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Measuring User Satisfaction in Website Usability by Considering Stress Level

Surya Jaya Raka[a], Djoko Budiyanto Setyohadi[a,*]

[a] *Informatics Department, Universitas Atma Jaya,Yogyakarta, 55281,Yogyakarta, Indonesia*
Corresponding author: [*]djoko.budiyanto@uajy.ac.id

***Abstract*—Usability testing, part of the human-computer interaction problem, is a method commonly used to evaluate the performance of a website interface. Today's study of human-computer interaction is important. It is now developed into UI UX (User Interface / User Experience). The website interface can affect user satisfaction and is a principal factor in a website being liked by users and meeting user needs. When a website is first developed, it can be difficult for a developer to understand the need for a website interface that matches the user persona of that website. Therefore, this research is important as an evaluation material for websites that are developed in the context of a website interface to provide a satisfactory appearance according to user personas. This study evaluates a website by conducting a usability test using the ISO-9241 aspect and getting an average result of 50,967, which is categorized as a bad website is taken from all users in the experiment. This study can also prove the psychological factors of users that influence usability testing, namely differences in the perceptions of website ratings between users with normal and (mild, moderate, severe, too severe) psychological stress levels. Users with normal stress levels will have better usability test results than users with stress levels. This study shows better results than user ratings with a normal stress level of 73,750, so it is categorized as a reliable website.**

***Keywords*—Usability testing; factor of usability; stress level of user; UI UX.**

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I. Introduction

The development of technology has progressed so rapidly in the last few years. They are developing information systems such as websites and mobile applications to the latest technological developments such as artificial intelligence (AI) and the Internet of things (IoT). Various innovations continue to develop along with the development of this technology, especially in information system technology. Technology has been able to change the nature of business processes run by the company [1]. Not only used in the business sector, but this information system has also begun to be developed by several non-business institutions such as educational and government institutions. The information system combines some information technology elements such as computers, software, databases, communication systems, Internet, mobile devices, and many more, to perform specific tasks, interact with and inform various actors in different organizational or social contexts [2]. Changes in this business model must be in line with the innovations made to remain competitive. Innovations are new ideas that allow for better change [3]. Another opinion about innovation says that the key to maintaining a company's excellence and improving company performance [4].

One company that has begun to focus on developing information system technology is loket.com, which has developed an online ticket service provider platform for various Indonesia events. loket.com is a long-established ticketing platform that provides event ticket sales services in various cities, namely Yogyakarta, Jakarta, Bandung, Surabaya, Solo, Medan, Bali, and others. Various companies use online tickets or often called e-tickets, to provide services or ticket sales via the Internet, for example, coupons for shopping, concert tickets, and sporting events [5]. Loket.com has utilized information technology in the form of a website to support the activation process and as an information center for clients. This website provides many features, from ticket sales to event creation. Online ticketing is effortless in transacting. However, users who purchase tickets online must have control over the tasks they perform over the Internet [6].

A website can be defined as a set of connected interfaces and has functional attributes designed to provide users information [7]. In designing a website, apart from paying attention to its function, the developer must also pay attention

to the website interface factor. Matters related to the website interface are commonly known as UI / UX (user interface/user experience), which is an important factor in delivering information on a website. In terms of appearance (user interface), the website must have a good and attractive design. The user's initial assessment of the website is directly focused on the initial design of a website. When the design is good and attractive, users will be interested in exploring more of the pages they use and want to reuse them. Meanwhile, in terms of user experience, what is meant is the perception or response that the user gets when interacting with the system, making it easier for users to "capture" the meaning and flow of a system's appearance, meaning that a system has a user-friendly user experience [8].

When a website is first developed, it will be difficult for developers to understand the need for a website interface that matches the website's user persona, including the loket.com website. No user sample causes this condition can be completely analyzed according to the persona or website being developed. Therefore, this research is important to evaluate a website developed in the context of the website interface to provide a satisfactory appearance according to the user persona of the loket.com website. The user persona is the user's border on how to model mental users to expect, given previous experiences, the behavior to be performed [9]. Therefore, this study aims to determine the level of user satisfaction on the loket.com website.

In this case, the evaluation method uses the usability test by considering the user's stress level. Usability testing is a fundamental step in the user-centered design process [10]. Usability testing aims to ensure that the website being developed and used is appropriate and user-friendly. Usability testing also tests how users interact with the website [11]. Apart from that, this evaluation also considers the user's stress level before experimenting with the Depression Anxiety Stress Scale (DASS-21) [12]. Measurement of stress levels is important because stress can affect cognitive behavior and increase the likelihood of narrowing perceptions, so it is necessary to measure stress levels before conducting evaluation tasks and comparing them with the results obtained [13]. Although usability is an important factor in a product's success, utility is also a major consideration. Usability and utility are closely related but not identical. According to Nielsen, utility is related to usability, but usability includes utility and efficiency, ownership, and satisfaction [14].

