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WEB BASED E-LEARNING SYSTEM ANALYSIS USING KANSEI ENGINEERING

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Abstract

Education has been developed in various techniques for decades. Technology is included in its development; it is begun by the usage of media such as Compact Disk, television, computer and web-based E-Learning recently. Many web developers provide web-based E-Learning and give their best features and interface design to ease and attract the user. One of concept to make them is Human-Computer Interaction (HCI). HCI is about designing computer system, how to make a good communication between user and computer system with all aspect, includes interface and features. The key of HCI is usability that aims the user is satisfied by the computer system. Now, the product is not only focus in technically aspects such as the easiness, the advantages or other sophisticated add-in, but the point is how to persuade the user to use the product by the first sight and psychological feeling. Kansei Engineering or KE is used to complete the concept of HCI. KE is a technology that involves psychological feeling to make or develop a product. One of KE techniques is Kansei Engineering Type I or called by KEPack. KEPack has some steps, started by decision of strategy, collection Kansei Word and structured to SD Scale; data analysis involves multivariate statistical analysis. And finally the result of KEPack is product guideline matrix or product prototyping. Main focus of this study is exploring the concept of emotion between user's psychology emotional factors to E-Learning website design by using Kansei Engineering approach.
Keywords: web-based E-Learning, Kansei Engineering, Kansei Engineering Type 1 (KEPack)

1. Introduction

E-Learning or Electronic Learning becomes a popular term for recent decades. E-Learning is an electronic based learning process using computer network or internet as one of learning media. Some institutions have developed E-Learning. However, most of them focused on developer perspective without considering what kind of E-Learning the learners really want.

Human Computer Interaction (HCI) is used to design an E-Learning model with "usability" as a main key, especially when designing E-Learning's interface [1]. However, the need of interface design is not only on "usability" aspect, but in its development the users need persuasiveness is more than usefulness and functional usability. In this case, psychology factor or user emotional is the parameter in interface design. It means *Kansei Engineering* approach is used in research analysis.

Kansei Engineering approach is the main focus in this study; how user's psychological feeling aspect is translated into concept of emotion that adapted to web based E-Learning design. The purpose of this study is to explore the relationship user's emotional factor to web based E-Learning design and build the concept of emotion based of user's psychological feeling.

Kansei Engineering is used in research analysis; some steps are followed in the method. Kansei Engineering was established in 1970s as a technology that unites Kansei to engineering realms. So far, six types of Kansei Engineering method have been developed [3], they are: Kansei Engineering Type I (KEPack), Category Classification, Kansei Engineering System, Hybrid Kansei Engineering, Kansei Collaborative Designing, Virtual Kansei Engineering.

1.1 Kansei

Based on Dainihon Japanese Dictionary that Kansei (感性) is sensitivity of a sensory organ where sensation or perception takes place in answer to stimuli from the external world [4] Schutte says that Kansei could be defined as individual's subjective impression from a certain artifact, environment or situation using all the senses [5]. Kansei is generally referred to sensitivity, sensibility, feeling and emotion [6].

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1.2 Kansei Engineering

In product design, generally personal objectivity is the main focus and ignores what the real needs of customer. So that would take effect on the level of sales. One of method in product design is Kansei Engineering that focuses on customer need. Kansei Engineering is a technology that combines Kansei and Engineering realms to assimilate human Kansei into product design targeting to engineer the production of goods that consumer will enjoy and satisfy with [7]. In other word that Kansei Engineering is a technology of ergonomic which is oriented to customer satisfaction in product developing.

One of method of Kansei Engineering is Kansei Engineering Type I or well known as KEPack. KEPack is the most popular technique combined as a pack and formulated as company's product development strategy focuses on design domain as well as the target users (costumers) [3]. KEPack involves multivariate statistical analysis to analyze and interpret data. The statistical methods that are commonly used are as follow Analysis of Variance, Correlation Coefficient Analysis, Principal Component Analysis, and Factor Analysis.

