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Comparison and Selection of Open Source E-Learning Systems Based on Users' Emotional Preferences Regarding Its Interface

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Abstract: One of the important elements in information system software is the user interface, which has the role of bridging between users and the inner system. Therefore, it is critical to analyze what users feel and to consider it in the design process to build a suitable user interface for the application of information systems. This study aimed to apply Kansei analysis to explore users' feelings related to the user interface and to analyze the relationships between users' feelings presented by Kansei words. Semantic differentials of 5 points were used in collecting data questionnaires. The research collected eight Kansei words and found that the Kansei word "Modern" has the greatest emotional influence to determine the appropriate e-learning system. The authors also found that there are also three Kansei words that have strong relationships with the Kansei words "Modern" and could be considered as alternatives. Kansei analysis using multivariate methods such as principal component and factor analyses were used to help the educational institutes in analyzing six open source e-learning systems as specimens. The adoption of Kansei analysis could help in the decision to recommend the Forma e-Learning system to be implemented.

Keywords: emotional feeling, open source e-learning, Kansei analysis, Kansei words, user interface.

基于用户界面情感偏好的开源电子学习系统的比较和选择

摘要：信息系统软件的重要元素之一是用户界面，它具有连接用户和内部系统的桥梁作用。因此，分析用户的感受并在设计过程中加以考虑，为信息系统的应用构建合适的用户界面至关重要。本研究旨在应用感性分析来探索与用户界面相关的用户感受，并分析感性词语所呈现的用户感受之间的关系。在收集数据问卷时使用了 5 分的语义差异。该研究收集了八个感性词语，发现感性词语“现代”对于确定合适的电子学习系统具有最大的情感影响力。作者还发现，还有三个关西词与关西词“现代”有很强的关系，可以被视为替代词。使用主成分分析和因子分析等多元方法进行感性分析，帮助教育机构对六个开源电子学习系统作为样本进行分析。采用感性分析有助于做出推荐实施福马电子学习系统的决定。

关键词：情感感受、开源电子学习、感性分析、感性词汇、用户界面。

Introduction

Recently e-Learning has become one of the most popular means for supporting distance activities such as e-Learning, especially during the COVID-19 pandemic. Because of this kind of condition, the implementation of e-Learning is more urgent [1]. The user interface is one of the most essential components in an e-learning system, so the user interface acts as a bridge between the student as a user and the internal E-learning system.

This research explored popular open source e-learning software such as Moodle, A-Tutor Open source E-Learning software was targeted as object research because it is more affordable and easier to implement than proprietary e-Learning software. The analysis used the Kansei method where e-Learning was assessed based on the users' emotional preferences because the users who interacted the most with e-Learning. Therefore, the more user-friendly the interface, the longer it is used.

Kansei engineering is a method that has been widely used in various fields of software products or websites such as education [2], political events [3], etc. Kansei Engineering has proven to have helped a lot in making the use of software better by improving the appearance of its user interface and extending the life of the software.

This paper discusses the influence of users' emotional factors on the e-Learning interface and looks for which emotional factors have a strong influence and must be considered in designing or redesigning the user interface of an e-Learning system in order to improve the user interface quality and increase the users' time interaction during online learning.

The advantage of the results of this research for educational institutions is that they can consider carefully and deeply in determining which is the most suitable open source e-learning system to be considered for supporting the best environment for online learning activities via the web.

The goal of this research is to apply coefficient correlation analysis (CCA), principal component analysis (PCA), and factor analysis (FA) to analyze in detail the relationship between students' emotional feelings represented by Kansei words.

The authors also tried to find the effect of emotion on an online learning activity. According to this result, the authors provide guidance based on user emotional feelings for providing an e-learning environment to support online learning using an open source e-learning system.

There have been implementations of Kansei Engineering in developing information systems, such as the design of the UI/UX of the Coding Bee

Academy website using Kansei Engineering [4], the design of an e-learning support system for high education learning activity using Kansei Engineering [5-8], Kansei analysis for a university website based on Kansei Engineering [9, 10], and Kansei for designing an e-commerce website [11].

