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Is PDA Good for Complex Documentation in Healthcare?

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Abstract. The screen interface has been believed to be the major barrier for the adoption of mobile devices with small display in healthcare. The study objective was to evaluate nurses' perception of the ease of use and usefulness of PDA application, designed with customerized design principles. The PDA application consisted of 18 categories composed of 262 questions over 63 screens, which was designed based on a 21-page Chinese version of the interRAI MDS-HC homecare assessment tool. A WiFi Palm©-based PDA was used. A convenience sample of 60 subjects was invited for evaluation in terms of Davis' Technology Acceptance Model. Results show that close to 95% and 93% of the subjects agreed, overall, the system was easy to use and useful for their work. We conclude that PDAs can be improved and managed to achieve to a very high usability with right interface design principles.

Keywords. interface design, PDA, homecare, documentation

Introduction

Studies have indicated usability, such as difficult data entry, small screen size, fitting the workflow on the screen, etc., are major concerns and barriers to the widespread adoption of PDAs in healthcare [1-5]. Among the major usability concerns impacting PDAs the screen interface factor is perhaps the most crucial and important factor [4-8]. Although many interface design principles are utilized for the desktop computing environment, which utilize larger display screens allowing for additional information to be represented, these approaches are not very useful applied to small-screen devices [6,9].

We had used a set of small screen interface design principles to design a PDA application for homecare assessment. This set of principles are called as *3+1 Hierarchical Grid Screen Interface Design Principles*, which consist of key rules such like screen layout is organized into 3 hierarchical layers and 4 sections totaling 11 rows so users can most of the time switch to any screen in 2 taps; all choice options for the assessment question are clearly laid out without pull-down or pop-up control components; a hyper-jumping approach, compared to a traditional leafing screen-navigation approach in which users navigate system sequentially using "previous" and "next" buttons, is used as the main approach to simplify the system navigation, etc.

The 21-page Chinese MDS-HC 2.0, composed of 17 sections and 250 assessment questions, was used to design this complex documentation PDA application. This application consists of 63 screens and the screen shots of three representative screens were shown in Figure 1. The objective of this study was then to test nurses' perceived ease of use and usefulness of the application.

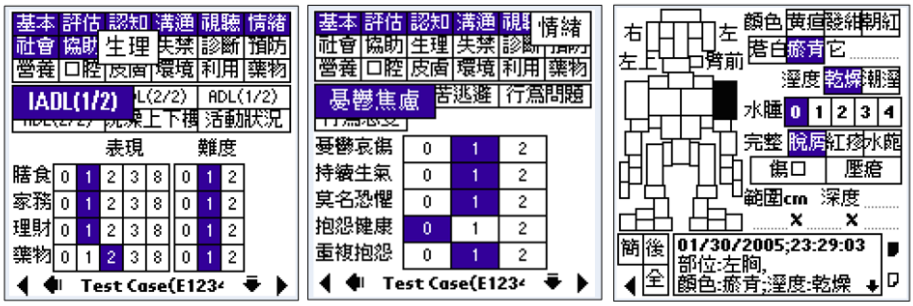

Figure 1. 3 sample screen shots of PDA application for complex documentation.

Materials and Methods

Two independent convenience samples from the Veterans Medical Care system in Taiwan, who attended a four-hour paper-based Chinese-version MDS-HC 2.0 documentation workshop, were invited to test and evaluate the system and system usability. The first group, 24 persons, is from the workshop held in 2006. The second group, 36 persons, is from the 2008 workshop. All participants had not used PDAs prior to their workshop attendance.

The test and evaluation required a one hour session after each workshop. The first 30 minutes were an introduction of the PDA system and the evaluation questionnaire content. Three written representative patient scenarios, which had been modified from real cases by referring to the examples illustrated by the Chinese MDS-HC 2.0, were then used for documentation with the PDA system.

Participants were asked to complete the evaluation questionnaire after the scenarios were documented. The Davis' Technology Acceptance Model (TAM) [10-11] was used to evaluate perceived ease of use and usefulness of the PDA system. The TAM has been used to show factors of perceived ease of use and perceived usefulness of systems are valid and reliable predictors of user acceptance of new information technology [10,12-17].

The TAM questionnaire used in this study, modified from the questionnaire based on work done by Davis [11] with content validity validated by experts and previous use [18-21], consisted of eighteen questions on "Perceived Ease of Use" and fourteen questions on "Perceived Usefulness of System." An experienced professor in interRAI instruments examined and assured the content validity of the PDA questionnaire with the original sentences and descriptions condensed to save space.

