Designing Online Discussion Site (ODS) User Interface for Emotional User Experiences: A Proposed Kansei Triangulation Method

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***Abstract*—There have been many studies conducted on online discussion sites (ODS) but studies related to the user interface of ODS is lacking. User interface design of ODS plays an important role in increasing user experiences. Thus this study aims to propose a suitable methodology for designing ODS for emotional user experiences. Emotional user experiences towards a design generally use a single investigation method. Using more than one investigation method for gathering emotional user experiences will help in overcoming weaknesses and problems in a single method. Thus a triangulation method is proposed to increase the credibility and validity of emotional user experiences related to the design of ODS. Implementation of the Kansei methodological triangulation approach will be able to quantify and qualify user's emotional responses in ODS design and hence investigate the user responses gathered from self reported and eye movement methods. This will provide some fundamental findings on using the self reported and eye movement data for identifying emotional user experiences in ODS design.**

***Index Terms*—kansei methodological triangulation, online discussion site (ODS), emotional user experiences**

I. INTRODUCTION

Online discussion site (ODS) is a general term used for online bulletin boards. It is also sometimes referred to as a web internet, internet forum or message board for having asynchronous discussions in an online environment. ODS has become a common place where people communicate online. It is being used in many higher learning institutions for conducting academic discussion among students. Higher education institutions have put efforts to encourage students to participate in discussion boards because students will learn through posting and reading message postings [1]. A user experience study towards ODS design reveals that user interface needs to be looked into for increasing user satisfaction [2]. Thus, a design that contributes to students' positive experiences during posting and lurking messages in ODS design needs to be investigated for learning to take place.

Previous studies in ODS design assessed promotion of collaborative learning [3]; improving students' classroom learning [4]; allowing students participation in knowledge construction [5], [6]; fostering critical thinking [7]; increasing student interaction [8]; promoting collaboration [9–11]; investigating message quality [12], [13] and studying for user experiences [14], [15]. In designing the ODS, the user interface that contributes to user's positive experiences are ignored.

Emotion plays an important role in the designing of products, games, websites and systems [16–38]. In Human Computer Interaction (HCI), emotion was promoted by [39] and able to help in the evaluation of certain situations. The user's emotional responses provide essential information to understand their experiences [40].

Therefore designing ODS requires considering the emotional aspect of users' experience and needs a method on how to design for emotions [41]. In order to address this issue, our study proposes a methodology using the Kansei Engineering approach to identify design requirements for supporting positive user experiences in ODS.

II. INTIAL STUDY

A. Background

The most familiar current online discussion in education is the ODS or forum in the learning management system (LMS). The ODS is widely used by higher education institutions to increase student-student and student-lecturer interaction. The forum is an ODS that is controlled by an administrator who manages online discussions for the e-learning course and also keeps track of students' performance. ODS is a web- based

doi:10.4304/jsw.8.12.3238-3245

technology which facilitates the distribution of a particular learning process [42]. Besides that, ODS also offers possibilities for changing and developing new methods in education as well as facilitating flexibility for higher education institutions.

The ODS is accessible via the internet where lecturers could access the system to establish online collaboration with students. Students can also access the system from anywhere to collaborate online. Therefore, the design interface of the ODS is important as its plays a vital role in user interface interaction. In the online environment, students will utilize the computer to access the content and interact with other students and lecturers. The ODS must be designed in an appropriate way so that users would not face any trouble when using it [42]. The problem in ODS design would decrease user satisfaction when using the portal. Thus, a simple ODS user interface must be included for easing the interaction between the user and the system [43].

A user satisfaction evaluation of the ODS design in the i-learn portal, LMS used in Universiti Teknologi MARA (UiTM) was carried out. A questionnaire was used to identify current design issues concerned with the ODS design [2]. Four main design components were studied. There were issues related to learner's interface, learning community, information and personalization of the ODS. The data collected from the questionnaire was used to identify the design components that the students were less satisfied with in the current design. Based on the finding, a methodology was proposed to design a user interface for further improvement.

B. Data Analysis

86 responses were collected from the questionnaire distributed among full time UiTM students who use the ODS for establishing online discussions for their courses. The questionnaire consisted of 24 items related to learner's interface, learning community, information and personalization of the ODS. The responses were analyzed using the Rasch model based software, WINSTEPS version 3.68.2.

