

Integrating Heuristic Evaluation and Cognitive Walkthrough in Usability Evaluation of Mobile Application

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Abstract

This study aims to present the usability evaluation of mobile applications. The growth of mobile applications has been spread to any type of digital activities, especially for paying bills or ordering things. Unfortunately, the lack of interaction design of the application makes the application not easy to use and learn. This study proposed a combination of two usability evaluation methods which are heuristic evaluation and cognitive walkthrough. Myindihome is an application that will be studied to present this evaluation. Those selected methods is employed to evaluate based on the 10's Nielsen heuristic principle and the Cognitive of the evaluator during the group determination. The heuristic evaluation and cognitive walkthrough are evaluated by 3 experts or evaluators. The result of the heuristic evaluation revealed 3 major issues and 6 minor issues. Whereas the cognitive walkthrough determination revealed that 1 critical main menu needs to be re-designed. Thus, the interaction design of the application in some parts is not easy to learn and not efficient. It is expected this study can be adopted by mobile developers to produce an ease-of-learn and efficient application.

Keywords: Cognitive walkthrough; Heuristic Evaluation; Human-Computer Interaction; Mobile Evaluation; Usability Testing;

1. Introduction

The mainstay of Human-Computer Interaction (HCI) is the experimental evaluation of user interfaces by conducting user testing with several users and task scenarios. In contrast with other types of software testing, usability testing involves user participation to assess the quality of the application[1] [2]. Nowadays, the growth of mobile applications has entirely transformed the way people check and pay bills including paying internet, electricity or any other digital payment. Myindihome is one of the internet providers in Indonesia that have 8,6 million users in 2024 [3].

The growth of mobile applications especially telecommunication applications has become popular to be used daily to check and pay bills. As A lot of similar telecommunication applications have been introduced to users, it will increase the company's competitiveness to produce a good quality of mobile application. However, the lower quality of applications produced by the company will become less satisfactory from the user's perspective.

Many kinds of research have been studied by combining heuristic evaluation and cognitive walkthrough [4], but few research that studied telecommunication applications. The previous study about telecommunication applications which is Myindihome has been studied by applying a system usability scale (SUS) and USE questionnaire to evaluate the application. In 2021 [5], Hidayat et.al evaluated about MyIndihome application by conducting USE Questionnaire by measuring Usefulness, Ease of Use, Ease of Learning and User Satisfaction. In addition, A single method of heuristic evaluation has been applied to assess the application and results achieved the lowest score [6]. Moreover, all the previous researchers stated the application is below standard or poor quality design.

In contrast, this research is combining two usability evaluation methods which are heuristic evaluation and cognitive walkthrough to evaluate Myindihome application. The test is conducted by 3 evaluator which are expert in usability testing. Furthermore, the bugs found in the application will be analysed to provide solution and recommendation to improve the application. As the result, the feedbacks given will increase and satisfy user during experiencing the application.

2. Literature Study

Heuristic evaluation is a method for finding interface design errors in inefficient parts [7], [8]. Heuristic evaluation provides an assessment when examining the interface and determining whether it conforms to what is recognized by the usability principle ("heuristic") [9][10]. The 10 Heuristic criteria according to Nielsen are as follows [11]: (1) Visibility of System Status: The system should provide clear feedback to the user about what is happening, for example by providing process or status indicators when operations are running. (2) Match between System and the Real World: The interface should use terms, conventions, and concepts that are familiar to the user. Following the user's logic and using easy-to-understand language aids more intuitive use. (3) User Control and Freedom: The user should have control and

freedom in exploring and abandoning an incorrect or unwanted action. Cancellation and redo options should be available to reduce errors. (4) Consistency and Standards: The interface should be consistent in terms of terminology, appearance, and behaviour with established standards. Consistency helps users understand and predict expected actions. (5) Error Prevention: The system should be designed to prevent as many errors as possible through clear design, removal of confusing elements, and use of confirmation before irreversible actions. (6) Recognition rather than Recall: The interface should minimize the burden on the user's memory by providing information that is clear, visible, and easily accessible. Users should be given hints and help when needed. (7) Flexibility and Efficiency of Use: The interface should be designed to support users with varying levels of expertise. Trained users should be able to speed up actions through shortcuts or direct access to features. (8) Aesthetic and Minimalist Design: The interface should have a visually appealing appearance and use a minimalist design. Avoiding unnecessary elements and reducing clutter helps the user focus on the main task. (9) Help Users Recognize, Diagnose, and Recover from Errors: When errors occur, the system should provide clear messages, explain the cause, and provide solutions for recovery. Error messages should be easy for users to understand. (10) Help and Documentation: If needed, the system should provide clear and easily accessible help and documentation. Relevant information should be available to assist users in solving problems or understanding deeper concepts.

