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Mobile Application Characteristics and User Perspective in Smart Healthcare Service Applications

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***Abstract*—The current COVID-19 pandemic has an impact on accelerating the digital transformation of various sectors in Indonesia, one of which is the health sector. Hence, many mobile applications of smart healthcare service have been developed, which can be a solution for people to get better health services. The aim of the research is to evaluate the mobile application (SpeedId and SpeedQ) for smart healthcare service based on the user perspective and the characteristics of the mobile application. The research is an analytic observational study that contains five stages of research. There are 64 respondents in the research using a questionnaire as data collection tool. Then, through a literature review, seven variables are determined, and a research model is proposed. The evaluation of the mobile application characteristics includes the operating system and network availability as independent variables and response time, responsiveness, and interface accessibility as dependent variables. Meanwhile, evaluating user perspective consists of respondents' gender and education as independent variables and duration and ease of use as dependent variables. From the mobile application characteristics, the results show that operating system and network availability do not significantly affect all dependent variables. From the user perspective, gender only significantly affects the duration variable. Meanwhile, education significantly impacts the duration and the ease of use.**

***Index Terms*—Mobile Application Characteristics, User Perspective, Smart Healthcare Service Application**

I. Introduction

SINCE 2020, Indonesia and the world have confronted the COVID-19 pandemic. This situation encourages various parties to accelerate digital transformation as the impact of the pandemic. One sector that needs consideration is the health sector. The health sector faces considerable challenges during the pandemic. Hence, health facilities are expected to quickly identify the problems encountered to identify the risks faced by the community and health workers [1].

As a place of service, health facilities have a waiting room that can be a potential place for the spread of the COVID-19 virus. Moreover, people expect to get fast service without queueing and standing [2, 3]. The fundamental issue with healthcare services is the waiting time for people to get services. People who use health services have to wait for queue numbers, wait for their turn to be examined by doctors, and wait at pharmacies to get medicine [4, 5]. Then, the issues during the current pandemic are the lack of optimal health services provided to the community while implementing health protocols.

In recent years, mobile devices have been required by most people because of their advantages and ease of use. This situation drives the pace of mobile application development. Hence, a mobile application of smart healthcare service has been developed, which can be a solution for people to get health service. Software testing has been carried out to optimize the development of smart healthcare service applications. The purpose of software testing is to ensure the functionality of the application meets the requirements or needs [6–8]. Furthermore, it is necessary to evaluate the application from the user perspective and the characteristics of the mobile application.

Characteristics of mobile applications are developed

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with various and different approaches to mobile application developments. The data reveal that the design dan combination of different methods have an influence on the characteristics of each mobile application [9, 10]. Each software or application has its characteristics. Based on previous studies, mobile applications have characteristics including response time, network availability, integration with other applications, diverse mobile connections, diverse user interfaces, diverse devices, diverse operating systems, limited screen size, and others [11–13].

In relation to the use of mobile applications, the success of this product is conditioned by its achieved popularity. The application must run on different mobile platforms, especially the two most popular mobile platforms, Android and iOS, to maximize its presence in the market [9, 14]. In addition, the success of the mobile deployments is influenced by the user perspective. Understanding all basic users' needs and requirements is the key to the successful implementation of mobile applications [15–17].

The evaluated mobile applications are SpeedId and SpeedQ. SpeedId is a smart city application for the community's needs. Meanwhile, SpeedQ is an efficient and real-time online queue application. These applications are used in health services such as hospitals. Some of the features provided are customers' database, QR code check-in, multi counter queue, real-time reservation, customer service history, service schedule and calendar, notifications to the customers, chat to customers, etc. These mobile applications have been used in several hospitals and for the registration of COVID-19 vaccinations [18, 19].

The main objective of the research is to evaluate the smart healthcare service mobile applications based on the user perspective and mobile application characteristics. It has two main research questions: what are the variables that affect the user perspective and mobile application characteristics of the smart healthcare service application? How do user perspective and mobile application characteristics affect smart healthcare service applications? The research is expected to offer important insights into the acceptance behavior of mobile applications of smart healthcare service to maximize the application in society, especially health service users.

II. Research Method

The research is an analytic observational study, which looks for the relationship between variables by analyzing the collected data through hypothesis testing. The relationship between variables is cause and effect so that independent and dependent variables are determined. Based on these variables, the research looks for how much the influences of the independent variables are on the dependent variables [20].

Fig. 1. Research stages.

