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Design of Mobile Learning Application Interface Using Kansei Engineering Method (Case Study: Majelis Daur Ulang)

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ABSTRACT

Kansei Engineering is a method for realizing certain product designs based on a systematic exploration of human feelings and sensations (sight, touch, smell, hearing, taste). In mobile applications, the most important factor apart from the technical aspects of the system is the design. Design is an important factor in a mobile application because it becomes a liaison between the user and the existing system. The Mobile Learning application is not only enough to run the application and there are no errors, but the application must be built according to the wishes and interests of the user, this study aims to determine the emotional factors of the user, apply Kansei Engineering in designing and make recommendations for application display design according to Kansei Engineering. This methodology refers to Kansei Engineering Type I. This study uses Kansei Word to detect the user's feelings when looking at the specimen design. The list of Kansei Words used is 10 words related to the Majelis Daur Ulang mobile learning application. There are 5 specimens of similar Mobile Learning applications used. This study involved 32 participants, using multivariate statistical analysis, namely Cronbach's Alpha (CA), Correlation Coefficient Analysis (CCA), Principal Component Analysis (PCA), *Factor Analysis* (FA) *and Partial Least Square* (PLS). *This research resulted in 2 recommendations for the design* Majelis Daur Ulang *Mobile Learning display, namely "Professional" and "Unique".*

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1. INTRODUCTION

The advancement of wireless technology has increased the number of mobile device users. Mobile-based applications, whether in the form of products or services, have significantly influenced daily human activities such as ordering food, reading news, shopping, selling goods, and even learning. Mobile Learning is a learning model that utilizes information technology and aims to facilitate students in accessing materials provided by instructors. Mobile Learning is considered a development of e-Learning due to its mobility, which provides added value for learners [1].

The design of the Mobile Learning user interface is a fundamental and crucial aspect. Interface design serves as a medium that bridges users and the software system. In designing the interface, some designers experience difficulties in determining the emotional factors of users that influence the mobile learning interface design. An application must also provide comfort and ease of use for its users. Users often evaluate an application not only based on its functionality but also on its user interface. If the interface design is poor, it may become one of the reasons users choose not to use the application [1] [2]. The Mobile Learning application for Majelis Daur Ulang is planned to be developed; however, there is currently no interface design that aligns with users' preferences.

Majelis Daur Ulang is an Islamic preaching institution in Purwakarta that focuses on teaching how to read the Qur'an. The institution intends to provide online learning services so that people can study anytime and anywhere. Therefore, Majelis plans to develop a Mobile Learning application as a learning medium to facilitate the community in learning how to read the Qur'an. In developing the mobile learning application, the interface design is created using the Kansei Engineering (KE) method. KE is a technology that integrates Kansei into the field of engineering to produce products that meet the needs and preferences of consumers [3].

In this study, a user experience analysis was conducted in designing the mobile learning interface using the Kansei Engineering (KE) method to determine the recommended interface design or display of the mobile learning application based on a systematic exploration of human emotions and sensory perceptions (sight, touch, smell, hearing, and taste) (Nagamachi and Lokman, 2010). KE is oriented toward product development through several stages, beginning with the collection of Kansei Words, followed by the determination of the data specimens to be analyzed.

Several previous studies have examined the application of Kansei Engineering in interface design to enhance user experience. One such study is conducted by Nugroho, Hadiana, and Singasatia (2019), entitled *Design of Wastu Mobile Interface Using Kansei Engineering*, which applied Kansei Engineering in designing the interface of the Wastu mobile application and demonstrated that this approach is capable of accommodating users' emotional aspects in interface design [1]. However, the study did not employ Principal

Component Analysis (PCA) to systematically reduce the variables of Kansei Words and specimen data, thereby limiting the optimization of complex emotional data.

Furthermore, the application of Kansei Engineering in the design of Mobile Learning interfaces, particularly within the context of religious learning such as learning to read the Qur'an, remains limited and has not been extensively explored in previous studies.

2. RESEARCH METHOD

The Kansei Engineering methodology employed in this study adopts the Type I Kansei Engineering approach, namely KEPack. The stages applied, as illustrated in Figure 1, are described as follows.

