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KANSEI EVALUATION IN OPEN SOURCE E-LEARNING SYSTEM

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Abstract

Many open source web based e-Learning systems are offered to support learning environment over the internet. Academic institutions usually choose to implement systems that meet the needs and characteristics of students. However, only little guide exists to support them in choosing systems that meet the implicit needs of students, thus adoption of e-Learning system is unsustainable. This paper reports an attempt to discover these implicit needs and how it correlates to the design of e-Learning systems by the adoption of Kansei Engineering. The objective is to analyze and choose the desired open source e-Learning system based on students' implicit needs. Five open source e-Learning system were used as specimen in a Kansei evaluation procedure, employing one hundred subjects from the target user group. The result suggests that Kansei Engineering can be used to determine open source e-Learning systems that meets the implicit needs of targeted users, and thus enable sustainability of the system implementation.

Keywords: E-Learning, open source, emotion, Kansei Engineering

1.0 INTRODUCTION

E-Learning is an electronic based learning medium which uses computer network as one of learning media via intranet / internet. Many web developers and solution providers compete to develop different kinds of e-Learning systems. These systems are mainly developed based on their bias definition of design requirements, and mostly ignored the importance of providing desired e-Learning system that matches with students' implicit needs or desires. There has been a lacking in terms of design guide that can be used to improve a system that caters for these students' needs and desires.

Usability is one of the most important aspect is interface design [1]. However, interface design should not only focus on the aspect of usability, but should also stress on providing usefulness and functional usability [2]. Therefore, a knowhow to design more persuasive interface for the users is of critical matters. Additionally, most e-Learning systems are lacking consideration of psychological factors, which includes addressing the implicit needs of users. In this research case, this psychological factor is focused to users' emotion as one of the important parameters in interface design.

Kansei Engineering (KE) has been widely used to address emotion in product design. This research adopted KE approach in its investigation of users' emotion due to its ability to translate user's psychological feeling into a concept of emotion, which the research proposed to be incorporated into web based e-Learning system design.

Many research have been performed adopting KE in diverse field for product emotion, which includes some focus to software systems. Example of past research includes emotion and entertainment [3-4], emotion and wheel chair [5], emotion and e-commerce [6-7], emotion and textile [8-9], emotion and fashion design [10], and many more. However, only little study is evident in the education domain.
The founder of KE, Professor Nagamachi, defines Kansei as a state of mind that psychological feeling and needs in mind [11]. Kansei is also referred to the state of mind where knowledge, emotion and passion are harmonized [12]. KE was established as a discipline

that successfully assimilates Kansei, psychology, engineering, and statistics [13]. The use of KE is targeted to enable development of products that win the heart and mind of the consumers. It has in its methodology, a systematic process to discover insights of consumers' responses toward artifacts via several physiological and psychological assessment methods. This knowledge will then be translated into design characteristics, which then enable the formulation of new product design that embeds consumers' implicit feelings and desires. This methodology can be used to enable inclusion of emotion in e-learning, as positive emotion has been found to positively associate with learning [14-15].

The development of research in education system domain involving the adoption of KE appears in late 2000s. Research in [16] investigated the element of colors on e-learning web interface, in the effort to enhance experience. Authors in [17] investigated the aspect of emotion in interactive e-learning system with the use of biometric signal and KE, by analyzing knowledge and emotion level. On the other hand, authors in [18] proposed a conceptual model for e-learning, in which they used a software agent to recognize and respond to the learner's emotional state during learning phase. Recent development in e-learning and KE can be seen in the work of [19], which revealed Kansei semantic space in online database courseware systems, and [20], which proposed a theoretical framework of playful interaction in mobile learning. There are other related research on KE on web based system development, which mainly implemented to designing interface [21-23].

The aim of this research is to explore the relationships between student's emotional factors (psychological feeling) with the interface design of web based e-Learning system. The result of this research could be used as guide in ensuring that a selected e-Learning system has a desired interface and function suit to students' psychological requirement. This research put its focus of investigation to open source learning management system to be used as e-Learning system in higher educational institution, and analyze students' experience on the interface and functions with the adoption of KE.

2.0 METHODOLOGY

This research adopted the KE Type I (KE Pack) due to its simplicity and wide use in many product development [2, 6, 10, 19-20, 22-23]. Figure 1 shows the research process by the adoption of KE Type I.

