Usability Testing on Android-based Mobile Application "Smart Assistant Diabetes"

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Abstract: Diabetes is a chronic disease characterized by disorders of blood sugar regulation in the body due to lack of insulin production by the pancreas, lack of the body's response to insulin, and the influence of other hormones that inhibit insulin performance. Mobile application could help people with diabetes to assist their needs such as medicine reminder, exercise guidance, or blood sugar tracking. To maximize their usage, the apps needs to be usable and easy to use. This paper aims to test the usability of Smart Assistant Diabetes Mobile Application based on SUS and SEQ method. The result from SEQ method has median value of 6, so the apps can be classified as Easy. Using SUS method, the average SUS values were 71.08 and can be classified as Good.

1 INTRODUCTION

Diabetes mellitus, commonly known as diabetes, is one of the diseases with the highest number of sufferers in the world with the number of sufferers reaching 422 million (Organisation, 2017). Indonesia, has the six-highest diabetes prevalence rate after PRC, India, and USA with 10.3 million adults living with diabetes(Federation, 2019). The diabetes prevalence has also rising from 6,9% in 2013 to 8,5% in 2018.

Diabetes is a metabolic disorder characterized by chronic hyperglycaemia and metabolic disorders of carbohydrates, fats and proteins caused by abnormalities in insulin secretion, insulin action or both (Kardika et al., 2015).

Many people assume that effective diabetes treatment is only enough with insulin injections or drugs only. In fact, this kind of treatments require a quite large cost. Another important effort that is quite easy to do and does not require a large cost but less noticed by people is to regulate a healthy diet and exercises, especially diabetes gymnastic and other simple exercises regularly.

The "Smart Assistant Diabetes" was built with the aim of designing a personal data assistant application interface for Diabetes patient by combining previous research and modifying it by adding various features that are different from previous studies. This apps is built on android platform. Android is one of the mobile device platforms with the most users (Atmodjo and Krisjanti, 2016). In addition, this study also tested the usability and ease of its interface by using the Single Ease Question (SEQ) and System Usability Scale (SUS) methods that proposed to users.

2 LITERATURE REVIEW

There are several applications that helps people with diabetes (Perwira, 2012)(Widiastuti and Syahbani, 2015). (Perwira, 2012) made an android apps that helps users to manage their diet with the consultation feature of the daily diet. This apps helps users in maintaining their daily diet. (Widiastuti and Syahbani, 2015) made an Android-based apps that was similar to the previous application, but equipped with a daily calorie recording feature. This apps also have a medicine and meal time reminder. Kalpajar (2018) made a similar application with a diet menu consultation feature and a daily calorie calculator feature that was made more detailed.

Diabetes management is not only about medicine but also healthy daily diet and exercise, especially diabetes and light exercise regularly (Yendi and Adwiyana, 2014). Healthy diet and doing diabetes and light exercises regularly will help control patient blood sugar level and also avoid various kinds of other disease complications (Novita et al., 2018). In addition, diabetes exercise itself helps insulin work in diabetics because through movements in diabetes ex-

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ercise makes sugar in the blood flow through muscle cells which is then converted into energy so that blood sugar levels in the body of diabetics also decrease (Sharoh and Salmiyati, 2017)(Nurahmatya and Asnindari, 2014) (Rehmaita et al., 2017)(AFRIZA, 2015).

An apps with low usability can frustate user and stop user from using the apps (Widodo et al., 2017). Some usability research has been applied in healthcare (Davis and Jiang, 2016)(Alturki et al., 2017), also in academic (Ardiansyah and Ghazali, 2016)(Santoso, 2018). Some usability testing method used in this research are Nielse usability testing (Widodo et al., 2017), Single Ease Question (SEQ) (Alturki et al., 2017) and a mix of System Usability Scale (SUS) and SEQ (Ardiansyah and Ghazali, 2016)(Santoso, 2018).

Smart Assistant Diabetes for people with diabetes was created by combining features in previous studies and existing applications and adding new feature them such as the meal and medicine reminder feature. This application also features a food catalogue and its calories that are suitable for diabetes and BMI (Body Mass Index) calculator. Furthermore, this application also has a blood sugar tracking feature that functions to monitor the user's blood sugar level. Finally, this application also features a simple guide to do some exercises suitable for users with diabetes. In general, this study discusses how to test a Smart Assistant Diabetes mobile application interface with its various features and the level of usability and ease of use using the SUS and SEQ methods.

3 METHOD

Data is collected by giving questionnaires to thirty respondents with diabetes. Then the test is carried out by lending an Android device containing the Smart Assistant Diabetes apps to the respondent. Respondents test the application by carrying out tasks in accordance with the tasks on the questionnaire given which are then filled out after trying the application.