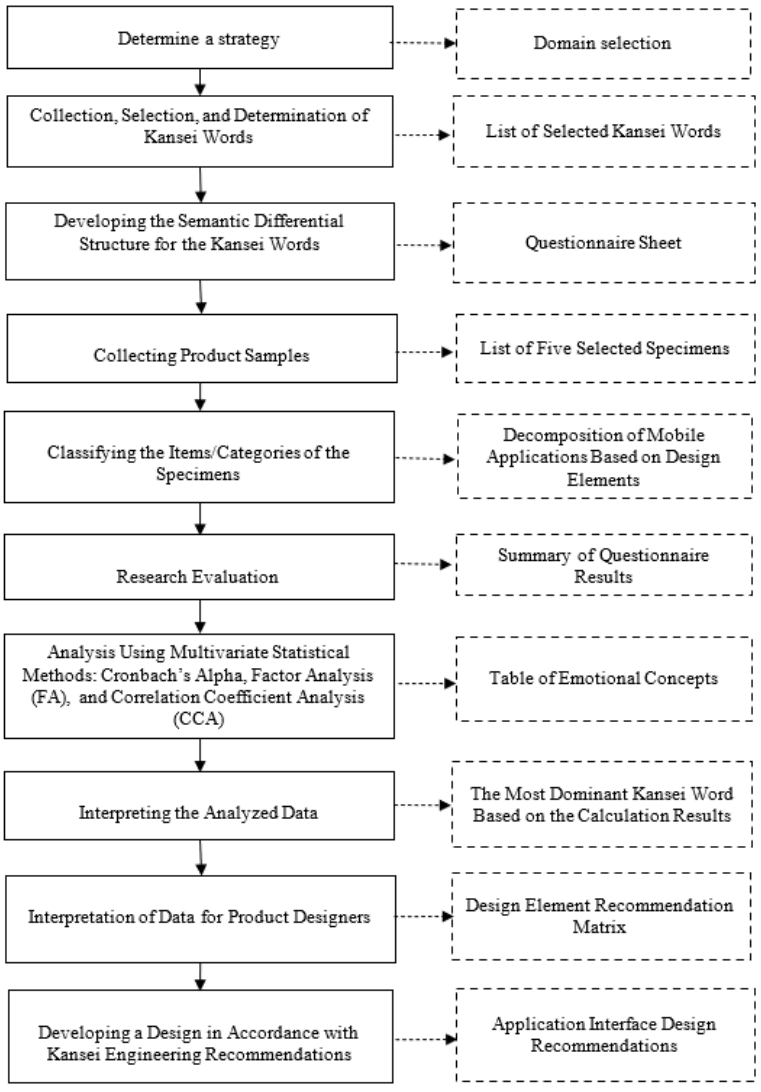

Figure 1. Research Methodology

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2.1. Determine a strategy

In this study, the object of investigation is a Mobile Learning application to be implemented at Majelis Daur Ulang (Madu). Within the Kansei Engineering Type I methodology, one of the fundamental stages is strategy formulation. A key component of this strategic formulation is the determination of the research domain.

2.2. Collection, Selection, and Determination of Kansei Words

Kansei Words (KW) are defined as key terms that represent users' emotional responses toward an application. The selection of appropriate KW is a critical determinant of research outcomes in the Kansei Engineering methodology. Therefore, careful consideration must be given to the identification and selection of KW to ensure that the research findings align with the intended objectives and accurately reflect users' affective perceptions [4].

2.3. Developing the Semantic Differential Structure for the Kansei Words

A total of ten identified Kansei Words will subsequently be structured and incorporated into a Semantic Differential (SD) scale for the purpose of developing a questionnaire to be distributed to the participants [5].

2.4. Collecting Product Samples

This study employs ten Mobile Learning application specimens, each of which possesses distinct characteristics. From the ten candidate specimens, five will be selected based on the distinctiveness of their visual interfaces. Specimens that exhibit similar appearances will be represented by only one selected specimen from among them. [6].

2.5. Classifying the Items/Categories of the Specimens

The design elements are classified and categorized based on the components identified within each specimen and subsequently organized into a tabular format. To facilitate the grouping process, the design elements are systematically decomposed into their most fundamental components for each specimen, beginning with the primary categories, namely the Header, Body, and Footer [6].