C. Finding and Discussion

The output from the data analysis for this study is concerned with the design component that the users are least satisfied with. The findings indicate that the underlying hierarchy order of item difficulty to endorse by respondents. The item hierarchy were arranged from least difficult to endorse (bottom) to most difficult to endorse (top) according to their corresponding logit measures.

The item hierarchy is illustrated in Table I in descending order of item difficulty. The results revealed that the top three items; "Operational Stability" (1.01 logits), "Layout" (0.95 logits) and "Ease of Use" (0.48 logits) were the most difficult items to be endorsed by the respondents. This finding shows that the least satisfaction towards the ODS design is commonly from items belonging to the learner interface. Therefore, an appropriate methodology is required to fully explore the elements in the ODS user interface to provide better student learning experiences.

Table I
Item hierarchy in Rasch Analysis of 24 items (n=86)

Item No	Item Measures	Item Difficulty (logits)
23	Operational Stability	1.01
12	Layout	0.95
5	Ease of Use	0.48
19	Records Learning Performance	0.37
20	Sufficient Information	0.37
16	Hyperlink Connotation	0.18
21	Guidance	0.18
4	Control Learning Progress	0.13
13	Learn Required Content	0.12
14	Exact Required Information	0.12
17	Discuss with Student	0.12
24	Rely on Information	0.12
2	Structured	0.06
8	Access Content	0.06
10	User Friendliness	0.06
22	Up-to-date Information	0.06
9	Easy to Understand	-0.06
15	Choice of Learning	-0.06
6	Information Clearly Presented	-0.13
18	Ease of Finding	-0.43
7	Choice of Language	-0.45
11	Discuss with Lecturer	-0.71
3	Useful Information	-1.25
1	Share Learning	-1.32

III. Literature Review

A. Evaluation Methods for User Experiences

User experience can be defined as "how people feel about a product and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it" [44]. User experiences can be positive or negative subjective qualities. Some examples of user experiences are enjoyable, motivating, satisfying, helpful, fun, frustrating, boring and etc. These are user's feeling towards a design or system. These feelings are evaluated by various quantitative and qualitative methods. Table II reveals some of the identified methods that influence user experiences in various studies.

User experience studies are widely found in e-learning systems [45–54], whereas only a few studies are found to be related to user experiences in ODS [14], [15]. This is due to the ODS for academic discussions being usually embedded in the e-learning system. Thus the measure for user experience in e-learning system includes the ODS. User experience studies for e-learning systems mainly focus on usability and its functionality. But recently the user experience focus has shifted to emotional user experiences in e-learning [55–57].

Students who were positive towards the use of ODS and their user experiences reported a higher perception of learning from the ODS [58]. The reason for using a ODS is for learning and knowledge sharing. Most of the time students have their formal and informal discussion in social networking sites. But some effort is always needed to get the students into discussion in ODS for educational

purposes. We need to identify what is lacking for students participation in ODS. Technology is one of the factors that contributes to online knowledge sharing [59]. It is essential that the tools used in ODS support online discussions.

Table II
User Experiences with its Evaluation Methods

User Experience	Methods Used	Study	Reference
Motivating Enjoyable	Interview	Web Content	[60]
Simplicity	Questionnaire, Observation	Mobile System	[61]
Engaging	Survey, Log Analysis	Blog	[62]
Anxiety Satisfaction Pride Frustration	Questionnaire	e-Learning System	[63]
Play Experience	Survey	Game	[64]
Readability Comprehensibility Satisfaction	Scenario Simulation, Questionnaire	e-Book	[65]
Satisfaction	Questionnaire	System	[66]
Playful Experience	Interview	Digital Games	[67]
Useful Motivating	Observation Interview Questionnaire	Virtual Word	[68]
Playing	Questionnaire	Digital Games	[69]
Satisfaction	Survey	LMS	[70]
	Survey, Pre and Post Knowledge Test	e-Learning System	[71]

Therefore the user interface design of ODS should be able to provide positive user experiences and thus adopted by the students for discussion to share their knowledge. In this case, the user interface design requirement that contributes to positive user experiences need to be identified and engineered into the ODS. To do so, the user's emotional responses in the ODS user interface need to be investigated. Through the literature the emotion aspect was identified in product, games, websites and systems design. However there is no indication in the literature on user's emotional responses towards the ODS user interface design.

