Usability Analysis on the Multitap ABC Standard Keypad and QWERTY Keypad on Mobile Phones based on Time, Errors and Satisfaction Scale

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ABSTRACT

The use of mobile phone keypads to exchange messages has become a daily activity at this time. Keypad is one of the most widely used input devices compared to other input devices. When typing on a cell phone, users will usually try to type correctly and quickly. The improvements of mobile phone products include a wide variety of physical designs. Keyboard or keypad is one part that does not escape the development. The keypad on the phone is an arrangement of keys containing numbers, letters of alphabet, punctuation marks and certain symbols that are needed. In general, there are two types of cell phone keypads on the market, namely the alphanumeric keypad on the Multitap ABC Standard keypad and the QWERTY keypad. Each type of keypad has a different arrangement of letters and different methods of use. With the development of variations in keypad designs, this study aims to compare the design of the Multitap ABC Standard keypad with the QWERTY keypad on Xiaomi cellphones in order to find usability problems based on time, error and satisfaction scale. The results showed that the usability of the QWERTY keypad is better than the standard ABC multitap keypad in terms of time and error. Based on the time to complete the task, the users completed the task faster using the QWERTY keypad compared to the Multitap ABC Standard keypad. Based on the error rate in completing the task, the users made less errors using the QWERTY keypad compared to the Multitap ABC Standard keypad. Based on the level of satisfaction in using the keypad type, there is no significant difference between two types of the keypads.
Keywords: Keypad, Cell phone, Multitap ABC Standard, QWERTY, Usability problems

Introduction

The rapid development of information technology has created new methods of inputting data such as keypads on mobile phones and touch screens. Technological developments also create new forms of long-distance communication like Short Message Service (SMS). According to Sandnes & Aubert, [5] SMS makes users more and more willing to use text software on mobile devices. The use of mobile phone keypads to exchange messages has become a daily activity at this time. Keypad is one of the most widely used input devices compared to other input devices. When typing on a cell phone, users will usually try to type correctly and quickly. Unlike, physical keyboards which allow users to type according to their long-term memory, virtual keyboards usually require more concentration to avoid typing errors.

The improvements of mobile phone products include a wide variety of physical designs. Keyboard or keypad is one part that does not escape the development. The keypad on the phone is an arrangement of keys containing numbers, letters of alphabet, punctuation marks and certain symbols that are needed. In general, there are two types of cell phone keypads on the market, namely the alphanumeric keypad on the Multitap ABC Standard keypad and the QWERTY keypad. Each type of keypad has a different arrangement of letters and different methods of use.

Usability comes from the word usable which generally means it can be used well. Something can be said to be useful if failures in its use can be eliminated or minimized and provide benefits and satisfaction to users [3]. According to the book "Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests" by Jeffrey Rubin and Dana Chisnell [4], there are five elements that are the main elements of usability, namely; 1) Usability; 2) Efficiency; 3) Effectiveness; 4) Satisfaction; and 5) Accessibility.

Several studies about keypad design on several devices have been carried out. Research conducted by Zulkarnaen [6] looked at the comparison between the QWERTY cell phone keypad and the Multitap ABC Standard keypad using the usability testing method. The results of the study, it was found that the Nokia 5130 keypad is the most usable alphanumeric keypad in terms of customer satisfaction. The QWERTY keypad is a type of keypad that is more usable in terms of efficiency in use in a conducive environment. Kim et al., [1] conducted a study on feedback display on a virtual keypad to reduce eye movements. This study compares a QWERTY keypad with 3 types of feedback, namely CBC (Character by character), Static WBW (Word by word) and Dynamic WBW. The results of this study found that the WBW QWERTY keypad provides better feedback because it makes users focus more on the virtual keypad when typing, reduces eye movements and increases typing speed.