This study uses the ISO-9241 aspects by considering effectiveness, efficiency, and user satisfaction while running the website. The results obtained in this study are to determine the level of satisfaction on the loket.com website. Then to determine the relationship between stress levels and usability testing that has been done by comparing the results of the experimental participant with stress levels and normal participants. This test is expected to know the value of website user satisfaction and determine how participant stress factors affect the experimental results.

In writing this study, we received preliminary information and knowledge about usability testing through publicly published journals. This literacy aims to obtain information and knowledge related to titles, calculations, and processes carried out in this research, such as theoretical foundations and other necessary studies.

The first literacy includes research that has been conducted by Iman Dianat *et al.* [7]. Research-based online services will certainly provide convenience and convenience for customers (users) to do various things related to banking matters. Moreover, Iran has a high population of internet users, more than 33 million users, and continues to grow. In terms of using online services, banks develop various platforms to support these online services. One of them is a website-based platform. In the early stages of creating a website, a website developer cannot fully consider user needs, so an evaluation is needed to conclude the website. The hope is that this website can provide comfort and convenience for users to perform various services in online banking.

The most important indicator in evaluating a website is its design, usability, and user satisfaction in using it. In designing a website, the most important thing is to consider user preferences. User preferences, in this sense, they can be measured by conducting interviews or distributing questionnaires. This study will evaluate four banking websites in Iran with as many as 798 participants to get results from the website's usability and user satisfaction. The method he uses is a survey technique by distributing surveys to customers (users). The survey used three questionnaires, namely the UCWD questionnaire related to website design, the SUS questionnaire related to website use, and the EUS questionnaire related to user satisfaction.

Furthermore, the questionnaire results' validity and reliability were checked by calculating the Cronbach Alpha value and the stability reliability using the intraclass correlation coefficient. From this research, it can be seen that user satisfaction is only influenced by the attributes of website design, especially the layout of the elements or website structure so that it needs to be more focused on the layout and structure of the website rather than on personal characteristics users in designing or developing banking websites for that matter.

Second, there is research that has been done by Erik Frokjaer *et al.* [13]. This study tested the correlation of these three aspects using the Spearman correlation test using a questionnaire with a value scale of 1-5. This study refers to a significant number to show the correlation between its aspects, while the correlation coefficient determines the level of correlation. The larger the correlation coefficient, the bigger the correlation. This study using the usability aspect of ISO-9241, namely effectiveness, efficiency, and satisfaction.

That research will be conducted to measure the experiment results and consider external factors such as the participants' stress level. The basis for measuring this stress level is a study conducted by Weenk *et al.* [15]. This study discusses the surgeon profession's study. This profession is indeed a profession that has the possibility of a high level of stress. Many factors influence it, such as high working hours and a kitchen with someone on and off. Thus, most of their time is spent in the operating room [15].

Researchers also get references from research that has been conducted on the evaluation of the mobile web energy monitoring system with the name EnerTrApp. Based on this research, Escanillan-Galera *et al.* [16] evaluate the mobile web-based on three aspects of ISO-9241: efficiency, effectiveness, and satisfaction. Researchers consider it important to evaluate websites based on mobile displays

because the development and use of smartphones are now becoming a popular moment. Mobile websites are also known as responsive websites [17]. Overall, this study can evaluate the appearance of the EnerTrApp website, and it can be concluded that the mobile website has a good user satisfaction level that reaches a score of 87.28.

This study measures the stress level, aiming to reduce the risk of errors inaction caused by stress measurements using Heart Rate Variability (HRV), the interval between heartbeats. The interval is between the peaks of two consecutive QRS complexes derived from a 125 Hz ECG. Then use the stress measurement, measured using the Strait Trait Anxiety Inventory (STAI), which will later be adopted for this study. From several previous studies, the authors of this study will combine the usability testing method with the measurement of stress levels as factors that might affect the usability testing results.

