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EVALUATING THE USER-FRIENDLINESS OF A MOBILE APPLICATION FOR OUTPATIENT FOOD MONITORING: A SYSTEM USABILITY SCALE (SUS) APPROACH

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Abstract

To maintain and enhance the quality of the Mobile Food Intake Control Application for Outpatients in the Hospital, usability testing must be conducted using the System Usability Scale (SUS). This research aims to evaluate usability and analyze user-friendliness for further action by the Hospital. The respondents consist of 138 outpatient patients. Testing is carried out by requesting respondents to perform scenarios on the Mobile Food Intake Control Application, observed directly by the examiner. Subsequently, respondents fill out a questionnaire containing ten statements with Likert scale responses. The average SUS score of 87.0471 indicates excellent acceptance of the application, and the user rating suggests that the application meets user expectations sufficiently. However, user speed in using the application and focusing on its features are still considered normal, and the error rate falls within acceptable limits.

Keywords: Evaluation; Usability Testing; System Usability Scale; Mobile; Food Controller.

Abstrak

Dalam rangka menjaga dan meningkatkan kualitas Sistem Aplikasi Mobile Pengontrol Asupan Makanan Pada Pasien Rawat Jalan Rumah Sakit, perlu dilakukan usability testing terhadap Aplikasi tersebut menggunakan System Usability Scale (SUS). Tujuan dari penelitian ini adalah untuk mengevaluasi usability dan menganalisis user friendliness sehingga dapat dilakukan tindak lanjut oleh pihak Rumah Sakit. Responden terdiri dari 138 pasien rawat jalan. Pengujian dilakukan dengan meminta responden untuk melakukan skenario pada Aplikasi Mobile Pengontrol Asupan Makanan yang diamati langsung oleh penguji, kemudian responden mengisi kuesioner yang berisi 10 pernyataan dengan skala likert untuk jawabannya. Skor rerata SUS sebesar 87,0471 menunjukkan bahwa tingkat penerimaan aplikasi sangat baik dan peringkat aplikasi menurut pengguna sudah cukup memenuhi ekspektasi. Namun, kecepatan pengguna dalam menggunakan aplikasi dan fokus ke dalam fitur-fitur aplikasi yang ada masih dikatakan normal dan tingkat kesalahan yang dilakukan masuk kategori wajar..

Kata kunci: Evaluasi; Usability Testing; System Usability Scale; Mobile; Pengontrol Asupan Makan

INTRODUCTION

Information technology is now integral to social life, with rapid developments enhancing the functionality of developed software. This progress provides opportunities for developers to improve the quality of human life, particularly in the health sector.

Recent years have witnessed a surge in the integration of mobile applications at the intersection of healthcare and technology, revolutionizing patient-centric care and contributing to a paradigm shift toward proactive health management (Smith, 2020; Johnson & Johnson, 2019). The proliferation of mobile health (mHealth) applications is fueled by the increasing prevalence of smartphones and the desire to foster patient engagement in healthcare processes (Xie, Nacioglu, & Or, 2018).

Users of smartphones, computers, or laptops connected to the internet can browse to find desired information (Setiawan & Widyanto, 2018). Emphasis has been placed on outpatient food monitoring applications designed to empower individuals to manage their dietary habits actively (Xie, Nacioglu, & Or, 2018). This paper aims to assess the user-friendliness of a specific mobile application

dedicated to outpatient food monitoring, utilizing the widely recognized System Usability Scale (SUS) approach.

Leveraging the capabilities of mobile devices, these applications offer innovative solutions to bridge the gap between traditional healthcare practices and the evolving needs of today's health-conscious individuals (Steinhubl, Muse, & Topol, 2015).

One crucial domain where this integration is making significant strides is outpatient food monitoring, a vital aspect of holistic health management. Monitoring dietary habits in real-time empowers individuals to make informed choices, improving overall health outcomes. The mobile application under scrutiny in this paper is positioned at the forefront of this movement, promising a user-friendly interface and enhanced functionalities for effective outpatient food monitoring.