To control the cell phone functions, keypad is directly related with human fingers as controller, so the usability aspect of the keypad is an important thing to consider. The use of the QWERTY keypad is considered more efficient and faster to type than the number keys commonly used on old cellphones. But sometimes there are some people who prefer to use classic buttons like in the old cellphones. For example, parents or people whose fingers are too big, making it difficult to press the buttons on the relatively small QWERTY keypad. With the development of variations in keypad designs, this study aims to compare the design of the Multitap ABC Standard keypad with the QWERTY keypad on Xiaomi cell phones in order to find usability problems based on time, error and satisfaction scale.

Methods

Subjects

The research subjects consist of cellphone users with a QWERTY keypad and cellphone users with a Multitap ABC Standard keypad. In general usability theory there are two types of system users, namely novice users and expert users. In this study, expert or experienced users were used to evaluate the attributes of usability related to efficiency of use, users' error rate, and users' satisfaction. Expert users are defined as mobile phone users who have used or currently using the keypad model that will be evaluated.

The criteria for the selected respondents were students at UGM, with ages between 20-25 years old. The way of selecting respondents was random sampling. The pilot study was conducted before selecting respondents to determine the respondent's typing speed level. Afterwards, there are 10 respondents consisting of 50% women and 50% men.

Devices

The device used in this study was Xiaomi Redmi Note 3 Pro mobile phone, meanwhile the keypad application used for typing was GO-Keyboard. A Samsung cellphone or an iPhone was used as a stopwatch to count the time during the usability test. Satisfaction was measured using a questionnaire with a Likert scale 1-5.
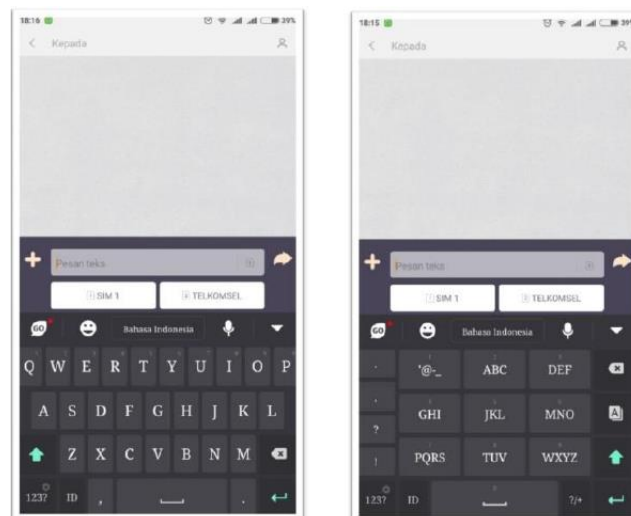

Fig.1 Display both types of keypad (left) QWERT keypad (right) multitap ABC standard keypad
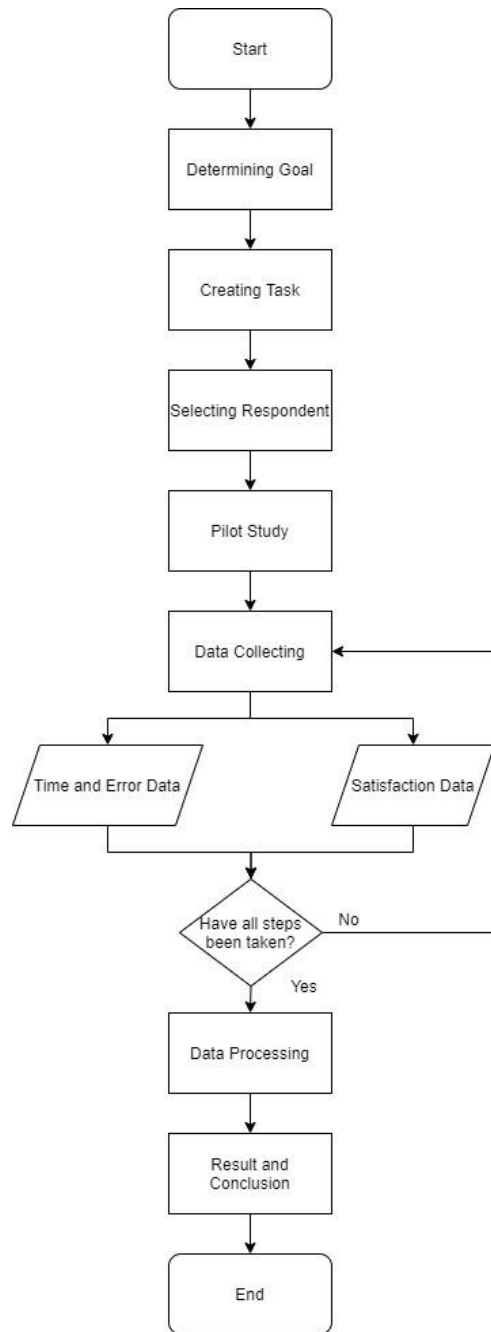
Research Flowchart