Kansei Word (KW) that represent psychological factor which involved in the study usually as the adjective word or customer's feeling that related with product. Kansei Word could be taken from many references such as book, magazine that related with the object or the expert's opinion. In this study which E-Learning as the research object involves 20 Kansei Word, for sample "Enthusiastic", "Dynamic", "Childish", "Feminine" and they are constructed to the Semantic Differential (SD) Scale 5 point :

Enthusiastic					Not Enthusiastic
Dynamic					Not Dynamic
Childish					Not Childish
Feminine					Not Feminine
…					

Figure 1 SD Scale

20 specimens were selected from some institutions or E-Learning website and identified to 10 specimens with different criteria to be involved in the study analysis.

2. Research Method

20 specimens were selected from some institutions or web-based E-Learning and identified to 10 specimens with different criteria to be involved in the study analysis.

Table 1 10 Specimens

No.	Spesimen	No.	Spesimen	No.	Specimen
1		5		8	
2		6		9	
3		7		10	

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4	

Then 10 specimens are shown to the 20 participants or students who have been selected in Senior High School, and they fill in the Kansei Word SD Scale questionnaire sheet. A Kansei question should take about 2 or 3 seconds to be answered [3]. The layout of evaluation experiment is shown by figure2:

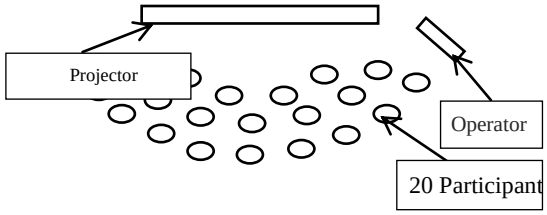

Figure 2 Evaluation Layout

All the data of questionnaires are recapitulated for each participant and averaged to find out the average score. Table 3 shows the average score from all participants.

Table 3 Participants' Average Score

NO	Website ID	Average Score				
		1	2	3	…	10
1	Dynamic	2.40	3.70	1.75		3.00
2	Futuristic	2.50	3.95	2.00		3.30
3	Informatif	3.05	3.65	2.90		3.75
4	Soft	2.25	3.05	2.50		3.00
…						
20	Elegant	1.85	2.50	1.80		2.85

3. Result and Discussion

This study involves 10 specimens, 20 participants and 20 Kansei Word (hereinafter referred as "emotion") generates the average data to be analyzed by multivariate statistical method. The statistical methods that used in the study are Principal Component Analysis (PCA) and Factor Analysis

3.1. Principal Component Analysis (PCA)

Principal Component Analysis or PCA is a statistical method that used to compress 20 emotion to smaller number two or three axis. The structure of emotion could be defined by the analysis. Participants's average score were processed by using XLStat software. Then, generates 9 factors or called by Principal Component (PC) that shown on table 4.

Table 4 Principal Component Score

	PC1	PC2	PC3	…	PC9
Eigenvalue	12.727	3.681	1.195		0.137
Variability (%)	63.637	18.403	5.976		0.685
Cumulative (%)	63.637	82.040	88.016	…	100.000

On table 4 shows eigenvalue score or variance and variability for each PC1 to PC9. The eigenvalue score of each PC1 and PC2 is 12.727 and 3.681 with level of variability 63.637% and 18.403%. On the row of Cumulative that PC1 and PC2 show 82.040% of total variance. It means PC1 and PC2 have represented from the data analysis and have the influence for the emotion. Further, if it is observed that PC3 to PC9 has the lower score of eigenvalue and the percentage of variability is not

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significant, because PC1 and PC2 have represented more than 80% of total variance, so PC3 to PC9 could be ignored and focus on PC1 and PC2 to the next analysis.

The following three steps of PC Analysis were calculated to analyze PC1 and PC2 and explore the relationship between emotions to specimen:

PC Loading

In this study PC Loading is involved to explore emotion distribution to the axis, so the concept of emotion could be defined that have influence to the specimen. On the **figure 3**, the emotion distributed to the axis.

