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Usability Evaluation of Hospital Information System Applications Based on The System Usability Scale

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Abstract.The key to successful technology adoption is to pay attention to several aspects including top management support, system quality, information quality, and user perception through usability. The Khanza Hospital Management Information System (SIMRS) application in the UDINUS Medical Records laboratory is prepared as a learning medium for students of the Medical Records and Health Information Study Program. This study aims to evaluate the use of Khanza SIMRS application based on user experience, namely students through usability testing to measure learnability, efficiency, memorability, error, and satisfaction.Quantitative research was designed through a survey to 3rd year students of D3 Medical Records and Health Information Study Program by purposive random sampling. Quantitative data was collected from 40 respondents by answering 10 questions of the System Usability Scale (SUS) questionnaire using a Linkert scale of answers Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.The results showed SIMRS application with SUS Score 62 (0-100 scale), Acceptability Marginal Low, Grade D, and Adjective Rating category "OK". Recommendations for the SIMRS application in the learnability aspect need to add vertical navigation on the left screen for ease of eye-tracking, while in the memorability aspect, it is necessary to add tooltips, tour wizards, screen transitions, and prominent visual effects.
Keywords:Hospital Information System, System Usability Scale, usability, Information System

I.BACKGROUND

Concrete steps have been taken by the Ministry of Health of the Republic of Indonesia in realising the Electronic-based Government System (SPBE), especially in order to support strategic programmes in the health sector through digital transformation, especially the implementation of e-health and Hospital Information Systems.[1] [2] [3]In order to support the national health system policy, every healthcare facility, especially hospitals, is required to organise a Hospital Information System (SIMRS). SIMRS is a communication information system that manages and integrates all hospital service process flows on a coordinated network in order to produce a precise and accurate reporting system that supports the health information system.[3]In some studies, it is mentioned that the success of SIMRS implementation is influenced by several factors. Reinheart Damanik's research states that 78% of the time is influenced by work culture, age, work experience, HR competence, and tool specifications on SIMRS Implementation. [4] The level of SIMRS user acceptance of SIMRS implementation can be seen through several approaches in the form of the Technology Acceptance Model (TAM Model) and Human, Organization and Technology-Benefit (HOT-Fit Model). The factors that can be used for assessment are user self-efficacy, compatibility, top management support, project team competency, system quality, information quality, perceived usefulness, perceived ease of use, and SIMRS acceptance. [5]However, Arista Pratama et al's research states that from the results of testing the relationship between the HOT Fit Model and the TAM Model which has a significant effect on the perceived usefulness variable is the variable top management support, system quality, information quality with a contribution value of 53.7% [6] This is also in line with Arif's research that perceived usefulness, convenience and usage constraints together have a significant effect on the use of the WifiTB application by 70.1% in the work area of the Semarang City Health Office. [7].The quality of the system and information is proven to have a significant contribution to user acceptance of application use, where the success of its implementation is influenced by this factor.

In addition to external factors of the system environment, no less important than the successful implementation of an information system application are the internal factors of the system itself. Usability review is an important aspect that must be considered in order to measure how effectively and efficiently an application is used, and how satisfied users are in using the application[8].

II.METHOD

This study uses a quantitative design through a survey with the System Usability Scale (SUS) method, then describes the description of the facts of the phenomenon of using the SIMRS application by the user [9].The population of this study were students as SIMRS application users in the medical record laboratory of Diploma III Medical Records and Health Information Study Programme, Faculty of Health, Dian Nuswantoro University Semarang. Selection of samples with the inclusion criteria of 3rd year students (the last year of education) on the grounds that students have taken all the material in the main competency areas as medical recorders.Data collection methods were carried out by distributing questionnaires in the form of standardised question instruments from the SUS method to measure user satisfaction with SIMRS product liking, understanding of the product, and usability of the product itself through a 10-question questionnaire, which was originally developed by John Brooke in 1986 and adopted according to the needs and culture in Indonesia by Zahra Sharfina and Harry Budi Santoso. [10][11][12]

Quantitative data was collected from 40 respondents with predetermined criteria. They filled out the questionnaire by answering all statements by choosing answers with a Linkert scale [18] through answer options in the form of Strongly Disagree (STS), Disagree (TS), Neutral (N), Agree (S), and Strongly Agree (SS).The calculation of the SUS score is obtained from the results of filling in the 10 questions with a contribution score in the form of a response score minus 1 for odd number questions (1, 3, 5, 7, and 9) and 5 minus the response score for even number questions (2, 4, 6, 8 and 10). Furthermore, the total score of the 10 questions was multiplied by 2.5 to get the final score of the SUS. So the range of total SUS scores is in the range 0-100. In detail, the formula used is:

$$\text{Score SUS} = ((Q1-1)+(5-Q2)+(Q3-1)+(5-Q4)+(Q5-1)+(5-Q6)+(Q7-1)+(5-Q8)+(Q9-1)+(5-Q10)) \times 2.5$$