II. Material and Method

This research is an experiment to evaluate the UI / UX of the loket.com website by conducting usability testing. The writer tries to do different things in this study by measuring the participant's stress level before the experiment and then comparing the usability results with the participant's stress level. It is to prove the existence of factors outside the technical usability that affect the experiment's results being carried out. The method used can be seen in Figure 1:

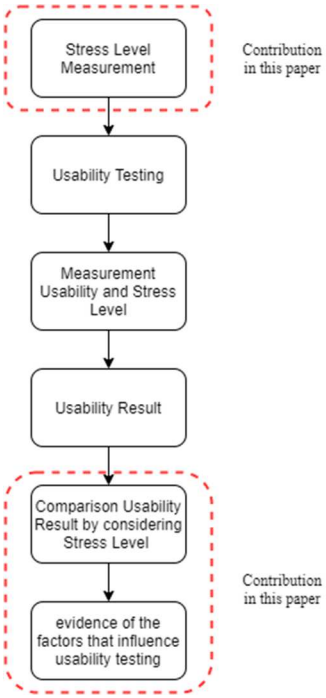

Fig. 1 Research methodology

A. Stress Level Questionnaire and Measurement

In carrying out evaluation tasks, the evaluation results will usually be influenced by everyone's passion. Individuals tend to appear or want to appear to be accomplished, especially when they are being watched [15]. Apart from that, stress can affect cognitive behavior and increase the likelihood of narrowing perceptions, so it is necessary to measure stress levels before carrying out an evaluation task and comparing it with the results obtained [18]. The Depression Anxiety Stress Scale (DASS-21) is used for the stress measurement method. This questionnaire consists of 21 question items, but we can also use a short version using 12 question items [19] DASS-21 consists of 21 questions that have a rating using a Likert scale of 0 to 3. However, in this study, the authors used seven questions specifically for calculating stress levels, namely questions number 1, 6, 8, 11, 12, 14, and 18, which will be reordered in order from numbers 1 to 7 [20]. The questionnaire details can be seen in Table 1 below:

TABLE I
Depression Anxiety Stress Questionnaire - Stress

No	Attribute
1	I found it hard to wind down
2	Tended to over-react
3	Felt nervous
4	Found myself agitated
5	Found it difficult to relax
6	Was intolerant of anything
7	Felt that i was touchy

The questionnaire calculation value can be determined from the number of scores obtained for each question and adding them up. The sum can be categorized based on the number of scores obtained by each participant [21]. These categories can be seen in Table 2 below:

TABLE II
Classification Of DASS-21 Scores

Category	Range of Scores		
	Stress	Depression	Anxiety
Normal	0-7	0-4	0-3
Mild	8-9	5-6	4-5
Moderate	10-12	7-10	6-7
Severe	13-16	11-13	8-9
Extremely Severe	>17	>14	>10

To categorize the participants from the questionnaire they filled in, they can refer to the table.

B. Usability Measurement and Result

After getting the participant's stress level, the researcher conducted a usability test to get the value of the experiment conducted by the user directly. Participants will carry out tasks that have been determined by the researcher within the specified time limit. To calculate the value of each of these aspects using the ISO-9241 aspects, which are as follows:

- Effective: Namely, the accuracy and completeness for users to achieve predetermined goals.
- Efficient: Efforts are made to achieve predetermined goals
- Satisfaction: Namely the user's comfort after using the system or completing a given task [13].

Based on the understanding of the three aspects, according to ISO-9241, the measurement of every aspect of website usability can be designed using the following effectiveness [22] calculations:

$$Effectiveness = \frac{t'}{t} \quad (1)$$

t'= number of tasks completed
t = total of the task undertaken

Then the next equation for calculating the efficiency aspect is as follows:

$$Efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}}{NR} \quad (2)$$

N= The total number of tasks (goals)
R = The number of users
nij= The result of task i by user j; if the user successfully completes the task, then Nij = 1; if not, then Nij = 0
tij = The time spent by user j to complete task i. If the task is not successfully completed, then time is measured till the moment the user quits the task

Calculating the satisfaction aspect[21] is performed using the System Usability Scale questionnaire [21]. Several questionnaires are used, but researchers choose to use the System Usability Scale because it is free, and its attributes match the satisfaction criteria suitable for researchers. The following questions from the questionnaire can be seen in Table 3:

TABLE III
SYSTEM USABILITY SCALE QUESTIONNAIRE

No	Attribute
	I think that I would like to use this system frequently
2	I found the system unnecessarily complex
3	I thought the system was easy to use
4	I think that I would need the support of a technical person to be able to use this system
5	I found the various functions in this system were well-integrated
6	I thought there was too much inconsistency in this system
7	I would imagine that most people would learn to use this system very quickly
8	I found the system very cumbersome to use
9	I felt very confident using the system
10	I needed to learn many things before I could get going with this system

To get the Jagoanhosting Indonesia's client area website's user satisfaction, the researcher used a System Usability Scale (SUS) questionnaire. The SUS calculations for this questionnaire are as follows:

- For each odd question, subtract 1 from the score (X1-1)
- For each even question, subtract the score from 5 (5-X2)
- The odd and even values are then multiplied by 2.5 [23].