In this test, there are two methods used, namely Single Ease Question (SEQ) and System Usability Scale (SUS). The Single Ease Question (SEQ) method is used to measure the ease felt by users after completing a given task. This method is used because the implementation is fast and does not require a long time because the questions are asked immediately. System Usability Scale (SUS) method is used to measure how high the usability and the acceptability levels of application design are developed (Ardiansyah and Ghazali, 2016). This method is also used because the test is very practical and easy, but the results remain valid and can be justified.

The Single Ease Question (SEQ) method used in this study contains 9 tasks that must be performed by the user. SEQ are administered at the end of every task in a test session. The task is coded F1 to F9. User rate the difficulty of the completed task, from Very Easy to Very Difficult on a 7-point rating scale. We then calculate the average of each task from the respondents with Equation 1. We then calculate the median as described in Equation 2 for even data and Equation 3 for odd data (Wetzlinger et al., 2014).

$$Scorepertasks = \frac{taskvaluesamount}{numberofrespondents} \quad (1)$$

$$Median = (Xn2 + Xn2 + 1)/2 \quad (2)$$

$$Median = \frac{(Xn+1)}{2} \quad (3)$$

Information :
X = data sequence
n = amount of data

As for the scale of values in the SEQ method, it can be seen inFigure 1.

Score	Results
7	Very easy
6	Easy
5	Not difficult
4	Enough
3	Not easy
2	Difficult
1	Very difficult

Figure 1: Scale Value of SEQ test.

List of tasks and questions of the SEQ method can be seen in Figure 2.

No.	Function Name	Task
F1	Login	Enter email and password to log into the application
F2	Register	Register a username, email and password to enter the application
F3	See exercises info	Open one type of exercise in the main menu, then select one of the exercises info and run the selected exercises program
F4	Calculate the Body Mass Index	Open the calculator menu, then calculate the body mass index
F5	Viewing Graph	Opens the graph menu, then sees a graph of random and fasting blood sugar levels based on blood sugar values and dates entered
F6	Look for the food database	Open the food database menu , then view a list of foods and their calories
F7	Make an alarm	Open the alarm menu, then create a new alarm as a reminder of the time to eat, take medicine, and do exercises
F8	See about Applications	Open the menu about the application to view the application description
F9	Logout	Look for the logout menu to exit the application to the login page

Figure 2: Single Ease Question (SEQ) task list.

In System Usability Scale (SUS) method, there are 10 questions with five response options for respondents that use a Likert scale with a value of 1 (strongly disagree) to 5 (strongly agree). In this method, each question with an odd number (1,3,5,7,9) has a positive tone and an even numbered question (2,4,6,8,10) has a negative tone. For odd numbered questions, the value of the respondent is calculated using Equation 4. Whereas in the even numbered questions, the value of the respondents was calculated using Equation 5. To calculate the final value of SUS, can be seen in Equation 6 (Bangor et al., 2009).

$$OddQuestionValue = X - 1 \quad (4)$$

$$EvenQuestionValue = 5 - X \quad (5)$$

$$SUSValue = (OddQuestionValueTotal + EvenQuestionValueTotal)x2,5 \quad (6)$$

Information:
X = data sequence

The assessment of testing using this SUS method starts from 0 to 100. For the scale of the value of this method can be seen in the Figure 3.

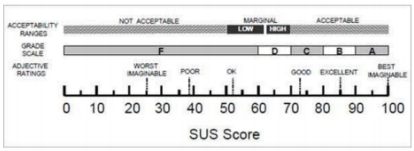

Figure 3: SUS Score Scale.

As for the list of SUS questions, it is shown in Figure 4 below.

No.	Question
1.	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 a lot of things before I could get going with this system.

Figure 4: List of System Usability Scale (SUS) Questions.

4 RESULTS

The interface of this application is shown in the following figures.

4.1 Login Display

This page is displayed after the splash screen and serves as a page for account authentication. On this page, the user input the registered email and password. If it fails or the user enters the wrong email or password, there will be a notification that the email or password entered is incorrect. Under the button, there is also the text ”Daftar” (Register) which can be selected by the user as navigation to go to the Register page. The login display is shown in Figure 5 below.

Figure 5: Login Display.

Figure 6: Exercise Info Display.

4.2 Exercises Info Display

This page is the main page when the users access the application. On this page, there are five main sub menus regarding exercises information suitable for people with Diabetes Mellitus, namely Muscle Training, Swimming, Cycling , Jogging, Yoga and Gymnastic . On the Muscle Training and Yoga and Gymnastic sub menus, there are several more sub menus containing info and exercise programs that can be selected by the user. The Exercises info display is shown in Figure 6 below.