A. Statistics and Research

In statistics, hypotheses can be interpreted as statistical statements about population parameters. Statistics are the measures assigned to the sample, and parameters are the measures to the population. It can be concluded that the hypothesis is an estimate of the population parameters through sample data. There are two kinds of hypotheses in statistics and research, namely the null hypothesis and the alternative hypothesis. The null hypothesis is the absence of a difference between the parameters and statistics. So, the hypothesis tested is the null hypothesis. Furthermore, the alternative hypothesis shows a difference between the parameters and statistics [21].

In the formulation of statistical hypotheses, the null hypothesis (H_0) and the alternative hypothesis (H_a) are always paired. If one is rejected, the other must be accepted to make a firm decision. Hence, if H_0 is rejected, H_a is accepted. Statistical hypotheses are expressed through symbols [21].

B. Research Stage

There are five stages of research: literature review, data collection, variable determination, proposed research model, and analysis of smart healthcare applications. The five stages in the research are shown in Fig. 1.

The first stage is a literature review. It includes exploring software testing theory, developing mobile applications, and testing user acceptance and perspective. The second stage is collecting data through an online survey. The target respondents are users of smart healthcare service applications, SpeedId and SpeedQ. There are two groups of given questions. The first group consists of the respondent's socio-demographics, such as gender, age, and education. The second group of questions is about using smart healthcare service applications. The questions consist of the duration of using the application, ease of use, brand of the used device, network availability, interface accessibility, response time, responsiveness, and information validity.

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TABLE I
DEMOGRAPHIC INFORMATION OF THE RESPONDENTS.

Characteristics	N	%
Age		
18–23 years old	31	48.4
24–30 years old	4	6.3
31–39 years old	12	18.8
40–55 years old	14	21.9
> 55 years old	3	4.6
Gender		
Male	42	65.6
Female	22	34.4
Education		
Senior High School	31	48.4
Higher Education	33	51.6

TABLE II
RESEARCH VARIABLES.

Variable (Code)	Description	Reference
Duration (DR)	Users' duration of using the application	[11]
Ease of Use (EU)	Users' ease of use application	[11]
Operating System (OS)	Users' mobile device operating system	[11]
Response Time (RT)	The response time of the application when accessed by users	[12]
Responsiveness (RS)	The adaptation of the layout of the application in users' device screens	[12]
Interface Accessibility (IA)	Users' access to application interfaces, such as touch screen or using stylus and keypad	[13]
Network Availability (NA)	Internet networks used when using the application, such as Wi-Fi and mobile data	[11]

There are 64 obtained respondents. The demographic information of the respondents is shown in Table I.

The third stage is the determination of the variables in the research. Based on the literature review conducted, the variables that affect user acceptance and characteristics of mobile applications have been determined. There are seven variables: duration, ease of use, operating system, response time, responsiveness, interface accessibility, and network availability. Table II provides the detail of the variables and their references.

C. Proposed Research Model

Based on the variables that have been determined, a research model is proposed. The evaluation of the mobile application characteristics includes the operating system and network availability as independent variables and response time, responsiveness, and interface accessibility as dependent variables. Meanwhile, the evaluation of the user perspective uses respondents' socio-demography (gender and education) as independent variables and duration and ease of use as the dependent variables. The fourth stage is the proposed research model, as shown in Fig. 2. The proposed research model shows the concepts of the influence of operating system and network availability on response time, responsiveness, interface accessibility, and gender and education on duration and ease of use. In the fifth stage, the collected data are analyzed using a linear regression approach. Linear regression is used to examine the relationship between two or more variables.

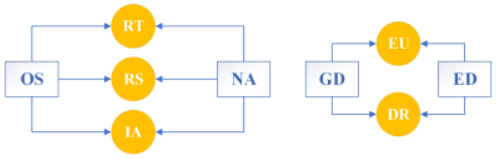

Fig. 2. Proposed research model. It shows Duration (DR), Ease of Use (EU), Operating System (OS), Response Time (RT), Responsiveness (RS), Interface Accessibility (IA), Network Availability (NA), Gender (GD), and Education (ED).

III. RESULTS AND DISCUSSION

A. Respondents' Characteristics

Based on the respondents' demographic information presented in Table I, it shows that the age of the respondents is dominated by 18-23 years old, with a total of 31 users or 48.4%. Then, most respondents are male, with 42 respondents or 65.6%. Meanwhile, the number of respondents based on education is fairly even, consisting of 31 respondents with senior high school or 48.4% and 33 respondents with higher education or 51.6%. Based on previous studies, moderator analysis confirms that age influences the habitual use of mobile devices and mobile applications [22, 23].