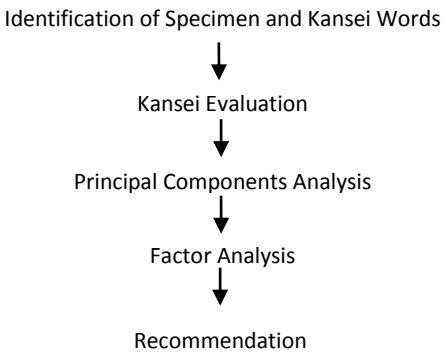

Figure 1 Research Process

Firstly, five open source e-Learning systems [24-28] were selected based on its suitability to be adopted in the academic institution's environment, to be used as specimen in the Kansei evaluation session. The specimens were selected based on their visible differences in design characteristics such as background colour and page layout. Then, ten Kansei Words representing psychological factors of systems were selected to represent psychological responses students have with the specimens. The Kansei Words are as shown in Table 1. Then, the research constructed each Kansei Word to 5 points Semantic Differential (SD) Scale to be used as measurement instrument in the Kansei evaluation session. One hundred students were recruited as participants to provide their Kansei responses towards the specimens into the Kansei measurement instrument. While each specimen is shown one by one in an experimental setting environment, all participants rate their Kansei responses and fill the score of every Kansei Word into the Kansei Checklist. Evaluation results from each participant were calculated to discover the average scores of each specimen according to each Kansei Word, as shown in Table 1.

Table 1 Average Data of All Participants

No.	Kansei Words	Specimens				
		1	*2*	*3*	*4*	*5*
1	Dynamic	3.02	2.85	3.04	3.09	3.15
2	Informative	3.1	3.3	3.4	3.29	2.9
3	Simple	2.98	3.14	3.05	2.96	3.01
4	Bright	2.96	2.84	3.02	3.02	3.14
5	Harmony	2.91	2.83	2.9	3.01	3.27
6	Comfort	3.14	2.74	3.06	3.17	3.03
7	Rigid	3.21	3.03	3.0	2.79	2.9
8	Unique	3.13	3.2	2.81	2.85	3.08
9	Passion	3.13	2.93	2.92	2.73	3.01
10	Formal	3.03	3.0	3.03	2.98	2.91

Multivariate analysis (Principal Component Analysis and Factor Analysis) was then performed to analyse the average data obtained from the evaluation session. The research finally concludes with recommendation of the desired open source e-

Learning system to be used in supporting learning process.

3.0 RESULTS AND DISCUSSION

In this research, the averaged evaluation data (as shown in Table 1) was analysed by Principal Component Analysis and Factor Analysis. The results are as reported in the next sub-sections.

It can be observed from Table 2 and Figure 2, there are factors that have significant impact to the specimens. It provides evidence of the variability for each D1 to D4. The level of variability of D1 is 47.771% and D2 is 29.407% respectively. So we found that the total of Cumulative D1 and D2 is 77.178%. It means that D1 and D2 have enough influence for representing students' emotion towards the five open source e-Learning systems. Therefore, the research could concentrate on the two factors of D1 and D2 for further analysis.

Table 2 Percentage of variance

	D1	D2	D3	D4
Variability (%)	47.771	29.407	18.679	4.143
Cumulative (%)	47.771	77.178	95.857	100.000

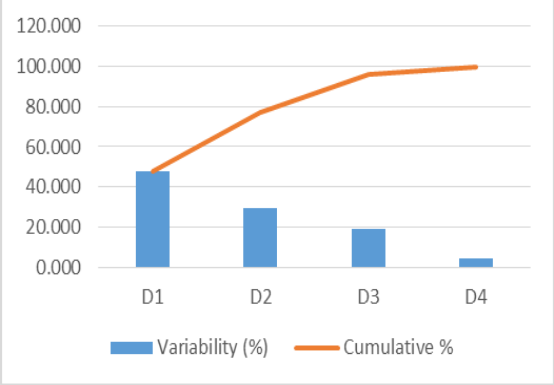

Figure 2 Factors of PCA

Figure 3 shows result of analysis using Principal Component Vector (PCV) Analysis. PCV is used to visualize direction and strength of emotion over the structure of emotion, and determine Kansei area [6]. It shows the distribution of e-Learning systems according to students' emotions. Evident in Figure 3 specimen ATutor, which is found residing in the positive x and y axes is nearest to emotion harmony. On the other hand, Chamilo is somewhat near to comfort, Opigno is informative, Efront is simple, and Moodler is mostly rigid.