The definition of usability is a quality indicator that measures how easy the interface is to use (Nielsen, 2003). Usability Testing is one way to determine whether users can easily use an application, how efficiently and effectively an application can help them achieve their goals, and whether users are satisfied. Usability testing differs from User Testing even though both methods test an application, whether desktop, website, or mobile-based. User Testing determines whether the application created meets the user's needs, while Usability Testing aims to determine whether users can use the developed application. To carry out User Testing, you need an application that has been created, while to carry out Usability Testing, you can use a wireframe from an application or an application that has been made. Usability testing needs to be carried out to determine the possible obstacles that users will face when using the application. We must remember that we are not necessarily the users of the applications created. So, testing it first on real users is necessary to get feedback. The design team and application developers can identify issues likely to arise when using the application and immediately fix them. Usability is related to the quality of the experience that users feel when using applications, whether in the form of website-based, desktop-based, or mobile-based equipment or applications. Usability or usefulness includes several factors: intuitive design, ease of learning, practical use, ease of remembering, level of errors that occur, and the level of subjective satisfaction. Therefore, when testing, factors related to usability will be tested. Usability can be measured by analyzing the opinions of end users of the application and using the perceptions of experts or experts who are experienced in the field of usability to strengthen the analysis results (Wardani 2019).

The System Usability Scale (SUS), introduced by John Brooke in 1986 (Jordan et al., 1996), has emerged as a robust method for evaluating the usability of various systems, including software applications and websites. Its simplicity, effectiveness, and broad applicability make SUS an ideal choice for assessing the user-friendliness of the targeted mobile application in our study (Bangor et al., 2008). The use of SUS has several advantages, including Test results from SUS are expressed in the form of a scale with a score range of 0-100 so that this can be applied easily (Brooke, 1996), (Jordan et al., 1996), (Bangor et al., 2008). Ependi says the SUS method calculation process is easy to understand and not complicated (Ependi et al., 2019). According to Gardner, SUS can be used at no additional cost and is also free of charge (Macklin, Chris, 2020).

As we embark on this evaluation journey, it is essential to consider recent literature highlighting the significance of user-friendly interfaces in mHealth applications. Studies by Smith et al. (2020) emphasize the positive impact of user-friendly designs on patient engagement and adherence to healthcare interventions. Furthermore, the work of Johnson and Johnson (2019) underlines the importance of usability in fostering positive user experiences and, consequently, the success of mobile health initiatives (Johnson and Johnson 2019).

Therefore, relevant evaluations can use the System Usability Scale (SUS) and Usability Testing methods by measuring usability. SUS is a method used to evaluate several products and services, such as hardware, software, websites, and mobile applications. Meanwhile, usability testing is a perfect and precise way to discover real user experience by looking at user processes when using the application. Wardani (2019) explained usability testing is carried out to identify problems that will be discovered when users use the application. By using these two methods, users can find out the usability level of the application from the user's perspective end of the application that relies on the user's experience when using the application (Wardani 2019).

In the ensuing sections, we will delve into the methodology, evaluation criteria, and results of our SUS-based assessment, shedding light on the strengths and areas for improvement in the user-friendliness of the mobile application for outpatient food monitoring.

RESEARCH METHODS

In this research, the author used a quantitative approach, and the data analysis technique was carried out after the data for each respondent was collected; the data was calculated based on the System Usability Scale (SUS) formula. According to Ramadhan (2019), the SUS assessment is as follows:

- Statements with odd numbers can be calculated by subtracting one from the respondent's score.
- For statements with even numbers, it can be calculated as follows: the value of 5 is reduced by the value of the respondent.
- The respondents' scores are added, then the result is multiplied by the value 2.5.

The SUS assessment above to clarify the calculation process can be seen in the equation below (Kharis 2017)

1. Similarity of Respondent Scores

$$\boldsymbol{Score\ R} = ((Q\mathbf{1}-\mathbf{1})+(\mathbf{5}-Q\mathbf{2})+(Q\mathbf{3}-\mathbf{1})+(\mathbf{5}-Q\mathbf{4})+(Q\mathbf{5}-\mathbf{1})+(\mathbf{5}-Q\mathbf{6})+(Q\mathbf{7}-\mathbf{1})+(\mathbf{5}-Q\mathbf{8})+(Q\mathbf{9}-\mathbf{1})+(\mathbf{5}-Q\mathbf{10})) \times \mathbf{2,5} \quad \ldots\ldots(1)$$

Information :
R Score: Score obtained from each respondent.
P1…P10: Likers value for each question from respondents

2. Equation of SUS mean score

Average Score

$$\boldsymbol{SUS} = \frac{\boldsymbol{\Sigma x}}{\mathbf{n}} \quad \ldots\ldots(2)$$

Information :
$\boldsymbol{\Sigma x}$: Total score for each respondent
$\boldsymbol{n}$: Number of respondents

The stages of this research are shown in Figure 1.

