Revisiting the Impact of Mobile Phone Screen Size on User Comprehension of Health Information

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Abstract. This is completion of the research and update of the previous work that was published in 2013[1]. The paper describes our recent experimental study of the impact of mobile screen size on the user comprehension of health information and application structures. An experiment was conducted to measure the impact of screen size on user comprehension and retention. Participants were given the same simple scenario, which consisted of searching from different menus, navigating and reading some contents. They were timed and tracked for correctness. Also, a follow-up survey was given to each participant that consisted of a rating scale to assess usability features, comprehension and retention abilities of the participants based on different mobile screen sizes. Results showed that there was a significant difference between mobile phone screen size and the time taken to read the contents, which was at its highest on small screens (p-value=0.02). Also, reading characters was hardest on a small screen (p-value=0.003). In addition, there was a significant difference between the three screen sizes regarding the organization of the application’s information, showing that the smaller the screen size, the more organized the information. On the other hand, there was no significant impact of screen size on user comprehension, retention scores, number of errors or effective task completion but it was generally better if a large screen size was used. This study concludes that the screen size is not the main concern in comprehension of the contents or application structure. However, reading speed improves with larger screen size. This also positively influenced task completion and understanding the application elements.

Keywords. Screen size, usability, comprehension, retention, reading, font size, mobile phone, smartphone, clarity, effectiveness, structure.

1. Introduction

With more than 1 billion smartphones and 100 million tablets around the globe, the adoption of mobile technologies has been phenomenal in almost every aspect of life

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One of these aspects is healthcare. Mobile health (mHealth) is a growing field that encompasses all of the characteristics related to using mobile devices and multiple mobile advances, such as applications, sensors, electronic resources, and remote monitoring devices [3]. This technology can be used to improve the quality of healthcare in patient interaction. Also, it facilitates healthcare workers to deliver more efficient care.

One of the most important mobile technology interventions is mobile health applications, which are rapidly gaining popularity among physicians, patients and the general public. As the numbers of these applications are increasing on daily basis, it is very important to focus on studying their usability in order to ensure safe, useful and usable products. Many authors define different attributes of usability. One of those definitions divides the usability into one or more dimensions of: usefulness, ease of use, learnability, and attitude (likeability) [4]. In the study that conducted usability testing of mobile applications to measure how a user will use the mobile device system, they found that one of the significant challenges for evaluating the usability of mobile application was its screen size, which significantly impacts the visibility of data in the application [5].

Within the field of mobile health, there is a great demand to improve and enhance mHealth applications’ usability to meet societal health needs through the use of technologies, as this play a significant role in educating patients and improving their communication level with their health provider. However, these applications would not be useful to the patients unless they are systematically tested for their usability features. To the best of our knowledge, only a few studies have focused on the effect of mobile phone screen size on user comprehension of an application’s content and structure. Our research question addresses this directly where we examine if there is a difference between small, medium and large mobile phone screens and whether they affect their usability.

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2. Methodology

Forty-five female English translation students, all aged under 29, who had already finished the medical terminology course were enrolled in this experiment. They were randomly split into three groups, and each group consisted of 15 students. The students who did not finish the medical terminology course at the time of study enrolment and those who had used the application before were excluded. It should be noted that, because of the limited time of the study, access to the male department was not possible.

In the intervention, three different mobile phone screen sizes that were similar in terms of their technical characteristics and used the Android operating system were chosen. These included Samsung Note 10 (classed as large screen size), Samsung Note 2 (medium screen size), and Samsung Galaxy III mini (small screen size). Moreover, one diabetes prevention and educational application (Diabetes 101 by WEGmob) was selected and downloaded onto the three mobile phones before the start of the experiment.
The participants were given the same simple and short scenario, which consisted of selecting the basic subject from the main menu, then selecting the second level of the menu from different options in order to go to a different window. Each window had a separate topic that can be navigated. The participants were asked to search for and read different reading sets.

After completing all of the tasks, participants completed a follow-up survey, which consisted of a 5-point likert rating scale (strongly agree, agree, normal, disagree, strongly disagree) of their opinions regarding completing the tasks effectively by navigating content within the window, finding the content from the menu, the clarity of characters, the organization of information, and their understanding of the content. Finally, the participants were given ten multiple choice questions (MCQs) about the content. Five questions assessed the comprehension of the participants and consisted of definitions and some treatment steps based on their use of the diabetes application during the experiment. The rest of the five questions evaluated the retention abilities and contained numbers and terminologies. Also, the time taken to read the contents and number of errors made in answering the MCQs was recorded.

In addition, a ‘screen recorder’ application was also downloaded onto each mobile phone to capture on-screen activity (users’ screen navigating, clicking processes, time and number of errors).

3. Results and Discussion

The results of this experiment demonstrate that there is no major impact of mobile phone screen size on user comprehension/retention of information. However, we found a statistically significant and positive moderate correlation between the ease of reading characters and mobile screen size ($r = 0.43$, $p = 0.003$) which was hardest on the small screen and the best reading was seen using the medium screen size. This means that the larger screen size enabled participants to read the characters easily. In addition, there is a negative moderate correlation between reading time and the mobile screen size ($r = -0.36$, $p =0.02$), which shows that the reading time was faster for the larger screen size group. This concluded that reading speed improves when the screen become larger. We observed that the ease of reading character attributes was at its highest using the medium screen and that reading speed was highest using the large one. As an expected result, the easiest items to read will take less time. But some reading difficulties can affect reading speed, such as in the understanding of contents, which was lowest for the medium screen size. This may be due to the participants’ familiarity with the content, as discussed by Polidu et al (2003) [6].

Clarity of characters is another core of the usability of a device. We tested the clarity of the structure of application on the three screens to check if that affected the usability of the application. The results showed that there was a negative moderate correlation between the clarity of organization of information and mobile screen size ($r = -0.31$, $p =0.05$), which shows that the smaller the screen size, the more organized the information. One possible explanation for this result is that the user may focus and pay more attention to the small screen. In addition, we evaluated the participants’ opinions on their ability to find information through navigating the menu. We found no significant difference between the groups. Also, the effectiveness of performing the tasks was not significantly affected by the screen size. Nevertheless, the highest score was better on the large screen size. Also, the error score showed that there was no
significant difference. The number of errors was higher using a small screen size and lowest using a medium one.

We also studied the effect of prior familiarity with the screen size that the participants were given in this study to check if this attribute can affect the usability regardless of screen size itself. Given that the 87% of participants in both the small and large screen size groups and 53% in the medium screen size group had used that screen size before the study in their normal day living, we adjusted for this familiarity in the analyses. However, the prior familiarity did not affect the readability attributes.

4. Conclusion

This study explored the impact of mobile screen size on users’ comprehension of health information and application structure.

There was no significant impact of various screen sizes on users’ comprehension and retention of contents. However, there was a significant impact of screen size on the time taken to read the content, on average, as participants with a small screen size took longer to read the content. Also, there was a significant difference in terms of the ease of reading characters, which impacted users’ readability.

Additionally, there was no significant difference in comprehension of the application structures, but there was a low task completion rate and a high number of errors when a small screen size was used.

Correspondingly, the purpose of the usual use of mobile phones can play a role in usability testing, if the mobile is to be used as educational tool or to conduct simple or complex tasks. Once more, our findings suggest that the screen size is not the main concern regarding the usability of mobile phones.

References