2.6. Research Evaluation

This stage describes the process of data collection from respondents who completed the distributed questionnaire. It involves data obtained from 32 participants, five Mobile Learning application specimens, and ten Kansei Words [7].

2.7. Analysis Using Multivariate Statistical Methods: Cronbach's Alpha, Factor Analysis (FA), and Correlation Coefficient Analysis (CCA)

The mean data obtained from the questionnaire results will be processed using multivariate statistical methods to generate an overview of the emotional concepts associated with the Mobile Learning specimens. The multivariate analyses employed in this study include Cronbach's Alpha (CA), Coefficient Correlation Analysis (CCA), Principal Component Analysis (PCA), and Factor Analysis (FA). All multivariate analyses are conducted using XLSTAT software [8].

2.8. Interpreting the Analyzed Data

The results of the PCA and FA analyses, which represent the identified emotional concepts, will subsequently be translated into design elements through the application of Partial Least Squares (PLS) analysis. The primary objective of this analysis is to determine the design elements that most significantly influence participants' emotional responses [8].

2.9. Interpretation of Data for Product Designers

Formulating recommendations for the Mobile Learning application interface design concept constitutes the subsequent stage of this study. Based on the results of the PLS analysis, a recommendation metric for the interface design concept can be established. Design elements exhibiting a range value above the overall mean range are identified as the recommended design elements [8].

2.10. Developing a Design in Accordance with Kansei Engineering Recommendations

The final stage of this study involves developing the design based on the recommended matrix derived from the Kansei Engineering analysis for the Majelis Mobile Learning application interface.

3. RESULTS AND DISCUSSION

3.1. Kansei Word Selection

At the initial stage of identifying words to be implemented as Kansei Words, a total of 39 terms were obtained. These terms were presumed to represent the participants' affective responses toward the given specimens. The terms were derived from public comments as well as from a review of terminology commonly employed in previous studies addressing Kansei Engineering in the context of mobile applications.

Following the identification of the Kansei Word candidates, the process was continued by selecting the terms to be utilized within the Semantic Differential (SD) scale for

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questionnaire purposes. After undergoing a selection process, the chosen Kansei Word candidates were incorporated into the questionnaire using the SD scale. The questionnaire was subsequently distributed to all participants, who were asked to complete it based on their individual perceptions and feelings toward the specimens.

Table 1. List of Kansei Word

No.	Kansei Word	No.	Kansei Word
1.	Dynamic	6.	Harmonious
2.	Attractive	7.	Comfortable
3.	Elegant	8.	Bright
4.	Simple	9.	Unique
5.	Colorful	10.	Professional

3.2. Developing the Semantic Differential Structure for the Kansei Words

This stage describes the process of data collection from respondents who completed the distributed questionnaire. The study involved 32 participants, five mobile learning application specimens, and 10 Kansei Words. The questionnaire was administered using Google Forms, where each respondent was provided with a link granting access to the survey instrument. The mobile learning specimens were displayed within the Google Form, enabling respondents to evaluate each specimen directly while completing the questionnaire.

3.3. Collecting Product Samples

From the ten candidate specimens, five were selected based on the distinctiveness of their visual appearance. In cases where specimens exhibited similar interface designs, only one representative specimen was chosen from each group displaying comparable characteristics.

Figure 2. Interface of Ruang Guru

Figure 3. Interface of Skill Academy

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Figure 4. Interface of Duolingo

Figure 5. Interface of Ummi Foundation

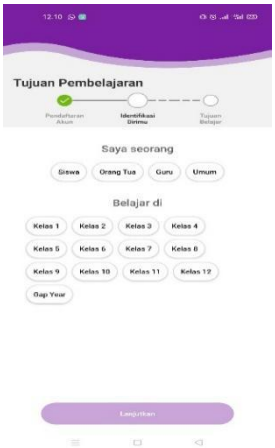

Figure 6. Interface of Zenius

3.4. Multivariate Analysis

3.4.1. Cronbach's Alpha (CA)

Cronbach's Alpha is employed to assess the reliability level of the data. The calculation yielded a Cronbach's Alpha coefficient of 0.925. Since the obtained value exceeds the minimum threshold of 0.6, it can be concluded that the entire dataset demonstrates a high level of reliability and is therefore suitable for subsequent multivariate statistical analysis.