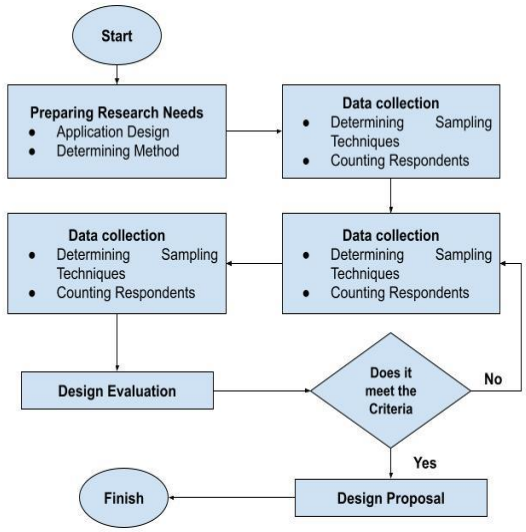

Figure 1. Research Stage

Data is collected at this stage by filling out a questionnaire given to application users and taking samples from a population. Sampling was done using purposive sampling by taking samples from the population, including Informatics students from the Class of 2018, Amikom University, Yogyakarta, and Medical students from the Class of 2019-2021, Muhammadiyah University, Surakarta. In general, this stage determines the need for application testing preparation. In this research, the sample size is determined using the Slovin formula as follows:

$$n = \frac{N}{1 + N\ e^2} \quad \ldots\ldots(3)$$

Information:
n: sample size
N: population size
e: error tolerance limit

For this research, with N = 1095 people, the number of respondents sampled was 92 people with the following calculation:

$$n = \frac{1095}{1 + 1095\ (0.1)^2} = 91.6$$

$$n = 92$$

The purpose of using instruments in this research is to measure user satisfaction with the built system. The instrument used in this research is a ready-to-use or ready-to-use questionnaire. Type The instrument used in the study was the System Usability Questionnaire Scale (SUS).

Research Questionnaire

The form of the questionnaire can be seen in Table 1.

Table 1. Questionnaire

No	Question
1	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 imagine 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.

RESULTS AND DISCUSSION

Instrument Testing

a. Validity test

Validity is carried out to determine the extent to which an instrument can perform its function. The questions created previously have been tested in previous research using the ProductMoment Coefficient test. For the Product-Moment Coefficient test, tests were carried out on 97 participants, and the table value was 1.6611. The table value obtained based on n is 95 (number of participants minus 2) and has a significance level of 5% or 0.05. Kharis et al. (2019) conducted the results of calculating the Product-Moment Coefficient, which will produce a count value where the count value is greater than the table; the question item is declared valid. The validity test results table is as shown in table 2:

Table 2. Validity test results

No	Score calculated	Validity
1	7,094	Valid
2	6,286	Valid
3	6,280	Valid
4	9,496	Valid
5	6,728	Valid
6	7,498	Valid
7	3,836	Valid
8	6,496	Valid
9	6,704	Valid
10	9,236	Valid

b. Reliability Test

Reliability shows the extent to which an instrument can be trusted. The reliability test aims to test the extent to which the instrument can be trusted. The reliability test in previous research used the Cronbach Alfa formula, where if the Cronbach Alfa value was more than 0.7 and less than 0.9, then the item was declared reliable.

The results show that the questions produced a Cronbach Alpha value of 0.778086452. According to Kharis et al. (2019), these results show that the Cronbach Alpha value is more than 0.7 and less than 0.9, and the items are declared reliable.

The following application display design is an application display design for patients: Landing Page, Login Page, Home Page, profile page, Detail Page, and Setting Page, as shown in Figure 2-7 below.

