font Color	Font Size
1	Easy	Mudah	N/S	N/S	N/S	N/S	N/S
2	Luxury	Mewah	N/S	N/S	N/S	N/S	N/S

Table 14. Modification of the website interface recommendation matrix for the 'header' section for male respondents

No	Konsep Desain	Kansei Words	Header			
			Logo Position	Background Color	Font Color	Font Size
1	Easy	Mudah	N/S	Blue	Purple	Small
2	Luxury	Mewah	Left	None	White	Small

Table 15. Table Modification of the Website Interface Recommendation Matrix for the 'Footer' Section for Male Respondents

No	Konsep Desain	Kansei Words	Footer			
			Logo Position	Background Color	Font Color	Font Size
1	Easy	Mudah	N/S	Grey	Green	Fair
2	Luxury	Mewah	N/S	None	White	N/S

The following interpretations are generated from the data obtained from table 11,12,13,14,15 which are interpreted by designing according to the 'simple' design concept and combined with 'elegance'.

a. The background on the body does not need to use color because it uses an image in the background, but it is recommended that a dominant image be blue, medium font size, and white body font.
b. The style on the top menu does not need to be defined because it has a 'not significant' value, the position of the top menu is on the right side of the mobile website page and does not use a medium font size background, and the font color is black.
c. In the left menu all values are 'not significant'.
d. In the header, the logo is positioned on the left, the background color is blue, the font color is purple, the font size is small.

318

e. At the footer the logo position has a value of 'not significant' and the background color is gray, the font size is medium.
f. For the 'simple' footer the background color is green and the 'elegance' is white.
g. The author compiled a prototype view sample which can be seen in Figures 2 and 4 based on the combination of the two concepts of simple and elegance.

V. Conclusion

Designing the appearance of the website by applying multivariate factor analysis is part of Kansei Engineering which has the goal of making proposals based on psychological elements and user desires. There are seven steps that are important and must be carried out in order to produce the same interface development as the methodology. The conclusion of this research can be seen from the following points There are three proposals for designing a website page that applies the combined six kansei words, namely; simple, Creative and peaceful, elegance, Cozy, exclusive. Based on the website browser's point of view, the matrix of website element values comes from Kansei word based on multivariate factor analysis calculations. Six innovations from Kansei words are assimilated between exclusive and simple. And elegance, Cozy and exclusive, lastly between Creative and peaceful.

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