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3.4.2. Correlation Coefficient Analysis (CCA)

To determine the correlations among the Kansei words, a CCA analysis was conducted. Table 2 presents the results of the CCA analysis derived from the questionnaire data. In this article, the findings are provided in a summarized format displaying only 6 rows and 10 columns due to space limitations.

Table 2. Correlation Coefficient Analysis

Variables	Dynamic	Attractive	Elegant	Simple	…
Dynamic	**1**	0.643	0.908	-0.036	…
Attractive	0.643	**1**	0.855	0.224	…
Elegant	0.908	0.855	**1**	-0.130	…
Simple	-0.036	0.224	-0.130	**1**	…
Colorful	-0.240	0.402	0.050	0.114	**…**
Harmonious	0.751	0.872	0.847	0.252	…
Comfortable	0.475	0.807	0.576	0.612	..
Bright	0.506	0.535	0.372	0.841	…
Unique	0.654	0.498	0.579	0.312	…
Profesional	0.571	0.966	0.829	0.064	…

Referring to Table 2, it can be observed that there are strong correlations among several Kansei words. Conversely, weak correlations are also identified among certain Kansei words in the CCA results for all respondents. Strong relationships are indicated by higher coefficient values compared to those of other Kansei words.

3.4.3. Principal Component Analysis (PCA)

To reduce the research data variables related to Kansei words and specimens, Principal Component Analysis (PCA) was employed. Through this process, the variables that remain after reduction represent the principal variables, without significantly diminishing the inherent characteristics of the data. The positive values identified within these variables were used as references in designing the mobile learning application from the respondents' emotional perspective. Table 3 presents the results of the PCA processed using the mean values obtained from the questionnaire data.

Table 3. Principal Component Analysis Results

	F1	F2	F3	F4
Eigenvalue	5.846	1.936	1.745	0.474
Variability (%)	58.460	19.357	17.446	4.736
Cumulative %	58.460	77.817	95.264	100.000

The results of the PCA are represented by factors denoted as F1, F2, F3, and F4. As shown in Table 4.4, the eigenvalues (variance) for F1 and F2 are 5.846 and 1.936, with corresponding variability values of 58.460 and 19.357, respectively. In comparison, the

variance and variability values for F3 and F4 are considerably lower than those of F1 and F2.

Furthermore, the cumulative values for F1 and F2 are 58.460 and 77.817, respectively. These findings indicate that F1 and F2 possess substantially higher variance and variability compared to F3 and F4, with cumulative values exceeding 50%. This suggests that F1 and F2 are sufficient to represent the underlying emotional structure of users. In other words, the principal components F1 and F2 adequately capture the dominant structure of user perceptions.

This implies that the emotional structure is predominantly influenced by the factors represented in F1 and F2. The PCA results are subsequently visualized in the form of a scree plot, as illustrated in the figure 7.

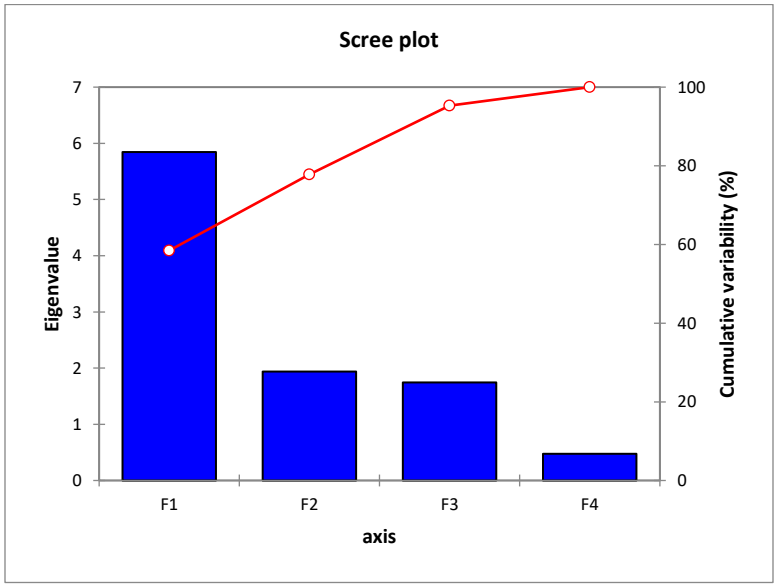

Figure 7. Scree plot of PC for the respondent group

3.4.4. Factor Analysis (FA)

Factor Analysis (FA) was conducted to reinforce the results of the previous analysis, namely Principal Component Analysis (PCA). Additionally, varimax rotation was applied to obtain more robust and interpretable results.