A five-point Likert scale was used for all questions where one meant "Strongly agree," and five, "Strongly disagree." The 2008 subjects were asked two extra questions: whether you are willing to use the system, in terms of a 5-point Likert scale, and the strength of willingness, in a 0-to-10 interval scale which 0, 6, 10 stand for "no willingness at all," "just acceptable" and "total willingness," respectively.

Result

There are no significant differences, examined with the Mann-Whitney U test, between two independent groups of subjects in demographic variables: age 20 to 39, female,

nurses, well-educated, good computer literacy, and inexperienced in MDS-HC. The descriptive analysis of pooled data was shown in Table 1.

Table 1. Participant Positive Perceptions on the Ease of Use and Usefulness of PDA System

Questions	Subjects "strongly agree" or "somewhat agree" with the questions^ (%)(N=60)
Ease of Use	
Interface	
Font size easy to read	94.8
Screen size meets work needs	89.7
Screen item allocation acceptable	93.1
Screen structure acceptable	93.1
Easy data-entering by tapping	100.0
Easy data-entering by hand-writing	70.7
Easy to operate	
Easy to learn	98.2
Easy to complete the assessment	92.9
Clear and easy interaction	89.7
Response time acceptable	96.6
Easy to use the systems	96.6
Easy to navigate the systems	96.6
Easy to find related information	91.2
Makes the entire work process easier	86.2
Overall ease of use	94.9
Usefulness	
Useful contents	
Good for complete data collection	91.4
Easy to analyze patient's care needs	94.8
Highlighting prevents missing of items	91.4
Good for learning homecare assessment	96.6
Improves assessment quality	89.7
Improves future analysis	96.6
Improving efficiency	
Makes assessment quicker	91.4
Easier to control the work	94.8
Less handwriting	98.3
More time for patients	75.4
Saves on entire assessment time	89.7
Enhances work efficiency	89.7
Makes the entire work process easier	81.0
Overall usefulness	93.2

Results show that participants (94.9% and 93.2%), perceived the PDA application positively in terms ease of use and useful for home care assessment and documentation. In interface-related questions more than 93% of subjects either strongly agreed or somewhat agreed the system was easy to use in terms of font size, screen item allocation and structure, and data entry by tapping. The screen size is considered to be acceptable and hand-writing is less preferred.

With regard to the 8 "ease of operation" questions (3 opposite but redundant questions were removed from analysis), almost all felt the system was easy to learn; more than 96% believed the system was easy to use, respond and navigate; 92.9% thought the assessment was easy to complete; 91.2% felt it was easy to find needed information; close to 90% considered the system easy to interact with; and as high as 86% either strongly agreed or somewhat agreed the system does make the entire process easier.

With regard to the "improving efficiency" questions, over 90% of participants strongly agreed or somewhat agreed the system would make evaluation quicker and easier to control. Furthermore, close to 100% strongly agreed or somewhat agreed the system could reduce the amount of handwritten work, while 90% of subjects strongly agreed or somewhat agreed the systems could reduce MDS assessment time.

In terms of subjects' willingness to use the system, held in 2008 study, 82.4% of 36 subjects were strongly willing to use the system right away. The average willingness score was 8.9 (SD 1.16) out of a 0-10 scale and 15 did give the full score of willingness.

Discussion

Although the study participants were from convenience samples, the evaluation results show the high perceived ease to use, usefulness, and willingness-to-use of an interface-enhanced PDA system involving complex documentation. The PDA system for complex documentation in this example is composed of 63 PDA screens. Even so the participants still perceived it was easy to use. The PDA screens are organized into a 3-layer hierarchical grid structure matching the conceptual structure of the original documentation contents. There is no doubt this relieves a user's memory burden when using a PDA for complex documentation since the PDA screens, although complex, are organized into a clear mental map with which the users are familiar.

Due to limited space available on a PDA screen, it is difficult to display all the text of the original questions without modification to make them more concise. The authors used keywords, abbreviations and concise sentences to save space. But surprisingly, during the testing and evaluation participants did not mention this problem at all. The reason might be the evaluation study was done after the participants were trained with the paper assessment tool.

Close to 100% of 2008 participants agreed the PDA system was, over all, easy to use. Although the authors did not formally evaluate participant acceptance of the PDA system compared to the original paper tool, it was observed participant obvious interest in the system and high level of intention to use the system. This is very important when promoting a complex assessment and documentation tool such as the interRAI's MDS-HC in healthcare because completeness of an assessment tool usually implies more effort and time to get it done if a paper format is used. This manual burden usually hinders the promotion of quality assessment tools when many clinical workers are already overburdened with paper work and limited time.

Conclusions

This study has shown the usability barrier affecting the adoption of handheld computers with a small screen when using complex documentation can be well managed.

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