1. Methodology

Usually, there are several methodologies that can be used in Kansei Engineering. However, in this study, the authors used the methodology of KEPack I [12-14] that is basic to be applied in user interface research.

The goal of this research mainly is to find the relationship between Kansei words and how they affect the user in choosing the open source e-learning system through its user interface.

The research methodology using Kansei Engineering in this research is mainly divided into four steps as illustrated in Fig. 1.

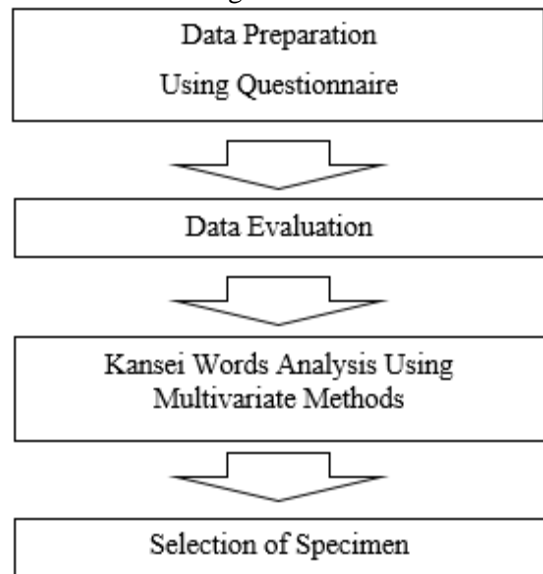


Fig. 1 Research methodology

2. Data Preparation

The methodology The authors used in our research, coefficient correlation analysis and principal component analysis, to explore the data of questionnaires and to find the relationship between the appearance of e-Learning's interface and users' emotional feelings. The authors gathered about 30 postgraduate students.

This research selected six open source learning management systems (LMSs) as sample designs or specimens, such as ELMS LN, Forma, Sakai, Opigno, Canvas, and Moodle. The authors chose each system with the criterion that the system was included as the most popular system [15].

The authors used the adjectives as Kansei words that show the related users' emotional feelings toward

the appearance of e-Learning. Eight Kansei words are described in the following Table 1.

No.	Kansei Word	Description
1	Clear	Looking easy to understand
2	Easy	Easy to use without any difficulty
3	Passion	Motivating the users to learn via website
4	Orderly	Showing the components are arranged in an orderly manner
5	Formal	Constituting an official situation
6	Modern	Relating to the present or recent times
7	Enjoyable	Endorsing users to be calm during learning
8	Pleasure	Making learning environment fun and happy

Thirty postgraduate students who had more than 1 year experience of web-based online learning were invited as respondents in collecting data questionnaires. Each student was shown the appearance of each user interface of e-Learning, and then asked to write what they really felt after they looked at the user interface of e-Learning using a five-point semantic differential scale for each Kansei word. The collected data questionnaires from students were calculated to find the averages of each Kansei word, as shown in Figure 2.

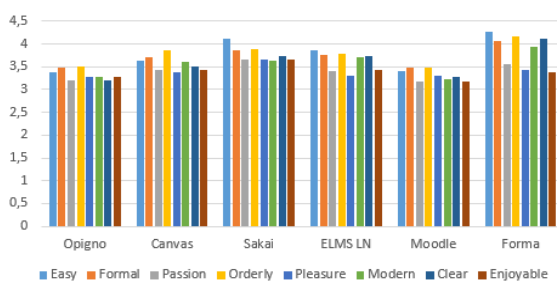


Fig. 2 Research methodology

The data described in Fig. 2 are obtained from the results of the questionnaires. It describes that the Kansei word "Easy" has the largest average value of 4,28 against e-Learning Forma, while the Kansei word "Passion" and "Enjoyable" have the smallest average value of 3,17 against e-Learning Moodle. Furthermore, the data in Fig. 1 is processed using the following multivariate analysis to find the critical points in designing an e-Learning user interface based on the users' emotional perceptions.