Tabel 4. Emotion Concepts Based on Factor Analysis (FA)

Kansei Word	D1	Kansei word	D2
Simple	0.121	Colorful	**0.584**
Unique	0.161	Profesional	0.080
Bright	0.364	Attractive	0.327
Dynamic	0.478	Simple	**0.332**
Comfortable	0.582	Elegant	0.442

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Kansei Word	D1	Kansei word	D2
Colorful	0.583	Dynamic	**0.586**
Harmonious	0.657	Bright	**0.591**
Elegant	**0.726**	Comfortable	**0.669**
Attractive	**0.945**	Harmonious	**0.737**
Profesional	**0.997**	Unique	**0.987**

Table 4 presents the emotional concepts derived from the Factor Analysis (FA) results based on respondents' evaluations, indicating that the proposed application design is expected to embody the emotional concepts of "Professional," "Attractive," and "Unique." Emotional concepts with values greater than 0.7 are considered to have high significance. However, to further refine and strengthen the emotional characterization, only those with values exceeding 0.9 are prioritized.

The emotional concept with the highest value is "Professional," which serves as the primary concept for designing the application interface. Meanwhile, the other two concepts function as alternatives. Accordingly, the design concepts to be developed are the two emotional concepts with the highest values.

3.5. Interpreting the Analyzed Data

The results of the PCA and FA analyses, which represent the underlying emotional constructs, are subsequently translated into design elements using Partial Least Squares (PLS) analysis. The primary objective of this analysis is to identify the design elements that most significantly influence participants' emotional responses. The outcomes of this process serve as a basis for formulating design element recommendations aligned with the target emotional attributes of the respondents.

The data involved in this process include: the dependent variable (Y), which consists of the aggregated mean scores of participant responses; the independent variables (X), which represent the design elements transformed into dummy variables by assigning a value of 1 to checked items and 0 to unchecked items; and five mobile learning application specimens.

Furthermore, the classified design element data are converted into binary values. Each design element is assigned a value of either 1 or 0, where a value of 1 indicates that the corresponding design sub-element is selected, while a value of 0 indicates that it is not selected.

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Table 5. Design Element Dummy Variables

No.	*Specimen*	*Header BG Color*				*Header BG picture*		*Header Logo*		
		#232645	*#438cb7*	*#141f23*	*Colorfull*	*Exist*	*Nonexist*	*Center*	*Left*	…
		HBGC #232645	*HBGC #438cb7*	*HBGC #141f23*	*HBGC #Colorfull*	*HBGP E*	*HBGP NE*	*HL C*	*HL L*	…
1	**Ruang Guru**	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*1*	…
2	**Skill Academmy**	*1*	*0*	*0*	*0*	*0*	*1*	*0*	*1*	…
3	**Doulingo**	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	…
4	**Ummi Foundation**	*0*	*0*	*0*	*0*	*1*	*0*	*1*	*0*	…
5	**Zenius**	*0*	*0*	*0*	*1*	*0*	*1*	*0*	*0*	…

The dummy variable data were subsequently processed using Partial Least Squares (PLS) Regression in XLSTAT, incorporating the mean values obtained from the questionnaire results and the design element data of the five specimens. The results indicate the coefficient values for each emotional variable selected from the emotional concept. Table 6 presents the outcomes of the PLS analysis. The data displayed are limited to the emotional concepts with the highest variable values based on the results of the PCA and FA analyses, namely "Professional" and "Unique."