B. Descriptive Statistics

A summary of descriptive statistics is presented in Table III. Responding to questions about the duration of using smart healthcare service applications, SpeedId and SpeedQ, the results show that 78.1% of the respondents use the application for less than six months, followed by six months to one year with 17.2% and more than one year with 4.7%. Then, for the ease-of-use question, around 54.7% of the respondents agree that it is quite easy to use the smart healthcare service application. However, 43.8% of the respondent's state that it is very easy, and 1.6% of the respondents answer less easy.

In the brand of mobile devices, the research groups it into iOS, Android, and other mobile device platforms.

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TABLE III
SUMMARY OF DESCRIPTIVE STATISTICS.

Questions	N	%
Users' duration using the application		
< 6 months	50	78.1
6 Months–1 Year	11	17.2
> 1 Year	3	4.7
Users' ease of using the application		
Very	28	43.8
Quite	35	54.7
Less	1	1.6
Users' mobile device operating system		
iOS	12	18.8
Android	48	75
Others	4	6.3
The response time of the application when accessed by users		
Very	24	37.5
Quite	33	51.6
Less	7	10.9
The adaption of the layout of the application in the users' device screens		
Yes	59	92.2
No	5	7.8
Users' access to application interfaces		
Touch Screen	62	96.9
Stylus	1	1.6
External Keypad	1	1.6
Internet networks used when using an application		
Wi-Fi	8	12.5
Mobile Data	13	20.3
Wi-Fi and Mobile Data	43	67.2

The highest percentage is 75% with the Android operating system. The result is followed by 18.8% of iOS and 6.3% of other platforms.

The results about network availability show that 67.2% of respondents use Wi-Fi and mobile data. Meanwhile, 20.3% of respondents only use mobile data, and 12.5% only use Wi-Fi. Next, regarding the response time of the application when accessed by users, 51.6% of respondents answer quite responsive. Moreover, 37.5% of respondents state that it is very responsive, and 10.9% mention less responsive.

Moreover, in the application's appearance according to the users' screen, the highest percentage is 92.2% stating responsive. Around 7.8% agree that it is not responsive. Moreover, in users' access to the application interface, the results show that 96.9% of respondents touch the screen of a mobile device. Only 1.6% of respondents use a stylus and an external keyboard.

C. Mobile Application Characteristics

In analyzing mobile application characteristics, operating system and network availability are independent variables, while response time, responsiveness, and interface accessibility are dependent variables. Several statistical tests are conducted to see the effect of a variable on another variable.

TABLE IV
TEST RESULT ON OPERATING SYSTEM AND NETWORK AVAILABILITY.

Variables	P-Value
Response Time on Operating System	0.7305
Responsiveness on Operating System	0.5550
Interface Accessibility on Operating System	0.5654
Response Time on Network Availability	0.8082
Responsiveness on Network Availability	0.8462
Interface Accessibility on Network Availability	0.3798

The alpha (α) value (level of significance) used in the statistical test is 0.05. The p-value is compared with the level of significance or alpha value in the research. If the p-value is bigger than the alpha value, H_0 is accepted, and H_a is rejected. Meanwhile, if the p-value is smaller than the alpha value, H_0 is rejected, and H_a is accepted. H_0 is not significant, but H_a is significant [21]. The results are shown in Table IV.

First, statistical tests are carried out to see the effect of the operating system. The response time has a p-value of 0.7305. The p-value is more significant than the alpha value. Thus, H_0 is accepted, and H_a is rejected. It implies that, statistically, the response time does not significantly impact the users' mobile device operating system.

Furthermore, the responsiveness has a p-value of 0.5550. The value is bigger than the alpha value. So, H_0 is accepted, and H_a is rejected. Statistically, the responsiveness also does not have a significant effect on the users' mobile device operating system.

Similarly, the interface accessibility variable has a p-value of 0.5654. The p-value is also greater than the alpha value. Thus, H_0 is accepted, and H_a is rejected. It means that, statistically, the interface accessibility variable does not significantly influence the users' mobile device operating system.

The second statistical test is carried out to see the effect of network availability. The response time has a p-value of 0.8082. The p-value is more significant than the alpha value. So, H_0 is accepted, and H_a is rejected. It shows that, statistically, the response time variable does not have a significant impact on the users' network availability.