The results of the questionnaire as shown in Figure 2 show that each specimen has the highest dependence on the different Kansei words as listed in Table 2.

Table 2 The highest average of each specimen

Specimen	Kansei word	Average
Opigno	Orderly	3,50
Canvas	Orderly	3,87
Sakai	Easy	4,13
ELMS LN	Easy	3,87
Moodle	Passion, Enjoyable	3,17
Forma	Easy	4,28

Based on the results in Table 2, Kansei words have average values ranging from 3,17 to 4,28 regarding different specimens. This means basically that all participants have good responses to all specimens of e-Learning. The Kansei word "Easy" is the highest average for specimens of open source e-Learning Forma.

3. Results and Discussion

Based on the collected data questionnaires, First the authors check Cronbach' alpha value to know the reliability. It turned out that its value was 0.97. This means that the questionnaire data is reliable enough to continue to carry out the next process such as coefficient correlation analysis (CCA), principal component analysis (PCA), and factor analysis (FA).

3.1. Relationship of Kansei Words

This stage is to find the strength of the relationship between Kansei words so that it can be known how Kansei words (the emotional feelings) relate to each other. In Kansei Engineering, the relational analysis is performed using coefficient correlation analysis (CCA). By knowing the strength of the relationship between Kansei words, the authors can find other Kansei words as alternative considerations.

The results of CCA are described using a headman to make it easier to understand as shown in Fig. 2. According to the results in Figure 2, it can be grouped into five groups based on the strength of the relationship as follows:

1. Easy-Formal, Formal-Clear;
2. Formal-Orderly, Orderly-Modern;
3. Easy-Clear, Formal-Modern, Modern-Clear;
4. Orderly-Clear;
5. Passion-Enjoyable.

Based on the results in Table 3, the strongest emotional relationship in this study is the relationship between Kansei word "Formal" and Kansei word "Clear", which has a value of 0.985, and the weakest relationship is between Kansei word "Pleasure" and Kansei word "Modern" that has value of 0.445. Therefore, these two Kansei words represent what users really feel that should be considered by the developer in the designing interface of an e-Learning system, because the interface in an e-Learning system is one of the most essential parts of bridging between users and the system. Therefore, the more suitable the interface with the users, the better it will be used.

Table 3 The relationship of Kansei words

Variables	Easy	Formal	Passion	Orderly	Pleasure	Modern	Clear	Enjoyable
Easy	1	0,980	0,915	0,916	0,711	0,913	0,964	0,711
Formal	0,980	1	0,892	0,975	0,622	0,968	0,985	0,654
Passion	0,915	0,892	1	0,867	0,871	0,813	0,814	0,909
Orderly	0,916	0,975	0,867	1	0,561	0,972	0,945	0,622
Pleasure	0,711	0,622	0,871	0,561	1	0,445	0,514	0,851
Modern	0,913	0,968	0,813	0,972	0,445	1	0,969	0,586
Clear	0,964	0,985	0,814	0,945	0,514	0,969	1	0,551
Enjoyable	0,711	0,654	0,909	0,622	0,851	0,586	0,551	1

3.2. Specimen Selection Analysis

The authors applied the principal component analysis method to analyze and determine the selection of specimens. Table 4 shows that there are two factors that must be considered based on principal component analysis. These two factors have cumulative variabilities of 96,687%, so it means these two factors are sufficient in analyzing the data questionnaire. However, F1 is dominant because it has more than 80% variability, so it is enough to focus only on F1.

Table 4 can be visualized to be more understandable as shown in Figure 3.