The average value of the SUS questionnaire score is obtained from the total SUS score/respondents who responded with the formula $\bar{x} = \frac{\sum x}{n}$

The interpretation of SUS measurement results can be seen based on Figure 1 where the assessment can be seen from 3 points of view *Acceptability*, *Grade scale*, and A*djective Rating*. [13]

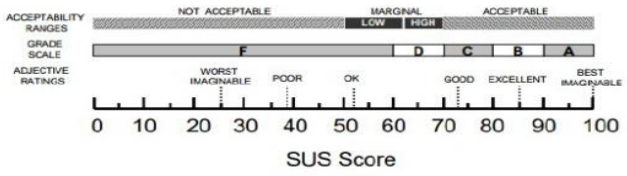

Figure 1. Interpretation of SUS Score

III.RESULTS AND DISCUSSION

Characteristics Responden:

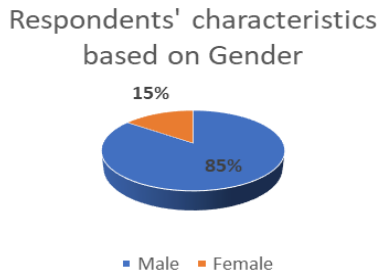

Figure 2. Respondents based on gender

Figure 2 shows that 85% of respondents in this study were female.

Recapitulation of Respondents' Answers

The recapitulation of answers from respondents is used to group answers and identify problematic questions based on respondents' answers. A summary of respondents' responses according to four Likert response scales is presented in Table 1. This question is divided into 2 categories, namely favourable (positive) in question 1,3,5,7 and unfavourable (negative) in question 2,4,6,8.

Table 1. Recapitulation of Respondents' Answers

No	Questions*)	STS	TS	N	S	SS	∑
1	Q1	0	1	12	16	11	40
2	Q2	4	18	10	5	3	40
3	Q3	0	0	7	22	11	40
4	Q4	2	3	20	9	6	40
5	Q5	0	0	6	22	12	40
6	Q6	10	9	12	5	4	40
7	Q7	1	1	14	13	11	40
8	Q8	9	12	8	7	4	40
9	Q9	1	5	13	13	8	40
10	Q10	0	1	19	11	9	40

Table 2. SUS Problem Identification

No	Questions*)	Positive	Negative
1	Q1	27	1
2	Q2	8	**22**
3	Q3	33	0
4	Q4	15	5
5	Q5	34	0
6	Q6	9	**19**
7	Q7	24	2
8	Q8	11	**21**
9	Q9	24	6
10	Q10	20	1

***) Descriptions :**

Q1=Saya berpikir akan menggunakan sistem ini lagi
Q2=Saya merasa sistem ini rumit untuk digunakan
Q3=Saya merasa sistem ini mudah digunakan
Q4=Saya membutuhkan bantuan dari orang lain atau teknisi dalam menggunakan sistem ini
Q5=Saya merasa fitur-fitur sistem ini berjalan dengan semestinya

Q6=Saya merasa ada banyak hal yang tidak konsisten/tidak serasi pada sistem ini
Q7=Saya merasa orang lain akan memahami cara menggunakan sistem ini dengan cepat
Q8=Saya merasa sistem ini membingungkan
Q9=Saya merasa tidak ada hambatan dalam menggunakan sistem ini
Q10=Saya perlu membiasakan diri terlebih dahulu sebelum menggunakan sistem ini

From the results of the grouping of respondents' answers in Table 2, the scores are striking in Q2, Q6, and Q8 because the negative is greater than the positive. This shows that based on user experience in usability assessment, as evaluation material for application developers, it is necessary to pay attention to the following: users feel the application is complicated and complex to use (Q2), some things are inconsistent or mismatched (Q6), and users feel confused in operating (Q8).

The ease of use of the application can be assessed from the user's perception of ease of use, one of which can be proven by the intensity of use and user interaction in using the system. When the system is used frequently, it shows that the system is considered easy to use because it has become a habit. Perceived ease is assumed to be the degree to which a person believes that the application is easy to understand. Indicators of ease of use can be measured by being easy to learn, controllable, flexible, easy to use, clear, and understandable[14].

Ease of use of the application will reduce the effort (both time and energy) of a person in learning and using information technology, which indicates that someone who uses a new system application in working will find it easier than someone who works with the old system. While problems related to consistency (Q6) are related to layout design issues, The impression of consistency given to the user can cut the length of the learning process, eliminate user confusion, and prevent users from re-learning new interactions. Users tend to apply the rules they know from their experience using the app, which leads to their own expectations. Inconsistency will result in user confusion (Q8) related to display design. Confusion in interactions can lead to frustration, and frustration can degrade the user experience. Therefore, distractions in every area should be minimized. There are five ways to maintain consistency: 1). use a language that is common to the audience; 2) provide a type of answer choice with radio buttons; 3) use a layout that most people have already seen, such as Microsoft and Apple products with logos on the top left and search on the top right; 4) create a design that meets user expectations; for example, if the site contains video sharing, it is expected to the analysis revealed that while RSU UMM has made significant progress in implementing EMR, certain areas still require improvement. Specifically, the Data Analysis, Strategy, People, and Information Security indicators showed room for development. provide facilities to be able to play videos; 5) Always use visual elements consistently[15].