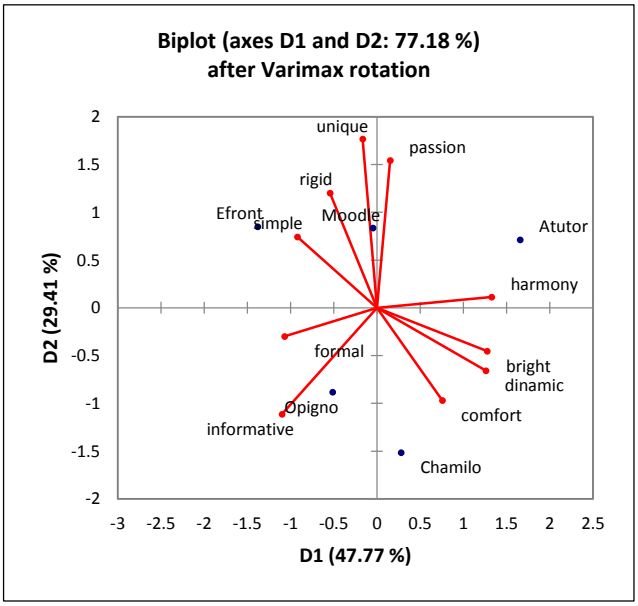

Figure 3 PC Vector

3.1 Factor Analysis (FA)

This analysis is to refine the result of PCA. Varimax Rotation is used in FA to generate more accurate result. Table 3 shows the result of FA using varimax rotation.

There are two factors with contribution level respectively, with factor 1 of 46.838% and factor 2 of 29.050%. This means that factor1 has the highest score of contribution. In cumulative percentage, factor 1 and factor 2 have represented 75.889% of total contribution. These factors are analysed to determine the coefficient of emotion and generate variability scores for each 10 emotions, as shown in Table 4 and Table 5.

Table 3 Factor Analysis Result

	Factor 1	Factor 2
Variability (%)	46.838	29.050
Cumulative (%)	46.838	75.889

Table 4 Factor Analysis 1

Kansei Words	Factor 1
informative	-0.819
formal	-0.787
simple	-0.628
Rigid	-0.376
unique	-0.093
passion	0.128
comfort	0.527
Bright	*0.896*
dynamic	*0.903*
harmony	*0.968*

Table 5 Factor Analysis 2

Kansei Words	Factor 2
informative	-0.570
comfort	-0.540
dynamic	-0.385
bright	-0.270
formal	-0.136
harmony	0.028
simple	0.402
rigid	0.658
passion	*0.795*
unique	*0.907*

The factor scores in Table 5 and Table 5 are sorted in ascending order to determine the influence of emotion in e-Learning system. The research set the reference threshold to 0.8. For factor 1, the emotions that have score of more than 0.8 are bright, dynamic and harmony, while in factor 2, there are the emotion of passion and unique. Factor 1 can be represented as the factor of harmonious, and factor 2 as unique. Other emotions shown in Table 4 and Table 5 have value lower than 0.7, and thus can be ignored because they have less influence to emotion in the selected open source e-Learning systems.

According to this result, it can be concluded that the emotion has influence to preferred system, and should be considered to the select open source e-Learning system are harmonious and unique. It could also mean that to design an e-Learning system that could capture users' emotional attention are the design concept of harmonious and unique. These emotions should be considered in designing e-Learning system that embeds users' emotional requirement in the future.

4.0 CONCLUSION

Kansei Engineering has been successfully adopted in this research to analyze users' psychological needs and desire in a system. In this research, psychological factors could be represented by Kansei Words and classified into the concept of emotion in e-Learning systems. Using Principal Component Analysis and Factor Analysis, the research found that ATutor influenced the emotion harmony, Chamilo influenced the emotion comfort, Opigno influenced the emotion informative, Efront influenced the emotion simple, and Moodler influenced the emotion rigid. Additionally, harmonious and unique have the highest influence to the concept of emotion in the e-Learning systems.

Further research is proposed to explore Kansei e-Learning system based on wider population and demography, to investigate e-Learning interface design elements in detail. Comprehensive investigation could be implemented in order to determine link between emotion and the design elements with full implementation of KE, in order to provide design rules to designer in the effort to enhance e-Learning systems based on students' emotion.

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