Figure 2. Landing Page

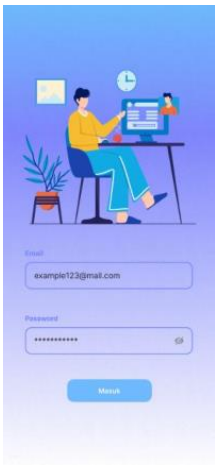

Figure 3. Login Page

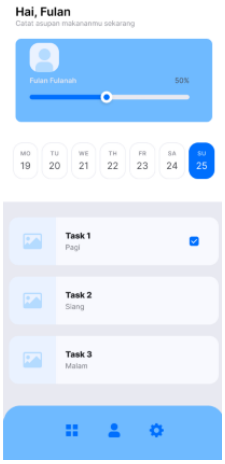

Figure 4. Home Page

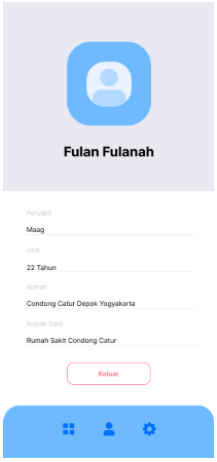

Figure 5. Profile Page

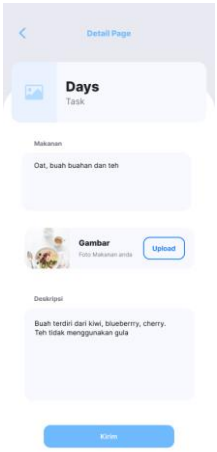

Figure 6. Detail Page

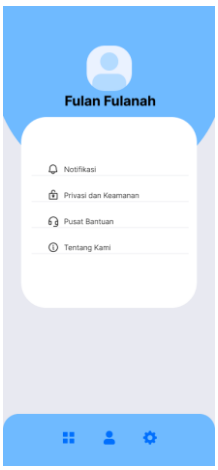

Figure 7. Setting Page

The data collection process using a questionnaire takes sufficient time to reach respondents using this application with the help of managers and developers. One hundred seventy-one respondents took part in the test, and all respondents filled out the questionnaire statement

completely. After the data is collected, data collection will be carried out on the data and conversion of the respondents' answers that have been collected. Answered positive statements have a scale of 5,4,3,2,1, while negative statements have a scale of 1,2,3,4,5. The results of the respondent data collection refer to the following table description, as shown in Table 3.

Table 3. Data collection results

Respondent	Q1	Q2	Q3	Q4	Q5
1	5	4	4	5	4
2	5	5	4	5	4
3	4	5	5	5	5
4	5	5	5	4	5
5	5	5	4	5	4
...	...	...	...	...	...
134	4	1	5	2	5
135	4	1	5	2	4
136	5	2	4	2	4
137	5	1	4	2	5
138	5	2	5	1	5
Sum	640	**221**	635	**237**	644

Table 4. Data collection results (cont)

Respondent	Q6	Q7	Q8	Q9	Q 10
1	5	4	5	5	4
2	5	4	5	5	4
3	4	5	5	4	5
4	4	5	5	4	4
5	5	4	5	5	4
...	...	...	...	...	...
134	2	5	1	4	1
135	1	4	2	5	2
136	1	5	2	5	1
137	2	5	1	4	2
138	1	4	2	4	1
Sum	**228**	637	**229**	629	**225**

It can be seen from the table above, especially in the number of calculations for each question, that some respondents experienced difficulty running the application. In question 2 (Q2), respondents felt the application could be simple. Question number 4 (Q4) respondents need help when using the application. In question 6 (Q6), respondents assessed inconsistent menus and features. Question Number 8 (Q8): respondents find this app very complicated. For question number 10 (Q10), respondents need to study before using the application to use it well. These five problems will be used as a reference in providing recommendations for solutions to the application to make future improvements.

The calculation for determining the SUS score is carried out with 138 respondents. For odd-numbered questions, the weight of the answers obtained will be reduced by 1; for even questions, five will be reduced by the weight of the resulting answers. The values from the first and second processes are multiplied by 2.5 to get the overall SUS score. So, in this study, the SUS score was 87.0471. The blue vertical line indicates the position of the SUS score obtained, which can be seen in Table 5 and Figure 8.