Table 4 Principal component analysis factors

	F1	F2
Eigen Value	6,673	1,062
Variability (%)	83,414	13,273
Cummulative (%)	83,414	96,687

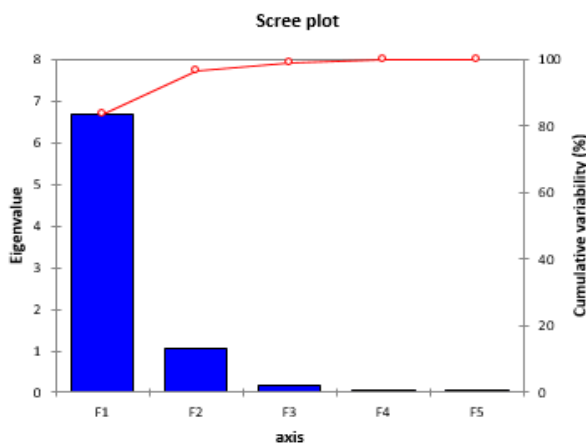


Fig. 3 E-learning distribution

Fig. 4 shows how the positions of each specimen are distributed on the basis of the user emotional preferences represented by Kansei words.

Observations (axes F1 and F2: 95.04 %)

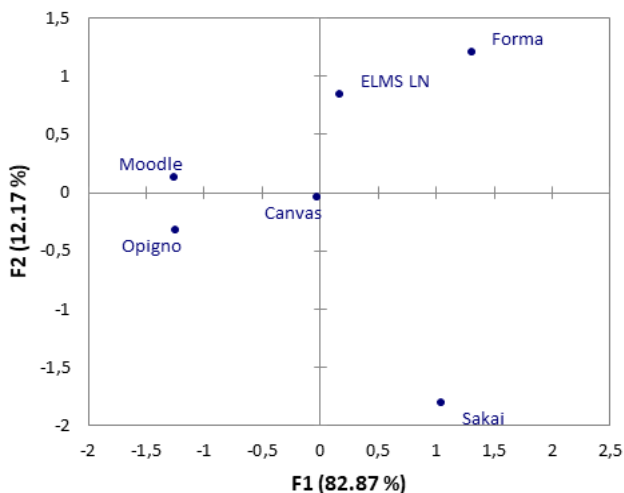


Fig. 4 E-learning distribution

Fig. 4 shows the distribution of specimens of open

source e-learning in this research. Three specimens of open source e-Learning such as Forma, Sakai, and ELMS LN are located on the positive F1 axis. This means that these three e-learnings have a suitable user interface according to users' emotional preferences. It also means that these e-Learnings, especially Forma, could be recommended to be implemented based on their appearance of the user interface.

Based on the results of Factor Analysis in Table 5, the e-Learning Forma is strongly influenced by the Kansei words "Modern", "Clear", "Formal", "Orderly", which have a coefficient value greater than. The Kansei word "Modern" is the greatest factor that contributes to e-learning forms. By combining the results in Figure 3, the authors find that the Kansei word "Modern" has a strong relationship with the Kansei words "Orderly", "Clear", "Easy" and "Formal". However, "Easy" has a value less than 0,9, so only Kansei words "Clear", "Formal", and "Orderly" can be used as alternatives for designing the user interface of e-Learning.

Table 5 Factor analysis

Kansei word	Coefficient
Modern	0,955
Clear	0,951
Formal	0,905
Orderly	0,903
Easy	0,835
Passion	0,633
Enjoyable	0,334
Pleasure	0,241

Therefore, by considering this relationship analysis, it would strengthen and enhance the design of the interface of e-Learning. Improving the interface could also improve the age of the system.

4. Conclusion

The user interface in an e-learning system plays an important role. The user interface acts as a bridge between users and the e-learning system. Therefore, considering users' feelings about the user interface is important in the decision of a suitable e-learning system. Our proposed method of Kansei analysis could help an educational institution to select a suitable system by analyzing users' emotional preferences toward the interface of e-Learning. The results show that there are three alternative e-Learning systems that could be implemented, especially the e-Learning system Forma, based on the users' emotion of "Modern".

For further research, it would be important to continue the research with more specific users to categorize the appearance of the user interface based on each category. It would also be important to apply this kind of research to lower educational institutions such as senior high schools.

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