Before taking measurements based on a questionnaire, namely measuring the user's stress level and measuring usability testing's satisfaction aspects, it is necessary to test the validity and reliability. The validity test is a test that measures the extent to which the variables used in the questionnaire are valid or valid variables[24]. While the reliability test shows that the variables used can be trusted to express something following what happened[25]. Participants' answers can be said to be reliable or reliable if the answers are consistent over time. The validity test's decision-making process was carried out in this test by comparing the R count per questionnaire item with the value in table R according to the amount of data.

From this comparison process, if the calculated R-value (attribute Corrected Items-Total Correlation) is greater than the value in table R in the statistical distribution provisions, the item is considered valid and vice versa. If it is not valid, it will not be used for further processing. Then the Cronbach alpha value is to determine the reliability of the questionnaire. If the value is greater than 0.7, the questionnaire item has good reliability [26].

C. Compare and Prove the Level of Stress on Usability.

From the DASS-21 questionnaire calculation results, it can be seen that the participants' psychological condition before experimenting. In this case, user psychology can be included in environmental psychology. Environmental psychology is a psychology branch that focuses on the relationship between humans and the environment [27]. The environmental psychology perspective wants to be useful for interpreting human attitudes when faced with information, such as when consumers are faced with many applications [28]. Then by conducting usability testing, experiments will get participant satisfaction results with the website.

The DASS-21 questionnaire calculation results are used to validate the factors that can affect the experiment's usefulness being carried out. Using DASS-21, the researcher pays attention to psychological factors that may influence the testing of practical usability. Then it will be found whether the stress factor affects the process and the results of the usability testing experiment carried out.

III. RESULT AND DISCUSSION

In this study, two questionnaires must first be calculated the level of validity and reliability. The first questionnaire is DASS-21, which is used to calculate the participant's stress level, and the SUS questionnaire is used to calculate the satisfaction level of website users. The two questionnaires filled out by this participant have good validity and reliability values. The value of the corrected item-total correlation attribute from the DASS-21 and SUS questionnaires, respectively 7 and 10 questions, all of which have a value above 0.3550 with calculations using a probability value of 0.05 and the value of DF (NR) using a value of 29 because the number of participants is 31. The reliability value of the two questionnaires is also good, seen from the value of Cronbach's Alpha if Item Deleted shows a value above 0.7 for each question. From the 31 participants, the results of measuring stress levels were obtained as in Table 4 below:

TABLE IV
CLASSIFICATION OF DASS-21 SCORES

Category	Total
Normal	8
Mild	1
Moderate	8
Severe	10
Extremely Severe	4

From the calculation of the participant's stress level, it was found that 74.19% of the participants had a poor psychological condition with details one categorized as mild stress, 8 participants experienced moderate stress, 10 experienced severe stress, and 4 participants experienced extremely severe stress while 8 participants had the normal psychological condition. Of the seven questions that are indicators of stress assessment, the first question (I found it hard to wind down) has the highest score.

Next are the results of the experimental usability testing carried out. Three aspects are considered, and each participant carries out three tasks. The first is the efficiency aspect, and

the results can be seen in table 5 to table 7, respectively, in task 1 to task 3 below:

TABLE V
EFFICIENCY SCORES – TASK 1

Participant	Task 1		
	Point of Success	Time (sec)	Result (goals/sec)
1	1	32	0.031
2	1	29	0.034
3	1	38	0.026
4	1	41	0.024
…	…	…	…
31	1	28	0.035
Result			**0.031**

In the calculation of task 1, all participants were able to complete the given task before the deadline was 60 seconds so that the point of success was all 1. The result of the calculation of the efficiency in task 1 was 0.031 goals/sec.

TABLE VI
EFFICIENCY SCORES – TASK 2

Participant	Task 2		
	Point of Success	Time (sec)	Result (goals/sec)
1	1	66	0.015
2	1	58	0.017
3	1	68	0.014
4	1	72	0.013
…	…	…	…
31	1	52	0.019
Result			**0.016**

Like task 1, in doing this task 2, all participants could also complete the task before the deadline was 100 seconds with the final result of the calculation, namely, 0.016 goals/sec.