These Nielsen heuristics have become important guidelines in evaluating the usability of user interfaces. They can be used by researchers, designers, and developers to identify problems and improve usability in application or system development.

Cognitive walkthrough is the method of usability testing by paying attention to problems from the user's view as an aspect that is assessed from several task scenarios and a number of questions [9]. The cognitive walkthrough method leads to each step that must be done on the interface to receive a certain goal. In addition, Cognitive Walkthrough is a usability evaluation method developed by Jakob Nielsen and Robert L. Mack aims to evaluate user interfaces with a focus on users' understanding and their cognitive interaction with the system [10]. Cognitive Walkthrough is used to identify potential cognitive errors that users may experience when using the interface [12].

3. Research Methodology

In general, this research is experimental research that applies the qualitative result. The data gathered is based on the evaluation of the experts or evaluators. The recommendation given about the application based on observation by applying 10 Nielsen's heuristic evaluation and the knowledge of the evaluator.

Firstly, the research conducted a heuristic evaluation to find the issues in the application. The heuristic evaluation method is conducted by experts to identify usability issues by applying heuristic principles. Before proceeding with the test, the following steps should be prepared by; (1) Determining the Evaluator. The first step before testing is to determine the user. The user criteria can be described as (a) having knowledge, skills and familiarity with UI/UX; b2) Having experience in designing U.I/UX; (3) Having experience in creating usability projects; (2) Test Preparation. After getting the user test, prepare the test requirements. The author guides users on what to do during the test, the application to be tested, and a questionnaire using Nielsen's 10 heuristic criteria as test metrics. While the evaluator checks the overall user experience of the app, while testing the user finds an issue, it is recorded and the branch severity level is used to assess the severity of the issue. Heuristic severity has 5 levels, as shown in Table 1 below.

Table 1: Heuristic Severity Ranking

Scale	Definition	Interval Level
Cosmetic	No problem found in the system	1
Minor	If there is additional processing time, there is a problem and needs to be fixed	2
Medium	Some issues affect usability and require fixing	3
Major	There are usability issues that need to be resolved	4
Catastrophic	Requires repair or redesign	5

The issues found will be grouped to the severity rating called Nielsen Severity Rating Scale [13]. So that it will make easier to categorise according to the priority to fix the application.

Secondly, during cognitive walkthrough evaluation, the same evaluators are employed by forming a group discussion. Before conducted the group discussion, the major issues found during heuristic evaluation will used as task scenario. One the task scenario developed, the analysis question is also created.

For this research, the data is analysed by providing the result from heuristic evaluation and the conclusion of the cognitive meeting with 3 evaluators. The recommendation is also proposed to provide a good design of the application and achieve the learnability goal.

4. Result and Analysis

This section presents the results of usability inspection methods which are heuristic evaluation and cognitive walkthrough. Heuristic evaluation is conducted by following 10's heuristic principles. Three experts are responsible for evaluating the system based on the principles. Meanwhile, cognitive walkthrough is also evaluated by three evaluators that are responsible for assessing the learnability (ease of learning) of the user interface and identifying specific problems with the design. In this evaluation, users are not involved during testing. The results of the evaluation revealed several strengths and weaknesses of the application as detailed in this section.

A. Heuristic Evaluation Result

Heuristic evaluation is assessed individually by each evaluator or expert review in finding issues in the applications. This evaluation results are categorised into heuristic principles and put several rating of application. The recommendation from evaluators are also given in the finding report. The following tables briefly reviews the most vital usability problems found by 3 usability experts.