Fig.2 Research flowchart

Task Creation

The first step in this research was creating a task. This scenario was used to conduct a Pilot Study before data collection. The scenario consisted of text that the research subjects had to type using the Multitap ABC Standard keypad and a QWERTY keypad. The difficulty level of the text increases, as more and more variations of punctuation, numbers and letters need to be typed at the end of the text.

Pilot Study

A pilot study was conducted to evaluate the experimental design that had been prepared. The pilot study involved two representative respondents. The results of the pilot study that need to be evaluated including job scenarios, equipment and determination of the respondents. The results of this evaluation were then used as a basis for redesigning new research procedures without changing the substance of the research design that has been made previously.

Usability Testing

Jakob Nielsen (1994) defines usability as a measure of the quality of the user experience when interacting with a product or system, whether a website, software application, mobile technology, or other devices operated by the user. ISO 9241:11 (1998) defines usability as the degree to which a product can be used by certain users to achieve its goals more effectively, efficiently, and satisfactorily within the scope of its users.

Usability testing [2] usually involves measuring how well the research subject interacts with the product/interface with respect to:

a. Learnability: the system must be easy to learn so that users can use the system to complete the task
b. Efficiency: the system must be efficient to use so that users who have learning the system makes it possible to achieve productivity tall one.
c. Memorability: the system should be easy to remember so that general users can recall after a certain period of time without having to re-learn.
d. Errors: which discusses the handling of errors made by users in the operation of a system.
e. Satisfaction: the system should be fun to use so that users will feel satisfied and happy when they use it

Usability measurement was carried out to assess whether the interaction between the user and the application can run well. Measurements are carried out following the concept of user testing, with an emphasis on measurement and not testing, as follows:

1. Define goals and explore questions.
2. Choose a measurement paradigm and technique
3. Designing a task that will be a means of measurement.
4. Select participants who will be users to try the application.
5. Prepare measurement conditions.
6. Planning the course of measurement.
7. Conducting evaluation, analysis and presentation of data

Result and discussion

Time

Figure 3. Shows that the time to complete a task on the QWERTY keypad has a time of (±SE) 135.40 (±8.84) much shorter than the Multitap ABC Standard keypad with a time of (±SE) 375,10 (±23,19). The normality test showed that the data were normally distributed (p=0.849), so that statistical data analysis could be done with parametric test. The results of the Paired T-Test shows that there are significant differences between the two types of the keypads (p = 0.001)
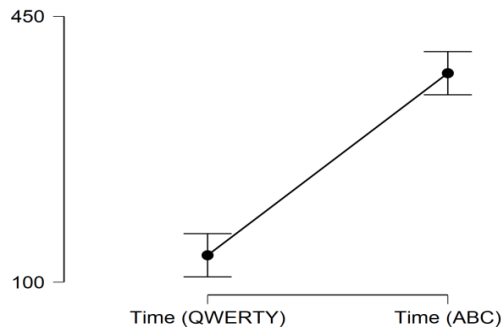
Fig.3 Measurement time using the QWERTY keypad and the multitap ABC standard keypad