TABLE VII
EFFICIENCY SCORES – TASK 3

Participant	Task 3		
	Point of Success	Time (sec)	Result (goals/sec)
1	1	325	0.0030
2	1	288	0.0034
3	1	319	0.0031
4	1	397	0.0025
…	…	…	…
31	1	303	0.0033
Result			**0.003**

The table above shows the results of the calculation of the efficiency aspect of task 3. In this task, two participants failed to complete the task, so that the point of success was 0. Participants who failed to complete the task were participants number 7 and 27. In task 3, the efficiency result was 0.003.

Next is the measurement of the aspect of effectiveness. This aspect is measured based on the completed tasks with the total tasks assigned to each participant. According to the data carried out from efficiency calculations, two participants (numbers 7 and 27) failed to complete the second task. So that the effectiveness of this experiment was 97.85%, as in table 8 below:

TABLE VIII
EFFECTIVENESS SCORES

Participant	Effectiveness		
	Completed Task	Total Task	Result (%)
1	3	3	100
2	3	3	100
3	3	3	100
4	3	3	100
…	…	…	…
31	3	3	100
Result			**97.85**

Considering the calculation of two aspects, the value of the two aspects obtained will be better if the value is greater and depends on the features or part of the website. To find out whether the value is improved or not. Comparative values can be determined by experimenting on the same part but different platforms [29] or re-measure after making improvements and comparing the two. In this study, the author might compare these results in future studies so that in this study, the authors tend to pay attention to the value of customer satisfaction levels. The results can be seen in Table 9 below:

TABLE IX
SYSTEM USABILITY SCALE SCORES

Participant	Odd Value	Even Value	Total
1	14	8	55
2	14	15	72.5
3	14	3	42.5
4	5	5	25
…	…	…	…
31	15	10	62.5
Total			**1580**
Average			**50.967**

The result of calculating the level of user satisfaction, the results are as in the table above. The average value obtained was 50,967. The average is included in the category of websites with low user satisfaction [30]. Referring to this study that did not compare the experimental results on the existing website with the improvements made (because this study did not carry out the improvement stage), the researcher will compare this aspect of satisfaction with the obtained efficiency and effectiveness values. The results show that the efficiency and effectiveness aspects are directly proportional to the satisfaction aspects. Participants with an average score on the satisfaction aspect of more than the same as 50 tend to better value the efficiency and effectiveness aspects than participants with an average score on the satisfaction aspect below 50. The comparison results can be seen in Table 10 below:

TABLE X
ASPECT SCORE COMPARISON

SUS Score	Efficiency (goals/sec)			Effectiveness (%)
	Task 1	Task 2	Task 3	
> =50	0.033	0.017	0.003	100
<50	0.028	0.013	0.002	95.24

Next is to see how the value of DASS-21 is a parameter of the participant's stress level with the usability experiment results. The researcher compared the participant's stress level

category with the mean value of SUS obtained. This comparison can be seen in Table 11 below:

TABLE XI
COMPARISON STRESS LEVEL WITH SUS SCORES

Stress Category	SUS Score	SUS Score Category
Normal	73.750	Good
Mild	32.500	Awful
Moderate	44.687	Poor
Severe	48.000	Poor
Extremely Severe	30.000	Awful

The comparison table above shows a difference in the participant's assessment of the website for each psychological condition. If we look again at a larger group by differentiating the categories of participants with normal psychological conditions from participants with psychological stress conditions (mild, moderate, severe, too severe), the results can be seen in Table 12 below:

TABLE XII
COMPARISON OF GENERAL STRESS LEVEL WITH SUS SCORES

Stress Category	SUS Score	SUS Score Category
Normal	73.750	Good
Stress	43.043	Poor

From the table above, it can be seen that, in general, the results of different satisfaction scores are obtained in different categories of participant psychological conditions.

IV. CONCLUSION

Experiment was conducted in this research to get the user's website's satisfaction score using ISO-9241, namely efficiency, effectiveness, and satisfaction. The study's results show that website users' satisfaction with a bad website category with an average value of the SUS calculation is 50,967. Another result obtained is that there are factors, and this research is to prove the existence of other factors related to the user's psychological condition. Researchers gained insights from previous research regarding the measurement of doctors' psychological conditions to reduce human error, as reported in the related works section in this study.

The result is that there are differences in satisfaction in the psychological conditions of different participants. Participants who have normal psychological levels will have good perceptions of the experiments they are doing. Meanwhile, participants with a psychologically stressed level (mild, moderate, severe, very severe) tend to have a lousy experiment assessment. It can be seen from the different levels of satisfaction. This research proves that other factors beyond the number of users, the test environment, the formulation of tasks, the think-aloud protocol, user characteristics, and usability actions affect usability testing. Consequently, it is necessary to consider the psychological factors of users in conducting usability testing.

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