

Perceived kansei and performance-based usability impact on satisfaction for web-based applications

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Abstract. Kansei Engineering has been applied intensively for product design and development considering the deepest layer of customer needs, known as Kansei, which is related to emotional need or affect. This method has been extended into service design and innovation. It has been shown that Kansei's impact on customer loyalty is equally important as that of cognition or performance. A recent research in investigating the proportional effect of Kansei and performance on usability measurement for e-services has been conducted. It shows that both Kansei and performance is found to be equally significant as well. Then, a question is raised, whether they are antecedent of customer satisfaction. This study is proposed to investigate both perceived Kansei-based and performance-based usability measures on satisfaction. Both theoretical and practical implication is highly expected due to the growth of more human-computer interaction (HCI) features and services nowadays. A proposed applicative framework followed by an empirical study on how the perceived Kansei and performance-based usability impact on satisfaction for web-based applications is discussed.

1. Introduction

Concerning to web service and web-based applications, usability analysis focuses on structure and behaviour rather than technical aspects. A web-based application is a program which can be accessed through a network connection using HTTP and runs inside a certain web browser. The usability of web-based application is highly expected. Both the impression and performance of the web-based application are significantly expected by the user. A recent study shows that both cognitive and affective process is associated with usability [1]. Cognitive deals with human capabilities, limitations, and tendencies; whereas, affective is known as Kansei (in Japanese) concerns on human feelings and impression. Affect complements the whole cognitive evaluation, according to a study by Hartono and Tan [2]. This study highlights the importance of emotional satisfaction in services, and how the service provider should take the impact of emotional needs on particular service attribute performance for the improvement prioritization.

In the area of Human-Computer Interaction (HCI), both cognitive and affective aspects for usability have been implemented into electronic products, medical equipment, mobile phones and e-commerce sites [1,3,4]. In the case of HCI-based websites, the cognitive aspect includes ease of use, content, identification, delay, and trust. More specifically, in usability study for e-commerce, its



cognitive process covers navigation, interaction, layout, merchandise and information quality [5]. A recent study on the role of affect and cognition on customer satisfaction and loyalty shows that affect has the proportional weight to cognition which leads to customer satisfaction and loyalty [6]. However, affect has received little attention for the usability evaluation [1]. Hence, a study on how to investigate the impact of affect- and cognition-based usability on satisfaction is highly prospective.

There is still no comprehensive conclusion about the relationship between affect and usability and how its impact on user satisfaction. Some studies on the affect-based usability have been conducted [7]. However, some studies could not show that relationship [1]. Therefore, a study on the combination of cognitive and affective processes is highly expected to deliver more comprehensive information for user satisfaction.

A case study on a web-based application is selected, or it is deemed related to the website. The development of usable websites is important for e-business and e-commerce success today as online customers and users will feel, search, and experience products or services mainly through websites. A full usable website has been deemed to be a media for delivering positive attitude toward online shops, boosting engagement and revisit rates and also stimulating online purchase [8]. It is also stated that *difficult-to-understand* website content, inconsistent format, disorientation, poor interaction, and reliability and ill-defined help functions are regarded as common problems for commercial websites [9].

Given this above background, this study has two objectives. First, it is to build an applicative research framework of perceived Kansei and performance-based usability impact on satisfaction for web-based applications. Second, it is to conduct a simple empirical test to investigate the effect of web-based application usability constructs on satisfaction.

This paper is systematically structured as follows. After the introduction section, it is followed by a brief Literature Review. Afterwards, it continues to the Research Methodology and Framework, Result and Discussion, and is wrapped up with Conclusion and Further Research Recommendation.

2. Brief Literature Review

2.1 Usability for website and web-based application

The mutual interaction between human and computer is highly needed in designing and implementing a variety of computing systems. According to ISO 9241 [10], usability is defined as the extent to which a product can be utilized by particular users to obtain effectiveness, efficiency, and satisfaction. Related to website or web-based application, it refers to the extent to which web can be used by specific users in achieving goals in terms of efficiency, effectiveness and satisfaction in a specified context of website or web-based application use.

According to Lee & Kozar [9], effectiveness represents the accuracy where the online users can achieve their goals (e.g., purchase, information gathering); efficiency is related to quick time and less cognitive effort to achieve goals (e.g., website with simple and consistent design features to make the pages easy to read and learn); and satisfaction is defined as the comfort and acceptability of a website to its users (e.g., real-time chat menu with customer support personnel).

