Implementation of Usability Testing in Measuring the Effectiveness and Efficiency of Mobile Application

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Abstract: The KPN PNB has developed a mobile-based application for its members who handle transactions in cooperatives. The mobile application released since 2021 is targeting 520 members. The KPN PNB Mobile application is currently in the acceptance test stage so it is necessary to evaluate usability to ensure the application has been able to meet user needs. Usability evaluation will be carried out using the usability testing method to find out how effective and efficient the application is. Usability testing was carried out by 10 respondents by completing 4 tasks. Usability testing on the aspect of effectiveness, obtained a success rate of 83.75 percent with a very effective level of achievement category. Usability testing user on the efficiency aspect is shown by the average Time-based efficiency of 0.0181 goals per second. When compared with the TBE expert's time of 0.0466 goals per second, the respondent takes 0.38 times longer to complete the task compared to the expert. The results of this usability test indicate that the application already has a good level of usability effectiveness in its use, and respondents are able to complete tasks efficiently in using the application.

1 INTRODUCTION

Indonesian Digital Report 2022 (hootsuite We are Social, 2022) states that the use of mobile phones increased by 3.6 percent during the period January-December 2021. The use of mobile phones to support various activities is increasingly popular in all circles. By using a mobile phone everyone can communicate with anyone and anywhere very quickly. They can complete homework, school, to the office using only one device. Even now mobile phone not only serves as a communication tool but also used as a medium to develop a business. The data shows 94.1 percent of the total internet users in Indonesia. access the internet via a mobile phone. Various needs are met from internet access via mobile phones including accessing information, using social media, conducting online learning, to running business activities. The increase in the use of mobile phones has triggered many emerging mobile-based applications that are designed to meet the needs of its users. There is an increase of 16 percent in

downloading mobile-based applications throughout 2021. This shows that mobile applications are getting special attention and experiencing rapid growth. Business people are forced to keep up with current mobile-based technology developments, as evidenced by the many emerging mobile applications that provide solutions for various needs. In its implementation, mobile applications must be designed attractively so that they will be effective, efficient, and satisfying when used by users (Hashim, Abubakar, & Hussain, 2019). However, there are still many mobile applications on the market that are difficult to use and learn due to low usability (Ali, Ouda, & Capretz, 2020).

Technological developments require all parties to digitally transform their business processes (Hariyanti, Sanjaya, , Sutawinaya, & Sudhana, 2021). The Bali State Polytechnic Civil Servant Cooperative organization (KPN PNB) whose members consist of employees in the PNB agency environment, have utilized information technology to support their business processes. The Bali State Polytechnic Civil

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Servant Cooperative has developed the Mobile Application with the aim of responding to various digital transformation challenges that are currently developing. The Mobile application is an application developed by the Bali State Polytechnic KPN in collaboration with Bank BPD Bali, to make it easier for members to get various services from KPN PNB. With this application, members can make transfers between members, transfer to and from various other national banks, apply for loans, find out the history of savings and loans, open deposits, pay various bills, top up e-money and view member voucher balances. For security, this application has been equipped with biometric technology with fingerprint login. The Mobile application, which was launched in August 2021, can not only be used by 520 PNB KPN members, but also targets all students of Bali State Polytechnic. Through this application, the entire PNB family is expected to be able to use the cooperative's services to get a variety of very up-to-date features, and make it easier for them to make various payment transactions on campus. The Mobile application is relatively new to use in the campus environment.
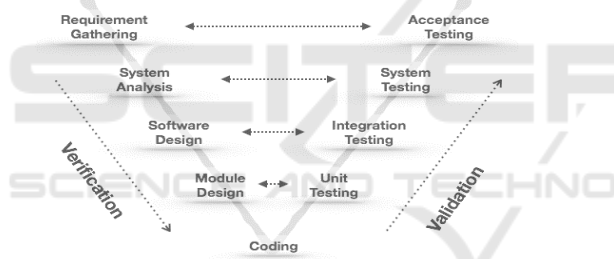

Figure 1: V Model Software development life cycle.