The user experiences study is usually used for evaluation purposes only. It is seldom used as a design requirement. If user experience is used as a requirement for design, the engineering of user experiences into a design is done using a single measurement method [72]. But a combination of measurement methods is more suitable when exploring a design [61]. Therefore a triangulation approach is needed for a better understanding of user's emotional responses towards ODS user interface design.

B. Kansei Measurement in Designing

Kansei is a Japanese term used to describe users' feelings and images thought in their mind towards certain artefacts, the environment or situations using all the senses of sight, hearing, feeling, smell, taste as well as their cognition [73], [74]. Kansei Engineering (KE) is used to identify emotional user experiences in a design. It is a technology related to the development of a product by combining psychology and engineering [75]. The KE approach was introduced by Nagamachi in 1992 for the product designing process. It was used to study user's psychological feelings towards a product when interacting with it. Using the KE approach a user's emotional response towards a product design can be investigated. KE translates the Kansei technology (user's emotion) into design requirements using statistical analysis and engineering methods. Figure 1 shows the flow in Kansei Engineering.

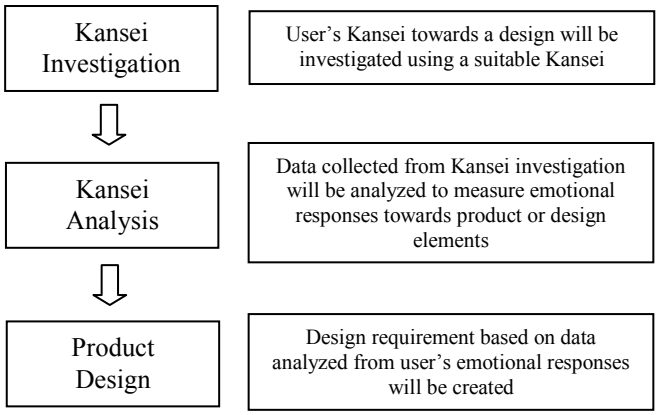

Figure 1: Kansei Engineering Flow (adopted from [76])

The user's Kansei can be measured by using various methods. Some of the methods are user's behavior and actions; words; facial and body expressions; and physiological responses such as brain wave (EEG), electromyography (EMG), heart rate, eye movement and etc. [77]. A study of user's Kansei will adopt physiological methods or psychological methods such as self reporting or a combination of both methods [78].

The widely used method for investigating user's emotional response towards an application design is a psychological method using Kansei words [78], [79]. It describes user's feelings towards the design in a list of opposite adjectives, nouns or short sentences. Some of the examples of paired Kansei Words are "confusing-clear", "beautiful-ugly", "organized-disorganized" and etc. Semantic Differential (SD) in the form of Kansei words is the most popular technique. The SD is a measuring technique that was developed by Osgood in 1957 for recognizing a space of word meaning [80]. It is a rating scale designed initially to obtain user response towards objects, events and concepts.

Later the SD rating scale was adapted for emotional evaluation [74]. This rating scale uses an unknown level of measurement for each of the paired Kansei Word. These words are analyzed in an ordinal scale where the neutral response is the middle alternative on the SD rating scale. The outcome is the user's emotional responses towards a design. These responses may be unreliable due to desire to provide positive responses. Thus to obtain reliable emotional user experiences a combination of self-reported and actual user's responses is needed.

IV. PROPOSED METHOD

A methodological triangulation approach is proposed for examining user's emotional responses in ODS user interface design. Methodological triangulation is a mixed measurement method approach that can increase robustness of measurement and reduces hesitation in using one method for measurement [69]. The proposed method will be employing a combination of qualitative and quantitative analysis for emotional measurement. Figure 2 show the proposed emotional measurement methods for ODS user interface design.

SELF REPORTED METHOD	**EYE MOVEMENT METHOD**
(Quantitative Analysis)	(Qualitative Analysis)
Instrument Development	Procedure Development
Pilot Study	Pilot Study
Emotional Measurement Analysis	Emotional Measurement Analysis

Figure 2: Emotional Measurement Methods

A. *Quantitative Analysis*

For the quantitative analysis, a self reported method is adopted. This technique uses rating scales defined with contrasting adjectives at each end to measure emotion [81]. An example of SD scale shown in Figure 3.