2.2 Kansei, Performance and Satisfaction in web-based application usability

In website design and application, affect refers to impression or delight (known as Kansei in Japanese) whereas performance deals with cognition, according to the previous study on emotional needs and Kansei Engineering [1]. Delight, firmness, and convenience are found to be determinants of customer satisfaction and loyalty toward the site [11]. Delight explains the effect, whereas, firmness and convenience are dominantly describing the performance or cognitive processes. Another study proposes a set of usability dimensions such as download delay, navigability, site content, interactivity and responsiveness which bring impact on the customer satisfaction, return possibility and frequency [12].

About various constructs used in various usability studies, Prastawa et al [1] proposes two main factors (i.e., cognitive and affective processes) which bring significant impact on usability. Even though this approach has simplified the understanding of usability performance drivers, an extended approach which is to investigate the proportional impact of effect and cognition on user satisfaction in a case of usable web-based application or website is prospective.

3. Research Framework and Hypothesis

Referring to what has been discussed in Section 1 and 2 above, this study starts with the perceived performance-based and Kansei-based usability measurement, and then followed by the overall satisfaction measurement, as shown in figure 1. The measure variables were adopted from Prastawa et al. [1]. The details of them are provided in the Appendix. According to Helander and Khalid [13], perceived performance-based is related to cognition, which is something more on analytical and rational thinking, whereas Kansei-based is related to emotions and attitudes. Variables of both constructs explain how usability can be derived from both rationale and emotional aspects. For instance, “readability” explains the performance-based usability, it may relate to sentences and steps to operate the website that are easy to understand. For the Kansei-based usability, for instance, “appeal” is proposed. Appeal is related to the appearance of the web is interesting and eye-catching.

Apart from performance-based and affective-based usability constructs, the third construct to consider is overall satisfaction, which is only measured by 1 variable called as “overall satisfaction”. The relationship among the three constructs is shown in figure 1.

There are two hypotheses defined, i.e., H_1 : there is a significant impact of perceived performance-based usability on overall satisfaction, and H_2 : there is a significant impact of perceived Kansei-based usability on overall satisfaction.

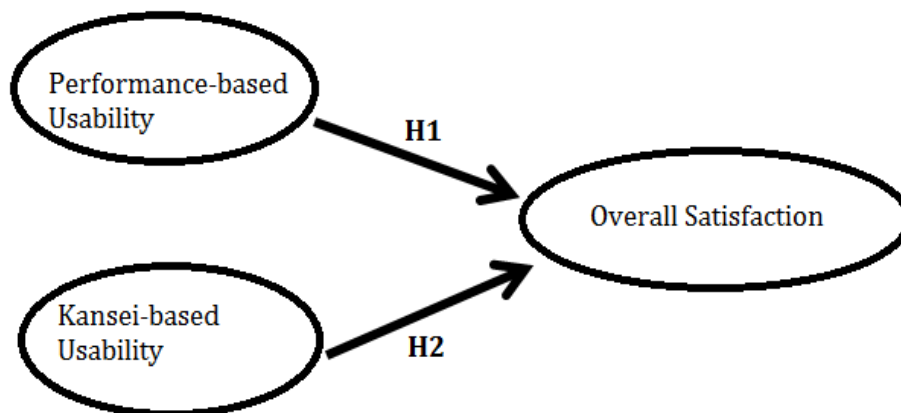


Figure 1. Conceptual framework of Performance- and Kansei-based usability for web-based application.

4. Result and Discussion

A case study has been conducted in one of the famous web-based application operated in Indonesia, namely Tokopedia. The targeted subjects were those who have experienced the Tokopedia services in the last six months (October 2018 – March 2019) through the purposive sampling method. It is a non-probability sampling method when the researchers believe that they can achieve a representative sample through a sound judgment which may save time, effort and money. There were 35 respondents involved during the survey using the questionnaire (20 males and 15 females) with the age range from 20 to 40 years. One copy of the questionnaire was given to represent one group of participants (e.g., either one family or one single respondent). The questionnaire consists of three different parts, i.e., Performance-based Usability, Affective-based Usability, and Overall Satisfaction. It took about 10 minutes to complete a questionnaire.

4.1 Validity and reliability test for constructs

The analysis is performed using SmartPLS 3 [14]. It is Partial Least Squares Structural Equation Modeling (PLS-SEM) which focuses on the analysis of variance with condition of small sample size and little availability of tested theory. Confirmatory factor analysis (CFA) has been carried out for testing how well the measured variables represent the number of constructs. In other words, CFA is used to confirm or reject the proposed measurement theory. Model was deemed fit, as it satisfied the following criteria: root mean square residual (< 0.1), d_{ULS} and d_G ($<$ the upper bound of the confidence interval), and normal fit index (> 0.7 and it is closer to 1). Reliability and validity tests (i.e., convergent validity, discriminant validity and reliability) have been conducted and are showed in table 1 and figure 2. In terms of convergent validity, all constructs were deemed acceptable since: (i) all item factor loadings in all constructs exceed 0.6, (ii) composite reliability in all constructs exceeds 0.7, and (iii) AVE in all constructs exceeds 0.5.