4.3 Body Mass Index (BMI) Calculator Display

This page contains the Body Mass Index (BMI) calculator. On this page, there are forms ”Height” and ”Weight” that can be filled by the user. Then there is the ”Calculate” button to display the calculation results of the value of the Body Mass Index (BMI) entered by the user. The Body Mass Index (BMI) calculator display is shown in Figure 7 below.

Figure 7: Body Mass Index (BMI) Calculator Display.

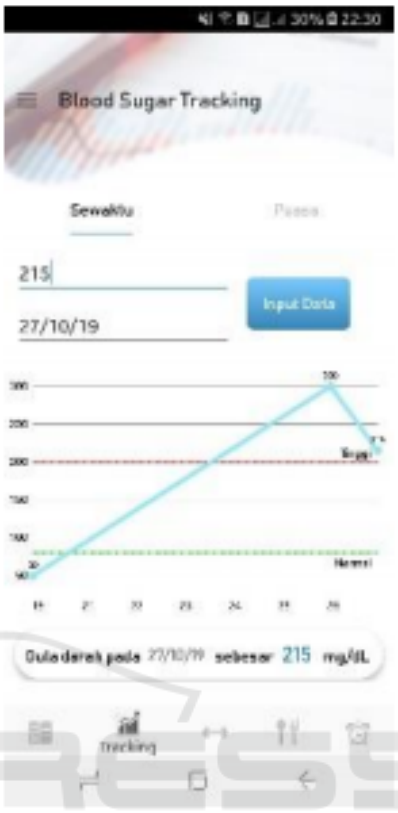

Figure 8: Blood Sugar Graph Display.

4.4 Blood Sugar Graph Display

This page contains a graph of the random and fasting blood sugar development based on the value and date entered by the user. On this page there are two sub menus namely ”Sewaktu” (random blood sugar) and ”Puasa” (fasting blood sugar). On both sub menus, there is a blood sugar form and a date that the user can fill in. Then there is the ”Input Data” button which functions to display the graph value and date along with the indicator based on input from the user. Blood Sugar Graph display is shown in Figure 8 below.

4.5 Food Database and Calories Display

This page contains a list of foods and their calories that can be seen by users. On this page there is a list of various foods along with an explanation of calories and weight that serves to help people with Diabetes Mellitus measure the food they want to consume. The food database and its calories display is shown in Figure 9 below.

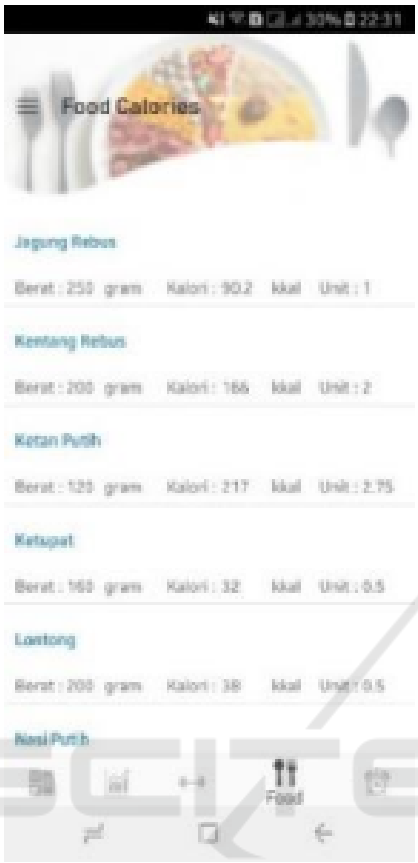

Figure 9: Food Database and Calories Display.

4.6 Reminder for Mealtime, Take Medication, and do Exercises Display

This page contains a list of reminder alarms for mealtime, take medication and do exercise that can be set by the user. On this page there are three sub menus namely ”Makan” (Eat), ”Minum Obat” (Take Medication), and ”Olah Raga” (Exercise). In each sub menu, there is a list of each alarm that has been set and a button to add a new alarm. If the button is selected, a new page will open where the user can change the name and set the time of the alarm as desired by the user. The reminder for mealtime, take medication, and do exercises display is shown in Figure 10 below.

Figure 10: Reminder for Mealtime, Take Medication, and do Exercises Display.

We conduct usability test using the SEQ method questionnaire that is given to thirty respondents. User rate the difficulty of the completed task, from Very Easy to Very Difficult on a 7-point rating scale. The obtained data and results is described in the Figure 11.