Table 6. Results of PLS Calculation

Variable	Coefficient Profesional	Coefficient Unique
HBGC #232645	-0.029	-0.108
HBGC #438cb7	0.071	0.035
HBGC #141f23	-0.018	0.035
HBGC #Colorfull	-0.079	0.021
HBGP E	0.055	0.017
HBGP NE	-0.055	-0.017
HL C	0.055	0.017
HL L	0.034	-0.060
HL N	-0.079	0.046
HIM E	0.071	0.035
HIM Ne	-0.071	-0.035
HFI E	0.055	0.017
HFI Ne	-0.055	-0.017

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Variable	Coefficient Profesional	Coefficient Unique
HS E	-0.029	-0.108
HS Ne	0.029	0.108
BBC #7fb0d0	0.071	0.035

The variables presented in Table 6 were subsequently grouped according to their respective elements and attributes. For example, variables "HL C" to "HL N" were categorized under the "Header Logo" element.

3.6. Constructing a Matrix of Kansei Engineering Analysis Results

This stage involves developing recommendations for the Mobile Learning application interface design concept. Based on the results of the PLS calculations, a recommendation matrix for the interface design concept can be established. Design elements with range values above the overall average range are considered recommended elements. According to the analysis results, these design elements have a significant emotional influence on application users.

As previously explained, the emotional concepts that exert a strong influence on the overall design concept for all respondents are "Professional" and "Unique." Table 5 and Table 6 present the recommended matrices derived from the Kansei Engineering analysis for the Mobile Learning application interface design.

Table 7. Pls Results Based on Ranking on the "Professional" Emotion Concept

Professional **Average Range: 0.118**

No	Category	Design Concept	Coefficient	
1	Body Slider	Exist	0.071	0.143
2	Footer Menu	Exist	0.079	0.143
3	Header BG Color	#438cb7	0.070	0.141
4	Body Background Color	#7fb0d0	0.070	0.141
5	Header Icon Massage	Exist	0.070	0.140
6	Body Search	Exist	0.070	0.140
7	Header Logo	Center	0.060	0.137
8	Header BG Picture	Exist	0.060	0.121
9	Header fitur Icon	Exist	0.060	0.121
10	Footer Color	N/S	0.071	0.106
11	Body font Color	N/S	0.048	0.096
12	Header Search	N/S	0.029	0.059

13	Body Icon Border	N/S	0.020	0.039

Table 8. Pls Results Based on Ranking on the "Unique" Emotion Concept

Unique **Average Range : 0.101**

No	Category	Design Concept	Coefficient	
1	Header Search	Nonexist	0.108	0.216
2	Body Icon Border	round	0.074	0.148
3	Header BG Color	#141f23	0.035	0.146
4	Body Background Color	#141f23	0.035	0.146
5	Footer Color	#141f23	0.035	0.146
6	Body font Color	#000000	0.059	0.113
7	Header Logo	None	0.046	0.104
8	Header Icon Massage	N/S	0.035	0.071
9	Body Search	N/S	0.035	0.071
10	Body Slider	N/S	0.021	0.034
11	Footer Menu	N/S	0.021	0.034
12	Header BG Picture	N/S	0.017	0.034
13	Header fitur Icon	N/S	0.017	0.034

3.7. Design Development Based on Kansei Engineering Recommendations

The final stage of this research involves developing a design based on the recommended matrix derived from the Kansei Engineering analysis for the Mobile Learning application interface design. Figure 7 illustrates the design with a professional concept, while Figure 8 presents the design with a unique concept.

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Figure 8. Professional Concept

Figure 9. Unique Concept

4. CONCLUSION

The study on the design of the *Mobile Learning* application for Majelis Daur Ulang employed ten Kansei Words to identify and represent users' emotional responses toward the interface design. Five comparable *Mobile Learning* application specimens were selected as benchmarking samples in the evaluation process. This research involved 32 participants who provided assessments through a structured questionnaire. The collected data were analyzed using multivariate statistical analysis to examine the relationships among emotional variables and to determine user design preferences.

The findings of this study resulted in two recommended interface design alternatives for the Majelis Daur Ulang *Mobile Learning* application, both of which explicitly incorporate users' emotional aspects into the design process. There are two emotional factors identified in the design of the Mobile Learning application for Majelis Daur Ulang, namely "Professional" and "Unique." These factors were determined through the application of the Kansei Engineering approach, which serves to translate users' affective impressions into specific design attributes.

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