Seeing the lack of use of the mobile application, because KPN members do not understand the use of the application, the level of trust in the reliability of the application, and there are still some errors that occur so it is necessary to carry out an evaluation. Based on Figure 1 (Kharchenko, Kovalenko, Siora, & Andra, 2018) where the final stage of development is to carry out acceptance testing to find out whether the application meets the needs of its users. The Mobile application is at the acceptance testing stage to find out whether the application is able to meet user needs and can be accepted for use in supporting transaction activities in cooperatives. In an effort to increase application use and future development, measuring the usability aspect of mobile applications is important and essential in order to capture the efficiency, effectiveness and accuracy of the interface (Hashim & Adamu, 2017). Likewise, with the Mobile application, because this is related to providing trust

and satisfaction to cooperative members with the service facilities provided. Usability evaluation on mobile applications, especially in applications related to financial transactions, needs to be carried out with the appropriate criteria dimensions, so that it is known whether the application can be used effectively, efficiently and fulfils the satisfaction and trust of its users (Liao & Ho , 2021). In addition, the lack of usability can be a major barrier in the process of adopting mobile application technology (Islam, Islam, & Mazumder, 2019). In this study, usability evaluation of the mobile application will be carried out using the usability testing method to determine how effective and efficient the use of the Mobile application is.

2 LITERATURE REVIEW

2.1 Usability Evaluation

Evaluation is a planning process, obtaining measurement values resulting from a series of work that has been done in an effort to provide information that is used for other options. the information can be used as a guide in making better decisions. Usefulness comes from the word usable which means good use. A good application can minimize failure and can provide satisfaction and benefits for its users. Usability evaluation is an evaluation conducted to find out about the ease of using something that describes how effectively users interact with a product.

According to (Maguire, 2011) usability is the main key that determines the success of an application system. Usability is also a characteristic of product quality where the sub-characteristics consist of the ability for appropriate recognizability, ease of learning (learnability), ease of operation (operability), protection against user error (user error protection), the beauty of the interface (user interface aesthetics), and accessibility (ISO/IEC 25010, 2011). A system that is not well designed and not easy to use will make it difficult for users to learn and operate. This will result in the system being used infrequently or incorrectly so that the costs that must be borne by the system user organization become high. it also threatens the reputation of the company that developed the system (Maguire, 2011) The importance of usability shows that usability evaluation is an important process in the development stage to produce a good system. Inspection methods involve usability experts to find usability problems by following clues, heuristics, or tracing. Meanwhile,

through the testing method, usability problems are found by observing users when using the product or system (Neilsen, 1993).

According to (Dumas & Redish, 1999) usability is a measurement method for user experience when using system products (software, websites, and mobile phones). Usability can refer to how users experience when using a product and their level of satisfaction with the product. According to (Neilsen, 1993), usability is the experience of interacting with the application so that users can use the application quickly even though the user is still in the new user category. The usability of the system can be identified by the ease with which users perform their tasks. According to (Neilsen, 1993) in measuring the usability level, there are five main measures, namely:

- Learnability is defined as the speed at which the user can use the system and the ease of use in the performance of a function and the desire of the user.
- Efficiency can be interpreted as a resource instrument that has a function to achieve better goals.
- Memorability is defined as user testing to remember using the application for a certain period of time.
- Errors and security can be defined how many problems are caused by users, errors that contain inconsistencies with what users expect from the system.
- Satisfaction can be defined as freedom of expression in using the application as well as user comfort in using the application as well as a subjective measure of the user's view of the system.

Usability according to ISO 9241 is a measure of the extent to which a product can be used correctly by certain users to achieve certain goals with effectiveness, efficiency, and satisfaction. Usability measurement needs to consider several things, namely as follows:

- Optimum, is considering the advantages and disadvantages of the current analysis.
- Effective, which relates to the ease and speed of users in completing the tasks given by the researcher properly and correctly.
- Satisfaction, is freedom of expression on the application or product that is being used.

In this study, we will conduct tests to determine the success of the KPN PNB Mobile application for users by focusing on the effectiveness and efficiency of its use

2.2 Usability Testing

Usability testing is a method used to evaluate the user experience of a product, whether on a website or application. Usability testing is one way to find out whether the user can easily use the application, how efficiently and effectively an application can help the user achieve its goals and whether the user is satisfied with the application used. Usability testing is divided into three methods, the first is expert-based testing, which is a test that requires expert system and interface developers who have been involved since planning the application by using a structured method to look for deficiencies that exist in the application being tested. The second is user-based testing, which in this test involves application users to complete the tasks given by the testers. While the third is Automatic testing; automated testing can be carried out with the software. On the device used apply guidelines to an interface and then can be taken into consideration as a comparison.

Usability testing method is done by testing a product directly to its users. Usability Testing aims to find out the experience from the user's point of view in a real way by looking directly and directly into the field of seeing the process when the user is using the application being tested. Usability testing is task-oriented, meaning that the user receives a set of pre-defined tasks to work on (A, M, & Alomar, 2017). Usability testing will carry out a more in-depth analysis of the application or system by testing the application used by the user. In the process, the user will complete a predetermined series of jobs. Then direct observations will be made to the user by seeing whether the user can be successful in completing the given task. The test will observe the time it takes the user to complete the given task. In addition, the examiner also asked questions about the opinions of application users.