Table 5 Mobile Application for Outpatient Food Monitoring SUS Score

Respondent	Score SUS	Respondent	Score SUS
1	47.5	128	87.5
2	45	139	90
3	47.5	130	85
4	55	131	90
5	45	132	90
6	50	133	90
7	95	134	85
8	87.5	135	87.5
9	92.5	136	87.5
10	92.5	137	90
...	...	138	90
Average Score			**87.0471**

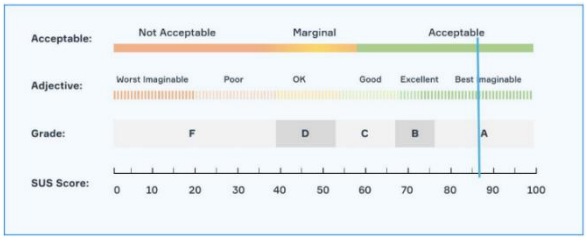

Figure 8. SUS Score

Based on the SUS average previously obtained, the Food Intake Control application will be observed based on the following 2 SUS value determinations:

1. Acceptability, Grade Scale, Adjective Rating

This first assessment determines users' views of the Food Intake Control application. Acceptability has three categories: acceptable, marginal, and not acceptable. The grade scale category is A, B, C, D, E, and F. The last category, adjective rating, consists of the worst imaginable, poor, ok, good, excellent, and best imaginable. These three categories are determined by calculating the average SUS score previously obtained, 87.0471. Based on the SUS scores obtained, the three categories are defined as follows:

a. Acceptability or the level of application acceptance by users included in the acceptable category. In other words, users can use the application well.
b. The grade scale for this application is Category A, which is the highest category on the grade

scale but quite close to the previous scale, namely Category B, referring to Figure 1, which shows the grade scale levels.

c. The adjective rating for this application falls in the Excellent category. This means this Food Intake Control application is still included in the rating, which is enough for the users.

2. SUS Score Presentile Rank

Determining the SUS Percentile Rank score value is different from previous value determination. For SUS the percentile rank score has its conditions as follows (Ependi et al., 2019):

a) Grade A = score>= 80,4
b) Grade B = score >= 74 and< 80,4
c) Grade C = score >= 68 and< 74
d) Grade D = score >= 51 and< 68
e) Grade F = score< 51

Based on these provisions, the average SUS percentile rank score on the Meal Intake Controller application worth 87,071 gets an A. In other words, the Food Intake Control application is classified as easy to understand and satisfying for users to use in carrying out their activities through the application.

Design Evaluation

Based on the problem findings obtained from the feedback and test observations, recommendations for improvements can be made to the Food Intake Controller application. Suggestions for improvements are made in the form of an application mockup. The following are several recommendations for interface improvements that can be provided in this research.

a. Respondents need help (Q4) and learn first (Q10) before using the application. The proposed solution recommendation is to create a role map to explain the function of each menu and feature and information in the application.
b. Users find the application complex to use. The application does not provide signs such as different colors for the currently open menu from other menus. Activating or giving the right color to provide differences or signs when a menu is being opened compared to other menus; in a situation, we need to use the last color used to determine a condition, then coloring is necessary in the background or foreground, which is active at that time. The use of the same color carries a similar message or meaning.
c. Users feel the application still needs consistent menus and features (Q6). The proposed recommendation is that the name of the menu and the name of the sub menu that is opened must be adjusted; for example, when opening one of the dashboard menus, namely the details page, the navigation on that page should be by the name of the menu and sub-menu that is opened. Consistency standards must be had in a system so that users are clear and ask questions about situations, words, sentences, and actions encountered by the user.
d. Recommendations for several features from medical students. Add a feature to see prohibitions on consuming certain substances and add a checkbox to select food intake that has been met, such as carbohydrates, protein, vitamins, and others. Provide a feature to remember medication and warnings if you forget to take medication.

CONCLUSIONS AND SUGGESTIONS

Conclusion

The usability level of the Food Intake Control application is classified as good. Based on data from the task scenario, users of the Food Intake Control application in the navigation section still need clarification. Users also have yet to be able to optimize the use of the Food Intake Control application outside of the tasks given and feel that improvements regarding the appearance are still needed. Based on the data and explanations described in the previous chapter, user satisfaction with the application is classified as good. The SUS average score of 87.0471 shows that the application acceptance rate is perfect and the application rating, according to users, has met expectations. However, the user's speed in using the application and focusing on the existing features is still considered normal, and the error level is also reasonable. The evaluation results show that the Intake Control application is ready to be developed further by considering the evaluation results.

Suggestion

Research needs to be carried out using other methods, using expert evaluators as assessors to find more representative evaluation results. In determining the task scenario, testing is based on data representing the application user population.

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