Easy ☐ ☐ ☐ ☐ ☐ Hard

Figure 3: Example of SD Scale

The 5 point scale is proposed because it is the best in giving the highest degree of correct responses [82]. The result obtain from the SD technique are correlations between user's experiences and overall positive and negative user experiences with the design. Using the SD technique, student's emotional responses towards the ODS user interface design can be identified.

But the issue in using the SD rating scale is the properties of the level of measurement is unknown. So for the purpose of analysis the positive side will be weighed with 5 points and decreased by one point when moving towards the negative side. The neutral responses will the middle option on the SD scale. This approach is similar to an ordinal scale.

The data obtained for the user's response can be analyzed using statistical procedures. The statistical procedures are linear regression, General Linear Model (GLM), QT1, Neural Networks, Genetic Algorithm and Rough set analysis [74].

But there are shortcomings in earlier statistical procedures to measure the emotional responses and as such the Rasch model is proposed to measure emotional responses towards the product design [83]. The common problem for measuring emotional responses is the calculation for user's and item agreeability. The user's agreeability is performed by producing the mean score for the user's responses. These mean score represents the user's agreeability towards the product design or design elements.

The average value for each of the Kansei words is also calculated by using the mean score. Each of the Kansei word mean score will provide their agreeability order. If the mean score is higher, then agreeability for the Kansei words is also higher. The data placed in agreeability order is not linear but in reality is a continuum. There are no equal intervals available for statistical analysis. Thus, this research is aimed to adopt the Rasch Model for quantitative analysis of the users' emotional responses towards design elements in ODS user interface.

Rasch Measurement Model

The Rasch model can be applied to measure latent traits (e.g., ability or attitude) in various disciplines. Latent traits are usually assessed trough the responses of a sample of users to a set measurement scale.

Location of items and users along the measurement scale is estimated by the model from the proportion of responses of each user to each item. The total response or raw score is converted into a success to failure ratio or odds. The probability of success depends on the differences between the ability of the person and the difficulty of the item. According to the Rasch model a user who is more developed (higher agreeability level) has greater likelihood of endorsing all the items and easier tasks are more likely to be endorsed by all users [84].

These measurement model represents the relative distances between the raw score by converting a raw score (ordinal scale) summary to its natural logarithms (interval scale) in the form of log odds. Figure 4 shows the scale used for the Rasch model.

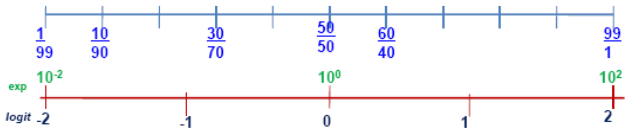

Figure 4: Scale for Measurement in Rasch Model

The scale resulting from the Rasch analysis of ordinal responses has the properties of an interval scale. This scale is linear and the numbers tell how much more of the attribute of interest is present.

The basic assumptions of the Rasch model are each user is categorized by their ability; and each item by a difficulty; user and item can be presented by numbers along one line and lastly the probability of observing any particular scored responses can be computed from the differences between the numbers [84].

B. *Qualitative Analysis*

Eye movement is used to conduct the qualitative analysis. This method is used to capture actual user's emotional response towards interface designs [85]. The eye-tracking technique will be used to collect data from student's eye movements to measure their emotional response towards the ODS user interface design. The function of eye tracking to record user's eye movements while performing a task provides information about the

nature, sequence and timing of the cognitive operation that takes place [86]. The hardware that is used to capture the eye movement is called an eye-tracker. The data collected from an eye-tracker will be analyzed using an eye tracking software.

Thus the methodological triangulation approach is aimed to identify the design requirement and emotional design issues associated with the user interface design of ODS.

V. Conclusion

We propose a triangulation method as a reliable measurement of emotional responses. A triangulation method will be used to evaluate the emotional user experiences towards the ODS user interface design using quantitative and qualitative analysis. We propose a statistical procedure; the Rasch model for quantitative analysis and eye movement for qualitative analysis to measure user's emotional responses. Using these methods, student's actual and self reported responses can be identified. Combining positive user responses from actual and self reported finding provides the emotional design requirement for ODS user interface.

VI. Future Work

The proposed Kansei methodological triangulation approach will be tested for ODS user interface designs. It is hoped that the design requirement for positive emotions can be identified using the Kansei methodological triangulation approach. Later the identified emotional design requirements for positive user experiences will be engineered into a new ODS user interface design.

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