To get the value of each task in Table 4, we calculate the average values of each task using Equation 1. We then calculate the median as described in Equation 2 for even data and Equation 3 for odd data. The results are described in Figure 12.

No.	Value								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
1.	4	3	7	7	7	7	7	7	7
2.	7	7	6	7	7	6	7	7	7
3.	7	7	7	7	7	7	7	7	7
4.	7	7	7	7	7	7	7	7	7
5.	4	4	6	6	5	3	7	5	5
6.	7	7	7	7	7	7	7	7	7
7.	7	7	7	7	7	5	6	7	7
8.	7	7	7	7	1	7	7	7	7
9.	6	6	6	6	5	5	6	5	6
10.	3	3	6	6	6	6	6	6	6
11.	7	7	7	7	7	7	7	7	7
12.	7	7	6	7	7	4	6	7	7
13.	6	6	6	6	6	6	5	6	6
14.	7	7	7	7	7	7	7	7	7
15.	7	7	7	7	7	4	7	7	7
16.	3	3	6	6	6	3	6	6	7
17.	7	7	6	6	6	6	6	6	6
18.	6	6	5	5	5	6	6	5	5
19.	4	4	4	4	4	4	4	4	4
20.	6	6	6	6	6	6	6	6	6
21.	7	7	7	7	7	7	7	7	7
22.	7	7	7	6	7	7	7	7	7
23.	5	5	5	5	5	5	5	5	5
24.	6	6	6	6	6	6	6	6	6
25.	6	6	6	6	6	6	6	6	6
26.	6	6	6	6	5	6	6	6	6
27.	3	5	4	5	2	2	3	5	4
28.	6	6	6	6	4	6	6	6	6
29.	7	7	7	7	7	7	7	7	7
30.	6	6	6	6	7	7	7	7	7

Figure 11: SEQ test results.

Task	Average
F1	5.93
F2	5.96
F3	6.2
F4	6.26
F5	5.86
F6	5.73
F7	6.23
F8	6.26
F9	6.3

Figure 12: Average values of each tasks using the SEQ method.

Figure 13 summarize the results of each task from Single Ease Question (SEQ) method. We then calculate the scale value by finding the median using Equation 2 and Equation 3 so that the median results obtained from all tasks from F1 to F9 are 6. That average value of each task indicates the usability as ”Easy”.

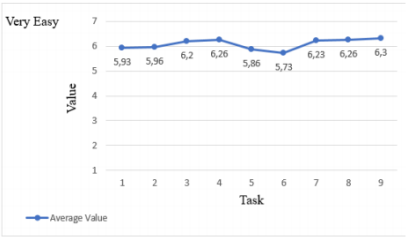

Figure 13: Graph of SEQ test results

The obtained data and results from System Usability Scale (SUS) is shown in Figure 14.

No.	Odd Questions	Even Questions	SUS Score	Class Scale
1.	10	12	55	F
2.	15	8	57.5	F
3.	16	17	82.5	B
4.	16	17	82.5	B
5.	12	10	55	F
6.	20	20	100	A
7.	20	18	95	A
8.	13	14	67.5	D
9.	15	16	77.5	C
10.	12	12	60	D
11.	20	15	87.5	B
12.	16	8	60	D
13.	16	14	75	C
14.	20	16	90	A
15.	17	17	85	B
16.	15	11	65	D
17.	14	15	72.5	C
18.	15	12	67.5	D
19.	15	14	72.5	C
20.	15	14	72.5	C
21.	17	15	80	B
22.	16	11	67.5	D
23.	10	12	55	F
24.	15	11	65	D
25.	15	11	65	D
26.	14	15	72.5	C
27.	7	3	25	F
28.	15	16	77.5	C
29.	20	16	90	A
30.	12	10	55	F
Average SUS value			71.08	C

Figure 14: The Sample Measurement of Three Tourist Destination.

Based on the SUS rating scale in Figure 3, the average SUS values were 71.08 and can be classified as Good.

5 CONCLUSIONS

Overall, testing F1 to F9 tasks using the SEQ method has a median value of 6 which when adjusted in Table 1 is included in the "Easy" classification according to respondents. We also using the System Usability Scale (SUS) method. The average SUS values obtained based on Table 6 were 71.08. Based on the SUS rating scale in Figure 2, it was found that testing using the SUS method with a value of 71.08 was included in the "Good" category with a "C" rating. In other words, the Smart Assistant Diabetes apps has good usability according to respondents.

The advice that can be given from the results of testing and analysis of this research is that it is expected that in further application development "task success rate" testing can be done which serves to measure the level of user success in completing tasks in the application and can be done "time-ontask" testing which functions to measure how much time is needed for users to complete the task.

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