Errors

Figure 4. shows that the QWERTY keypad has an error rate of (±SE) 15,30 (±1,85) much less than the Multitap ABC Standard keypad with an error rate of (±SE) 24,70 (±3,37). The normality test showed that the data is normally distributed (p=0.999), so statistical data analysis could be done with parametric test. The results of the Paired T-Test show that there are significant differences between two types of the keypads (p = 0.002)
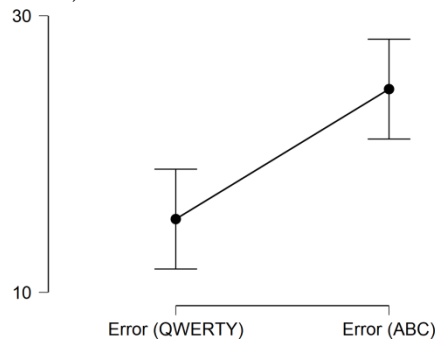

Fig.4 Measurement error using the QWERTY keypad and the multitap ABC standard keypad

Satisfaction

Figure 5. shows that the level of satisfaction using the QWERTY keypad are (±SE) 3,68 (± 0,466) which higher than the Multitap ABC Standard keypad with a satisfaction level of (±SE) 2,37 (±0,340). The normality test showed that the data are not normally distributed (p=0.04), so statistical data analysis were performed using non-parametric statistics. The results of the Wilcoxon Signed-rank Test showed that there is no significant difference between two types of the keypads (p = 0.284)
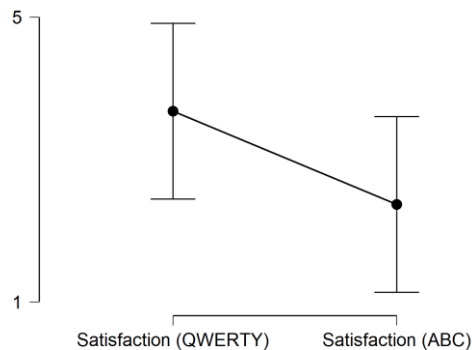

Fig.5 Measurement satisfaction using the QWERTY keypad and the multitap ABC standard keypad

Discussion

After usability testing was carried out on 10 respondents using the QWERTY keypad and the Multitap ABC Standard keypad to complete the task. Based on the results on this study, the time to complete a task using the Multitap ABC Standard keypad are longer than using the QWERTY keypad, it because the Multitap ABC Standard keypad has to be pressed repeatedly to reach the desired letter and there is a pause or time interval when the users want to type the same letter.

In measuring the error rate, it can be seen that the error generated by the Multitap ABC Standard keypad is higher than the QWERTY keypad. The most common errors or mistakes that occur on the Multitap ABC Standard keypad are errors in typing characters on the same key and also errors in changing the caps lock input mode.

In measuring satisfaction, it can be seen that respondents are more comfortable using the QWERTY keypad when compared to the Multitap ABC Standard keypad, this is because the use of the QWERTY keypad is more practical and efficient for typing. As well as the better appearance of the QWERTY keypad design so that respondents tend to prefer this features.

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Recommendations

There are several recommendations to overcome the usability problems found in this study:

1. ABC Standard Multitap Keyboard

- On ABC Standard multitap keypad, fuzzy keys function should be removed.
- The choice of symbol keys on ABC Standard multitap keypad are too many and make users confused, preferably only one button for symbols like in a QWERTY keypad
- Character input mode should be able to change quickly

2. QWERTY Keyboard

- The size of the QWERTY keypad should be enlarged and the distance between the letters should be made farther apart
- Contrast and comfortable color selection on keypad keys
- Placement of the comma (,) and dot (.) symbols should be put closely
- Function keys (alt) and key (shift) should be distinguished clearly

Conclusion

There are several conclusions that can be drawn in this research:

1. Based on the time to complete the task, there is a significant difference between two types of the keypads where the users completed the task faster using the QWERTY keypad compared to the Multitap ABC Standard keypad
2. Based on the error rate in completing the task, there is a significant difference between two types of the keypads where the users made less errors using the QWERTY keypad compared to the Multitap ABC Standard keypad

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