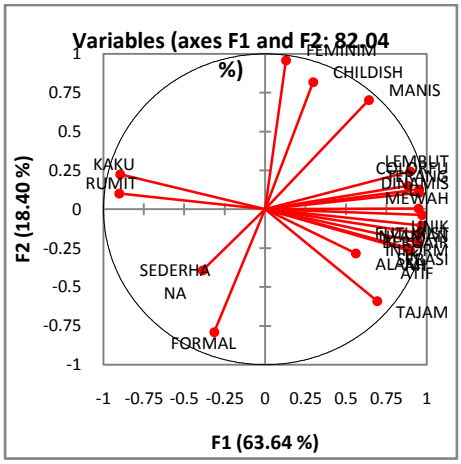

Figure 3 PC Loading for PC1 and PC2

In **figure 4** there are two axis, it is *x* axis and *y* axis. On the *x* axis there is two opposite emotions which has positif and negative value. On the left side there are two emotions, "Complex" and "Rigid", whereas on the right side there are some emotion, they are "Dynamic", "Soft", "Bright", "Colorful" and "Luxurious", subjectively this axis named by "Attractiveness" concept. So if it is concluded that on the left side indicate something "not attractive" and the right side indicate something "attractive"

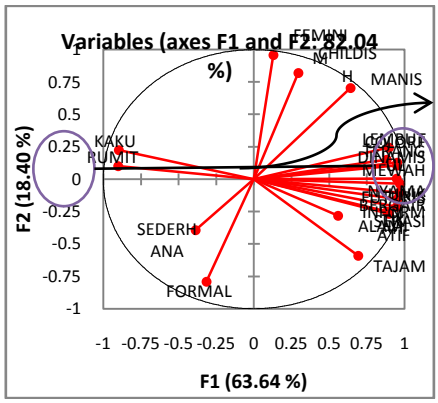

Figure 4 *x* axis; "Attractiveness

Then on the *y* axis where have the opposite emotions, in the upper side is the positive zone consists of two emotions, "Feminine" and "Childish" while in the lower side has only one emotion, "Formal". Subjectively, the *y* axis named by "Cuteness", where in the upper side or positive zone indicate "Cute" while in the lower side or negative zone indicate "Not Cute".

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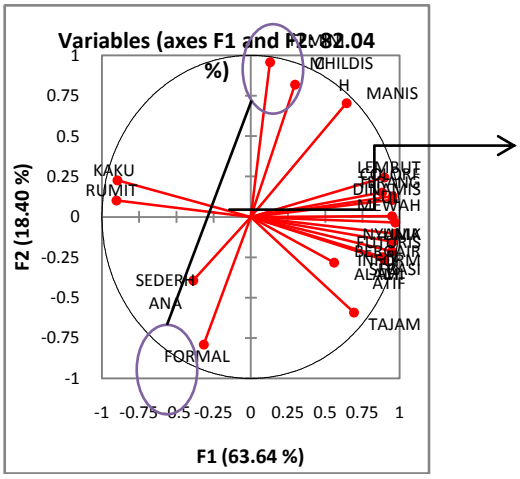

Figure 5 *y* Axis; "Cuteness"

After determining two concepts of emotion, "Attractiveness" and "Cuteness". The next step is executing PC Score.

PC Score

PC Score is executed to explore the relationship between emotion and E-Learning specimen, how specimen distributed to the axis based on two concept emotion, "Attractiveness" and "Cuteness"

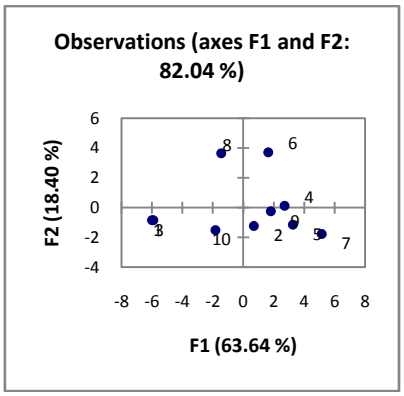

Figure 6. Distributed E-Learning Specimens (*y* axis; Cuteness)

To ease in interpeting distributed specimen, screenshot of specimen could be put in the axis, shown by **figure 7**