Table 1. Measurement of constructs.

Construct	AVE*	Composite Reliability	Cronbach's Alpha
Performance-based Usability	0.571	0.922	0.905
Kansei-based Usability	0.580	0.917	0.896
Overall Satisfaction	1	1	1

*average variance extracted

Referring to discriminant validity, these three constructs above were considered valid as the square root of AVE for each construct is greater than its corresponding inter-construct correlation coefficient [15]. Lastly, in terms of reliability, all three constructs show Cronbach's alpha values which exceed 0.6, thus, they were deemed acceptable.

4.2 Path coefficients and hypothesis testing

It was found that Kansei-based (known as affect or emotion) and performance-based (referred to cognition or rationale) usability account for 47.7% and 50.5% of their impact on overall satisfaction, respectively, as shown in table 2.

Table 2. Parameter significance values.

Construct	Original Mean	Sample Mean	Standard Deviation	T Statistics	p values
Performance-based Usability	0.505	0.505	0.091	5.538	< 0.001
Kansei-based Usability	0.477	0.479	0.089	5.379	< 0.001

The first hypothesis (H_1) that perceived performance-based usability is positively related to overall satisfaction is supported by the results (T Statistics = 5.538, p-value < 0.001). The second hypothesis (H_2) is also supported. Kansei-based usability is significantly positively correlated with overall satisfaction (T Statistics = 5.379, p-value < 0.001). This study shows that both Kansei and performance-based usability have a significant role and impact on overall satisfaction. They cannot be separated; they are a set of human-based experience evaluation in a service encounter. The high value of R square of 0.918 explains both Kansei and performance are regarded as the significant predictors of overall satisfaction. Their impact on customer overall satisfaction is relatively equally balanced.

More specifically, the critical usability variables for both constructs (performance-based and Kansei-based) were defined according to high factor loadings (i.e., factor loadings ≥ 0.8). The most critical performance-based usability measures were interactivity (P3), logical navigation (P8) and easy

back option (P9), whereas Kansei-based usability measures were salience (A4), appeal (A5) and reliability (A7).

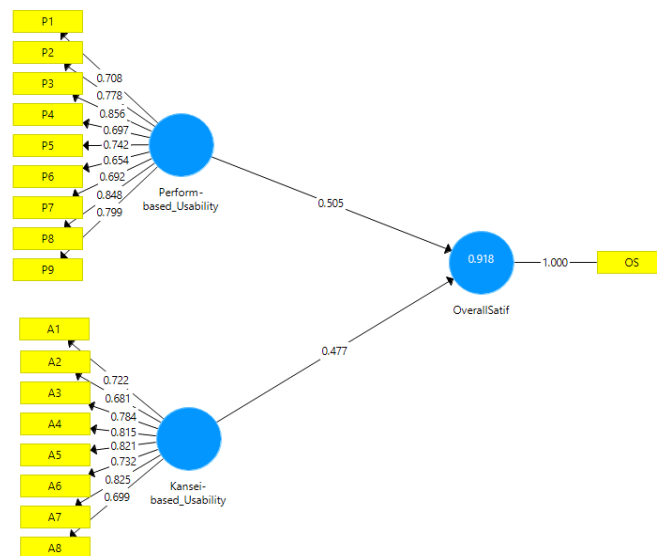


Figure2.Structural model and path coefficients for web-based application case study.

5. Conclusion and Further Research

Kansei(which is related to affect or emotion) was found to be equally important as performance (known as cognition) in usability measurement which brought significant impact on overall satisfaction. This study complements the previous study on usability in web-based application by taking into account both performance and Kansei impact on overall satisfaction. This study is limited due to relatively small sample size and a single service setting. Future study should consider that concern.