Table 2: Heuristic Evaluation Result

No	Issues	Heuristics	Severity	Recommendation
1	The profile account displayed is not common	Consistency and standard	Major	Should display the data consistently
2	The name of main menu “profile” displays “setting” menu	Match between system and the real world	Major	The name of menu “profile” should change to “setting” and change to appropriate icon
3	Have double profile menu with different sub-menu	Error prevention	Major	The name of menu should provide different name
4	The unknown notification always pop-up during application opened	Visibility of system status	Minor	The unknown notification should not appear many time while using the application
5	Unsuccessfully buying internet package cannot be deleted	Error prevention	Major	The unsuccessfully package should have delete button to remove from our profile
6	The feature “Top up” data is not working	Functionality	Minor	The application should be able to “top-up” data
7	The recommendation of product offered is disturbing the user visual	Flexibility and efficiency of use	Minor	Allow for customization
8	The recommendation of product offered is changing fastly	Flexibility and efficiency of use	Minor	It is better the recommendation product to be set static
9	The search engine for internet product offered takes time to load	Visibility of system status	Minor	The loading should be at least 5 second

Based on the table above, 3 evaluators have discovered 3 major issues and 6 minor issues. The evaluation of the application has been assessed by following 10 Nielsen’s heuristic evaluation principles [11]. The issues found during heuristic evaluation has been also ranked by following Nielsen Severity Rating Scale (SRS) [13].

B. Cognitive Walkthrough Results

Once all evaluators have been identified the heuristic issues, the next step is to prepare the group discussion among evaluators. In this cognitive walkthrough method, several task scenarios has been created. The design of the task scenario is based on the problem found during heuristic evaluation. The scenario can be seen in table 3 below.

Table 3: Task Scenarios

Task no	Goal	Task Scenario
Task1	User can successfully find user profile	User edit profile such choose the active package, as name, date of birth, gender and photo profile

The task scenario is discussed with 3 evaluators to get more details about user interface design issues. The issue is about the profile menu on the application as it is categorised as a major issue. During the walkthrough analysis, the evaluator team addressed 4 analysis questions as mentioned in the table below:

Table 4: Cognitive Walkthrough Result

Task	Analysis Question	Evaluators Determination
Task 1	Would users effort to achieve the right way to complete the task?	Yes: the users will definitely input the right information in profile to complete in profile information and choose active package to see bills and other data. Note: during the team discussion, the evaluators found 2 menu of profile that consist different submenu. It takes some times for user to find the intend action user took. The evaluator suggest to re-design menu profile according to the human-computer interaction standard.
	Would users the right steps is available?	No: the group discusses that the profile menu make user confused to choose as the application provide 2 profile menu in the upper left application and the another one is in the lower right of the application. It takes a cognitive effort to choose the intent task scenario. The evaluators agrees to simplify the application by researching more design of the profile menu or change the name of menu.

Will users associate the right step with the result they are attempt to achieve?	Yes: The users can fine the menu as it visually appears on the application, but it may take some times to. Choose the correct action.
After the right step is performed, will users see that progress is developed toward the goal?	Yes: the page the menu change and the user can choose the active package, change their profile and so on. All the menu well displayed.

According to a group discussion with three evaluators, there is one step that will have the wrong action of the user in completing the task scenario. The others will spend a lot of time to complete the right action. As a result, it suggested changing the menu profile by following the standard. Once the issue is solved, the user will easily learn the use of the application. it will be more efficient as the user does not need to spend much time in choosing the right action by increasing the level of learnability and efficiency, the satisfaction level of the application will also be elevated to the maximum.

5. Conclusion

This research has presented the main challenging issues found during heuristic evaluation and cognitive walkthrough. The major issues found are about the profile menu that has bad design and the naming of the menu. The issues found in heuristics are also discussed deeply during the cognitive walkthrough. the result of the team discussion is to provide a solution to improve the application in the context of design and user learnability.

Overall, the goals of this research are to evaluate the Myindihome application to find major and minor issues and also to measure the metric of learnability and efficiency. The result of the research the evaluators found issues in the design that make users take the wrong action at first and need to spend more time learning the application. Moreover, the current evaluation can be used by the developer to redesign, so that, the user can easily learn the application. Overall, this study is significant to other software developers to develop a good application that is easy to learn.

However, those issues required more testing in the aspects of real users to get the direct feedback. Experiencing the application may lead to other issues once the real user experience test in the formal laboratory. It is highly recommended to have many evaluators who are expert in UI/UX design. In addition, Evaluators that have cognitive knowledge about Human-Computer Interaction (HCI) are highly recommended to verify the result.

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