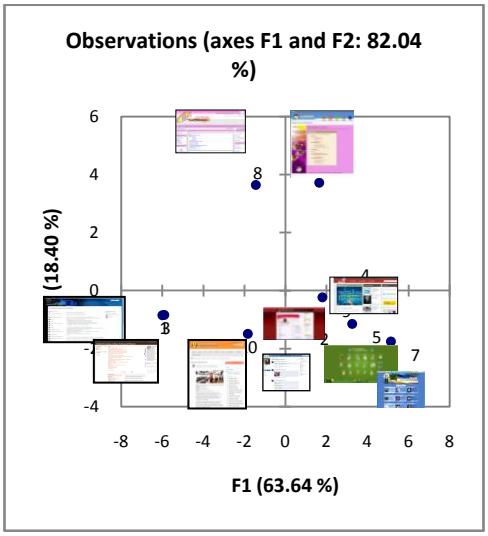

Figure 7 Screenshot of Distributed Specimen

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Specimen 1 and 3 are in left lower position, it means this specimen is "Not Attractive" in *x* axis or "Attractiveness" concept and "Not Cute" in *y* axis or "Cuteness" concept. If the specimens are observed, white color and text dominate to the layout web pages, this causes that specimen in negative zone. While specimen 4 is in right upper position, which in positive zone, means "Attractive" and "Cute", the display of the specimen combines some colors or colorful and has a few of empty space.

Specimen 6 has strong "Cute" value, which indicated on the top position in *y* axis or "Cuteness" concept. The dominated color is pink and has the element of "Attractive". Same with specimen 8, which has strong "Cute" value but on the left side position, which means "Not Attractive". Specimen 7 has strong "Attractive" value, but in "Not Cute" position.

PC Vector

PC Vector which is used to visualize direction and strength of emotion over the structure of emotion, and determine a Kansei area [8]. Figure 8 shows result of PC Vector.

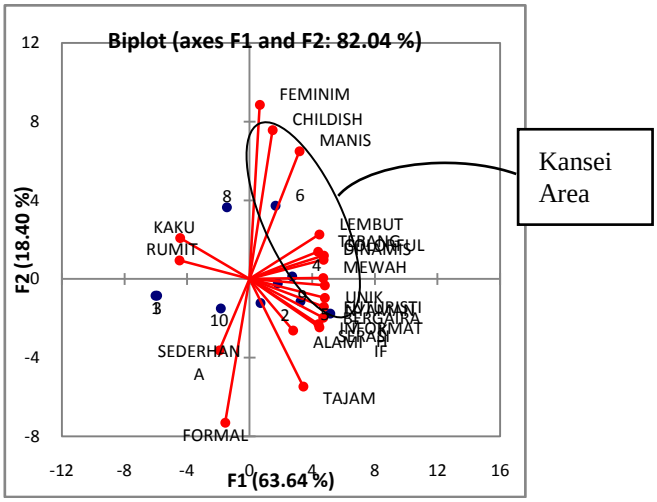

Figure 8 Result of PC Vector

PC Vector shows distributed emotion and specimen. On **figure 8**, specimen 6 where the nearest emotion is "Cute" and "Childish" while specimen 10 is "Simple" and "Formal". The ellipse indicates Area of Kansei on positive zone. It means that the emotions on the positive zone are the reference in E-Learning website design.

3.2. Factor Analysis

Factor Analysis or FA is used to sharpen and itemize the result of PCA. Varimax Rotation is used in Factor Analysis to generate the accurate result. Table 5 shows the result of FA after Varimax Rotation:

Table 5 FA Result after Varimax Rotation

	Faktor 1	Faktor 2	Faktor 3
Contribution (%)	59.881	18.626	7.081
Cumulative (%)	59.881	78.507	85.588