6. Appendix

Performance-based and Kansei-based usability variables for web-based application, adopted from [1]

Performance-based usability variables	Kansei-based usability variables
P1. Error prevention a [usability – multiple similar tasks to be done easily]	A1. Colour [usability – conceptual image of the app]
P2. Error prevention b [usability – warning message to prevent possible errors]	A2. Brightness [usability – conceptual image of the app]
P3. Interactivity, Feedback, and Help [usability – multiple opportunities for interaction and communication]	A3. Harmoniousness [usability – compatibility and alignment of the app]
P4. Learnability [usability – appropriate information related to attributes sold]	A4. Salience [usability – convenient use of the app]
P5. Readability [usability – sentences that are easy to understand]	A5. Appeal [usability – appearance of the app is interesting]
P6. Memorability [usability – steps that are easy to remember]	A6. Comfort [usability – convenient use of the app]
P7. Easy Navigation [usability – guide to easy to operate]	A7. Reliability [usability – reliable and trusted app]
P8. Logical Navigation [usability – guide to logical to run]	A8. Attractiveness [usability – attractive and pleasing app]
P9. Easy Back Option [usability – return to the previous page]	

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Preface

Welcome Remarks,
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It is a great pleasure to welcome all of you to Bali and to the International Conference on Informatics, Technology, and Engineering 2019 (InCITE 2019) held by the Faculty of Engineering, University of Surabaya (UBAYA) in collaboration with The University of Adelaide, Australia and Sirindhorn International Institute of Technology (Thammasat University), Thailand. The first InCITE has been successfully held in Bali, Indonesia in 2017. We are very delighted to host the second InCITE here in Bali, Indonesia again.

There are more than 75 presentations in this conference. We welcome leading experts not only from Indonesia, but also from different parts of the world. The experts will share the knowledge and experiences in the fields of informatics, technology, science, and engineering. The main theme of this conference is **Enhancing Engineering Innovation Towards A Greener Future** in response to several world challenges including sustainable development, global convergence of information and communications technologies, climate change and global warming as well as the depletion of unrenewable natural resources. We hope this conference will provide you a good opportunity to get to know each other better and consolidate bonds of friendship and mutual trust.

We would like to express our sincere gratitude to the Keynote and Plenary speakers, International Scientific Committee, Steering Committee, and Organising Committee for their huge efforts to make this conference successful.

Thank you all for your support and attendance at InCITE 2019. Please enjoy the conference and Bali !

Asst. Prof. Djuwari, Ph.D.





Preface

Welcome Remarks,
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Welcome to Bali, Indonesia to all delegates and presenters. It is my pleasure and privilege to welcome all of you to the 2nd (second) International Conference on Informatics, Technology, and Engineering 2019 (InCITE 2019) held by the Faculty of Engineering, University of Surabaya (UBAYA) in collaboration with The University of Adelaide, Australia and Sirindhorn International Institute of Technology (Thammasat University), Thailand.

InCITE 2019 has received more than 75 papers to be presented in this conference. All papers represent four following parallel clusters: Green Design and Innovation, Green Manufacturing and Green Processes, Power System and Green Energy Management, and The Role of IT in Innovation Enhancement. Each cluster supports the main theme of the conference, which is **Enhancing Engineering Innovation Towards A Greener Future**. The engineering innovation is the key to increase our awareness in maintaining the sustainable growth and development in the world.

The Organising Committee of InCITE 2019 would like to express our sincere gratitude for the tremendous supports and contributions from many parties. The supports from The Faculty of Engineering of UBAYA, keynote and plenary speakers, our International Scientific Committee, the Steering and Organising Committees are really acknowledged.

The last but not the least, thank you for your supports, enjoy the conference and we hope through this meeting all of you can extend your networks and collaborations.

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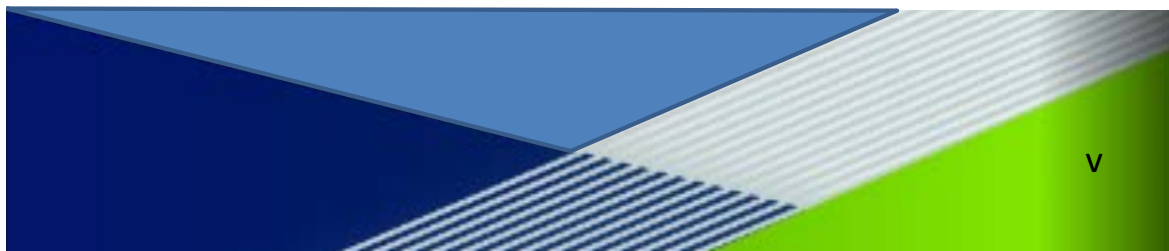


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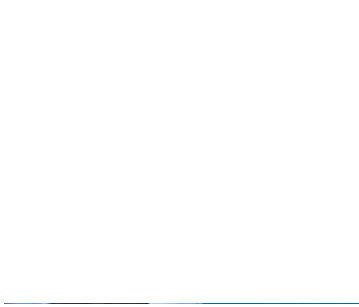
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