The steps needed to carry out usability testing include:

- Determination of Respondents. In data collection, respondents are required to perform usability testing. Determination of respondents is done to determine which users will participate in conducting the test. In this research, 10 users of KPN PNB Mobile will be selected as respondents in conducting usability testing. The ten users consist of five new users and five active users.
- Determination of Task Scenario. A task scenario is a set of tasks that are determined by the examiner and must be carried out by the usability testing respondent. This task covers

the usability and superior features of the KPN PNB Mobile application. The task scenario consists of four tasks as shown in the table.

Table 1: Task Scenario Usability Testing.

No	Task scenario
1	Login to the application
2	Do a mutation check on the savings
3	Make a transfer to your virtual account
4	Do a loan simulation

▪ Implementation of Usability Testing. After the respondent and task scenario are determined, the next step is the implementation of usability testing. Testing will be carried out one by one to the respondents so that the examiners can perform maximum analysis in finding usability problems in KPN PNB Mobile. In the implementation of usability testing, all activities will be recorded including screen recording on the respondent's mobile device.

▪ Usability testing data processing. When conducting usability testing, observation and data recording are carried out to analyse the effectiveness and efficiency aspects. The data recorded is the success in completing the task and the time required to complete the task. The data will be analysed with Calculations and data analysis.

2.2.1 Effectiveness

The level of effectiveness will be analyzed based on the level of user success in completing each task given in usability testing. In this study, the calculation of success rate is used to measure the usability testing component. The success rate is used to determine the user's understanding of the user interface and the success of the user in completing operations based on previously prepared tasks. In the calculation of the success rate using the abbreviation S indicates the abbreviation of success is given for each time the respondent can complete the task. When the respondent makes a mistake while doing the assigned task, it will be given a PS statement or the abbreviation for partial success.

$$SR = ((S + (PS \; x \; 0.5))/T) \; x100\% \qquad (1)$$

Where SR = Success Rate; S = Success (Task Successfully Done); PS = Partial Success; T = Number of Tasks

After obtaining the results from the SR calculation, then the results will be interpreted into

the level of effectiveness with range Very Ineffective (less than 40 percent) to Very effective (more than 80 percent).

2.2.2 Efficiency

The efficiency level will be analysed based on the completion time of each task in usability testing. And here are the parameters used to analyse:

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

3 IMPLEMENTATIONS

The evaluation of the Mobile application testing implemented the usability testing method which was carried out by 10 respondents as application users. Respondents were 10 people consisting of 5 active users and 5 inactive users. Determining respondents based on transaction data made by application users, taken the top 5 and bottom 5 from 40 data users, sorted by the number of activities taken from the application system database. Usability testing was tested on 10 respondents to get user experience data when accessing application features. The feature being tested is the daily transaction feature that users make on the mobile banking application. Based on the results of scenario testing for the four tasks, an effectiveness analysis will be carried out based on the user's level of success in completing the given task to obtain a success rate calculation. While the efficiency analysis is obtained by calculating time-based efficiency. The results of these two components are used as an analysis to determine the usability level of the Mobile application.

3.1 Effectiveness

The respondent data obtained, which has been described in Table 1 is the result of all respondents having completed the assigned tasks as many as four tasks that must be done.

Based on the measurement results using equation (1), the success rate is 83.75 percent with the level of achievement being very effective. This shows that the mobile application has been effective in terms of its use and has a good usability effectiveness level. When testing is carried out, users can indeed perform the tasks that have been prepared, although there are several obstacles, including adjustments to the application interface, especially for users who rarely

use it. However, the user has sufficient time to get to know the interface and complete the given task.

Table 2: Data success rate.

No	Name	Task1	Task2	Task3	Task4
1	PM1	S	S	PS	PS
2	PM2	S	S	S	S
3	PM3	S	S	PS	PS
4	PM4	S	S	PS	S
5	PM5	S	S	S	S
6	DM1	S	S	PS	PS
7	DM2	S	S	S	S
8	DM3	S	S	PS	PS
9	DM4	S	S	PS	PS
10	DM5	S	S	PS	PS

When tested, the user was able to perform the specified task although there were some obstacles which were mostly due to adjustments to the application interface. However, the user has sufficient time to get to know the interface and complete the given task (Lazar, Feng, & Hochheiser, 2017) From the Usability Survey it was found that most of the participants found problems on tasks 3 and 4 which were marked by partial success. Task 3 is to make a transfer to the BPD account virtual account. In task 3, the difficulty they faced was forgetting the virtual account number from the BPD bank. They were forced to fail the task because they had to look for information from other menus. As for task 4 in the form of doing credit simulations, they block the credit time limit. Users do not understand that there are KPN rules, the longest loan limit is when the employee retires.