There are three factors with contribution level on factor 1 59.88%, factor 2 18.63% and factor 3 7.08%. This means factor 1 has the highest score for contribution level and factor 2 has less than factor 1. As seen that factor 3 has the lowest score of contribution level, factor 1 and factor 2 could be accepted as dominant factor for parameter emotion, whereas factor 3 could be reduced becase it has no significant score in contribution level. In cumulative percentage, factor 1 and factor 2 have represented 78.50% of total contribution. Those factors are analysed to determine the coefficient of emotions and generate various score for each 20 emotions that shown on table 6:

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Table 6 Factor and Emotion Correlation Score

Emotion	**Faktor 1**	**Faktor 2**	**Faktor 3**
Simple	-0.222	-0.229	-0.754
Complex	-0.876	-0.056	-0.237
Harmonious	0.936	0.033	-0.187
Childish	0.120	0.919	-0.088
…			
Cute	0.433	0.745	0.436

The correlation scores in table 6 arranged from small to large number, to explore which the emotion that has influence to concept of emotion Table 7 is a description of table 6. The minimum score which used is > 0.7, but to narrow the amount of emotion and focus only to the emotion that has high influence value, for factor 1 the minimum score is > 0.9, where there are emotions "Enthusiastic", "Comfortable", "Futuristic", "Unique", "Harmonious", and "Informative", subjectively those emotions named and grouped into "Attractiveness" concept. There is no specific way to name the concept of emotion; the words that represent all of the emotion could be given in the concept name. While in the second factor there are three emotions which have score > 0.7; "Cute", "Feminine" and "Childish" that subjectively the emotions named and grouped into *"*Cuteness*"* concept. Whereas as seen in the third factor that there is no emotion has the influence or by means emotion score in factor 3 < 0.7, so the third factor could be reduced

Table 7 Emotion Concept Based on Factors

Variabel	**Faktor 1**	**Variabel**	**Faktor 2**	**Variabel**	**Faktor 3**
Rigid	-0.945	Formal	-0.915	Simple	-0.835
Complex	-0.886	Sharp	-0.424	Complex	-0.242
Simple	-0.224	Simple	-0.235	Harmonious	-0.194
Formal	-0.156	Natural	-0.080	Natural	-0.092
Feminine	-0.119	Informative	-0.075	Childish	-0.088
Childish	0.119	Complex	-0.063	Sharp	-0.008
Cute	0.435	Rigid	-0.054	Enthusiastic	0.037
Natural	0.594	Enthusiastic	0.023	Unique	0.069
Soft	0.785	Harmonious	0.031	Formal	0.123
Sharp	0.807	Futuristic	0.041	Informative	0.141
Bright	0.814	Comfortable	0.098	Comfortable	0.143
Dynamic	0.894	Luxurious	0.179	Colorful	0.154
Colorful	0.896	Unique	0.200	Futuristic	0.166
Lucurious	0.899	Dynamic	0.268	Rigid	0.192
Informative	0.925	Bright	0.318	Bright	0.203
Harmonious	0.938	Colorful	0.322	Dynamic	0.279
Unique	0.955	Soft	0.385	Luxurious	0.290
Futuristic	0.962	Cute	0.761	Soft	0.363
Comfortable	0.963	Feminine	0.905	Feminine	0.402
Enthusiastic	0.973	Childish	0.942	Cute	0.469
ATTRACTIVENESS		**CUTENESS**			

If it is concluded that the result of Principal Component Analysis has the sameness to Factor Analysis, where two concepts of emotion are generated, "Attractiveness" and "Cuteness". As described before, Factor Analysis is used to sharpen the result of Principal Component Analysis by breaking down the concept of emotion to the specific emotion coefficient score.

4. Conclusion

Kansei Engineering could be adopted in product design, psychological factors which translated by Kansei Words were classified into concept of emotion is the main focus to build the recommended

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product or product prototype. Principal Component Analysis and Factor Analysis are multivariate statistical method that translate psychological factor into concept of emotion. In this study we determine that the concept which is needed for building web-based E-Learning is "Attractiveness" and "Cuteness"

For further analysis, the other multivariate statistical method, for example by Partial Least Square or cluster analysis is needed to interpret data into element design which called by Guideline Matrix Recommendation in specific design

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