The calculation of the SUS score is based on respondents' responses to 10 questions, where the responses to questions with odd numbers are reduced by 1 and for questions with even numbers, 5 is reduced by the response score on even numbers. The total score of the 10 questions is multiplied by 2.5, and the results of the answers of 40 respondents obtained a SUS score of 62.

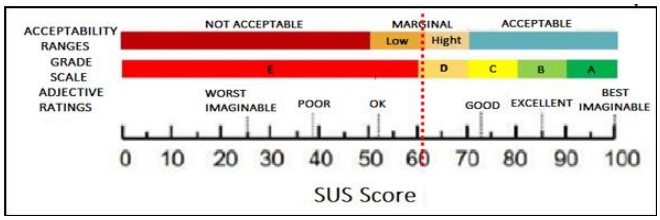

Figure 3. SUS score of SIMRS application

The interpretation of the SUS score from Figure 3 shows that the application assessment can be seen from three points of view, namely acceptability, grade scale, and subjective rating. Acceptability as a measure of the level of acceptance by users with a score of 62 indicates that the SIMRS application in the UDINUS Medical Records Laboratory is in the **marginally low** category. or the level of acceptance of the application is still relatively low and Grade D, while for the adjective rating, which is interpreted as determining the application rating, including the "**OK**" category.

Based on the respondents' response scores, which are dominated by negative statements, the following solutions can be drawn:

1) Users feel that the application is complicated and complex to use (Q2), it is necessary to add navigation buttons in the form of *next, previous, last previous, reload,* or *emergency exit buttons* when users find problems with the system. Use the concept of *left-side navigation*, where navigation buttons can be arranged vertically and placed on the left. In general, vertical navigation

is suitable for applications with content that tends to continue to grow or increase. In some *eye-tracking studies*, 80% of users' attention tends to look to the left side of the website. [16][17] This is related to the concept of usability to facilitate the learning process for users or the **learnability** category.

2) Users feel that the system is inconsistent or mismatched (Q6), and users feel confusion in operating (Q8). This can be anticipated by providing instructions to users on important buttons in the form of tooltips or a tour wizard for a particular operation. This is because users will be more likely to immediately try to use the application (*learn by doing*) than they have to spend time reading the manual first, which is commonly known as *the paradox of the active user.* [18] In addition, to provide a more flexible space for users, applications can be provided with easy transition information screens for primary and secondary information. This allows users to access and view additional information without leaving the main screen or environment. Important information can be displayed prominently through visuals by emphasizing it so that it appears to grab the user's attention, for example, by colouring the background or foreground that is currently active, because the use of monotonous colours will carry a similar message [19]. In principle, consistency should be standardized across applications to reduce user confusion and questions about situations, words, sentences, and actions that users encounter[20]. This kind of thing in usability analysis is known in the memorability category to make it easier for users to remember.

IV.CONCLUSIONS

Based on the results of the usability analysis of the SIMRS application at the UDINUS Medical Records Laboratory through 10 standard System Usability Scale (SUS) questions, it can be concluded that: a). *Three striking question* responses need to be considered by application developers: users feel the application is complicated and complex to use (Q2), some things are inconsistent or mismatched (Q6), and users feel confused about operating (Q8). b). The SUS score of the application obtained a value of 62, which can be interpreted from 3 points of view, ***acceptability, grade scale***, and ***Adjective rating***. Acceptability shows that the SIMRS application is in the **marginally low** category (the level of application acceptance is low) with Grade **D** in terms of the Adjective rating, which is interpreted as determining the rating of the application, including the "**OK**" category.

By considering the usability component according to Nielsen, there are 2 recommendations in the form of *Learnability and Memorability*, as follows: a). In the concept of learnability, it is necessary to add navigation buttons in the form of Next, Last previous, Reload, or emergency exit buttons when users find problems with the system. The placement of navigation is on the left side vertically to fulfil the aspect of ease of eye-tracking. b). The concept of *memorability* suggests several things, namely providing instructions to users, especially on important buttons in the form of tooltips, and a kind of tour wizard for certain types of operations because users will be more likely to immediately try to use the application (learn by doing) than they have to spend time reading the manual first, according to the concept of the paradox of the active user. In addition, it is necessary to provide an easy transition between information screens, both primary and secondary, to provide users with the flexibility to access and view additional information without leaving the main screen or environment. As well as providing a prominent visual effect to grab the user's attention, for example, by colouring the background or foreground that is currently active.

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