3.2 Efficiency

The efficiency level will be analyzed based on the completion time of each task in usability testing. The parameter used to analyze the efficiency is Time-based efficiency, which is the testing phase used to obtain how much time is used and the success of the respondents in completing the tasks that have been given. The success value obtained from the successful completion of the task is worth one. For respondents who can only complete several tasks, a success value of 0.5 is given and for those who cannot complete the task at all, a score of zero is given. The processing time is obtained from scenario testing on respondents.

Initial testing will be carried out by experts who are responsible for the creation and management of the application. The testing time of the expert is used as a basic benchmark for the normal time of the respondent to do the tasks given by the author. The

time of the test results carried out by the expert is obtained by running a timer when the expert starts doing the task and stops the timer when the expert finishes doing the task. The test carried out by the expert gets a success score of one because it can complete all the tasks that have been prepared in the usability scenario. The next test scenario will be tested on the ten respondents The results of the data testing shown in Figure 2.
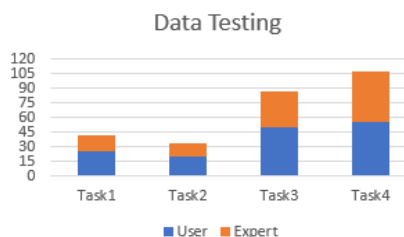

Figure 2: Data testing.

Based on equation (1) the results of TBE expert are 0.0466 goals per second. TBE expert will be the reference, where the maximum time by the user to complete the task is (Shneiderman & Plaisant, 2017) three times the expert time that has been obtained. After getting the calculation of the average results of the TBE expert, calculation also done for data respondents. Based on the data test, then time-based efficiency is calculated along with the average for the respondents. The results of the time-based efficiency calculated using equation (2) for the usability scenario test of the expert and respondents are listed in Figure 3.

Figure 3: Time-based Efficiency.

Based on calculation using equation (2), the time-based efficiency values expert is task 1 of 0.0625 goals per second, task 2 of 0.0769 goals per second, task 3 of 0.0278 goals per second, task 4 of 0.0192 goals per second. TBE users for the four tasks are generated, namely for task 1 of 0.0101 goals per second, for task 2 of 0.0128 goals per second, for task 3 of 0.0051 goals per second and for task 4 of 0.0046 goals per second. From the four TBE calculations,

the average user TBE is 0.0181 goals per second. And the expert's time of 0.0467 goals per second.

When tested, the user's speed in using the application and focusing on the features of the existing application is still said to be normal and the error rate made is also in the reasonable category (Hussain, Mkpojiogu, Jamaludin, & Somia, 2017) The results obtained are normal and the user gets enough time to understand the location and function of the features contained in the KPN PNB Mobile application so that it does not take too long when completing the given task. When compared to the user's time, the number is 0.38 times longer than the respondent in completing the task compared to the expert, which is still in the reasonable category (Hashim & Adamu, 2017).

4 CONCLUSIONS

Usability testing on the effectiveness analysis of the success rate of using the KPN PNB Mobile application, obtained a success rate of 83.75% with the category of the level of achievement being very effective, which indicates that the KPN PNB Mobile application already has a good usability effectiveness level in its use.

Usability testing on efficiency analysis of the level of task completion in using the KPN PNB Mobile application obtained time-based efficiency for task 1 of 0.0101 goals per second, for task 2 of 0.0128 goals per second, for task 3 of 0.0051 goals per second and for task 4 of 0.0046 goals per second. the average TBE of users is 0.0181 goals per second. When compared with the TBE expert time of 0.0466, it is obtained that the number is 0.38 times longer for the respondents in completing the task compared to the expert. This means that respondents are quite fast and able to complete tasks in using the KPN PNB Mobile application.

From the research conducted, it can be concluded that the usability level of the application is quite good. Based on data from task scenarios, many application users encounter difficulties when making inter-bank transfers and credit simulations. Suggestions that can be given are the need for additional transaction facilities, for example in the form of a QRIS facility, so that users can make transactions more easily. Users also have not been able to optimize the use of mobile applications outside of the tasks given, especially for new users. This can be overcome by continuing to provide socialization to users which can be done regularly and also providing access to user manual documents for new users. Meanwhile, the user's

speed in using the application and access to existing application features is still normal and the error rate made is also in the reasonable category. To expand the use of the application, it is necessary to develop the IOS version so that it can reach more users.

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