Similarly, the responsiveness variable has a p-value of 0.8462. The value is bigger than the alpha value. So, H_0 is accepted, and H_a is rejected. Statistically, the responsiveness variable does not have a significant impact on the users' network availability. The last variable is interface accessibility, with a p-value of

0.3798. As the p-value is greater than the alpha value, H_0 is accepted, and H_a is rejected. Statistically, the interface accessibility variable also does not have a significant impact on the users' network availability.

The test results show that all dependent variables, response time, responsiveness, and interface accessibility, have no significant effect on the users' operating system in mobile device and network availability. It shows that the smart healthcare service mobile applications, SpeedId and SpeedQ, can run well on various operating system platforms. Likewise, the applications can be accessed via Wi-Fi or mobile data in network availability.

D. User Perspective

The user perspective analysis has gender and education as independent variables and duration and ease of use as dependent variables. Similar to the statistical test the analysis of mobile application characteristics, the level of significance or alpha value used is 0.05. The p-value is compared with the level of significance or alpha value. If the p-value is more significant than the alpha value, H_0 is accepted, and H_a is rejected. Meanwhile, if the p-value is smaller than the alpha value, H_0 is rejected, and H_a is accepted. H_0 is not significant, but H_a is significant [21]. Table V shows the results of the statistical test.

The duration variable has a p-value of 0.0174. The p-value is smaller than the alpha value. Thus, H_0 is rejected, and H_a is accepted. Statistically, the duration of application use has a significant impact on gender. However, the ease of use has a p-value of 0.1538. The p-value is bigger than the alpha value. Thus, H_0 is accepted, and H_a is rejected. It shows that statistically, the ease of use of the application does not have a significant impact on gender.

Next, duration has a p-value of 0.0497. The p-value is smaller than the alpha value. So, H_0 is rejected, and H_a is accepted. Statistically, the duration of application use has a significant impact on the level of education. Likewise, the ease of use has a p-value of 0.0016. The p-value is also smaller than the alpha value. Thus, H_0 is rejected, and H_a is accepted. Statistically, the ease of use of the application has a significant impact on the level of education.

The test results on the user perspective show that the ease of use does not significantly affect gender but affects users' level of education significantly. In contrast to users' duration of using the application, this variable significantly affects gender and level of education. It means that the users' experience and habits affect the ease of use of the application.

TABLE V
TEST RESULTS ON GENDER AND EDUCATION.

Variables	P-Value
Duration on Gender	0.0174
Ease of Use on Gender	0.1538
Duration on Education	0.0497
Ease of Use on Education	0.0016

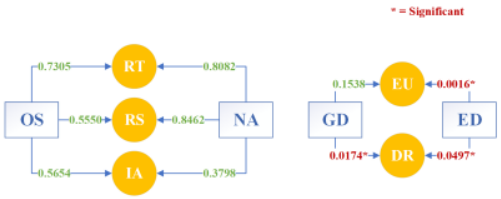

Fig. 3. Summary of the research model. It shows Duration (DR), Ease of Use (EU), Operating System (OS), Response Time (RT), Responsiveness (RS), Interface Accessibility (IA), Network Availability (NA), Gender (GD), and Education (ED).

E. Summary of the Results

A summary of the research model is shown in Fig 3. From the mobile application characteristics, the results show that operating system and network availability do not significantly affect application response time, application adaptation to the user's mobile device screen, and user accessibility on mobile applications of smart healthcare service. Meanwhile, the results reveal that gender only affects the users' duration of using the application significantly from the user perspective. Then, the education level significantly affects the users' duration of using the application and the ease of use. The research can provide important insights into the acceptance behavior of smart healthcare service mobile applications to maximize the application in society, especially health service users.

IV. CONCLUSION

The research analyzes the variables that affect the use of mobile applications of smart healthcare service based on the user perspective and mobile application characteristics. Seven variables have been determined: duration, ease of use, operating system, response time, responsiveness, interface accessibility, and network availability. The evaluation of the mobile application characteristics shows that response time, responsiveness, and interface accessibility have no significant effect on the operating system and network availability. It means that the smart healthcare service mobile application can run well on various operating systems and can be accessed via Wi-Fi network or mobile data.

From the user perspective, the results reveal that gender only significantly affects the users' duration of

using the application. Meanwhile, the education level significantly affects the users' duration of using the application and ease of use. The results imply that only the user perspective significantly affects the use of the application.

Although the research has provided important findings on the acceptance behavior of smart healthcare service mobile applications, some limitations can be overcome in future work. The research limitation is the small size of the respondents. It has an impact on the statistical significance of a regression coefficient of a variable. Future research can use more samples and investigate other variables from the user perspective, such as age and domicile, and compare it with this research result.

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