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Heuristic Evaluation of a Web-based Prototype for a Personal Digital Assistant-Decision Support System for the Management of Obesity

Nam-Ju Lee[a], Leanne Currie[a], Ritamarie John[a], Elizabeth Chen[b], Myra Joyce[a], Suzanne Bakken[a,b]

[a] *Columbia University School of Nursing, New York, New York*
[b] *Department of Biomedical Informatics, Columbia University, New York, New York*

Abstract

This study used heuristic evaluation to identify usability issues of a Web-based prototype for a personal digital assistant -based decision support system (PDA-DSS) for the management of obesity. Three usability experts evaluated the prototype using heuristics, scenarios, and an evaluation survey form. In a usability laboratory, evaluators were asked to think aloud and their verbalizations were audio and video recorded. The overall severity scores of each heuristic were between 0 (No usability problem) and 2 (Minor usability problem). Generally, the experts agreed that the navigation, terminologies, options, and abbreviations were clear and consistent.

Keywords:

decision support systems, clinical, heuristic evaluation, computers, handheld

Introduction

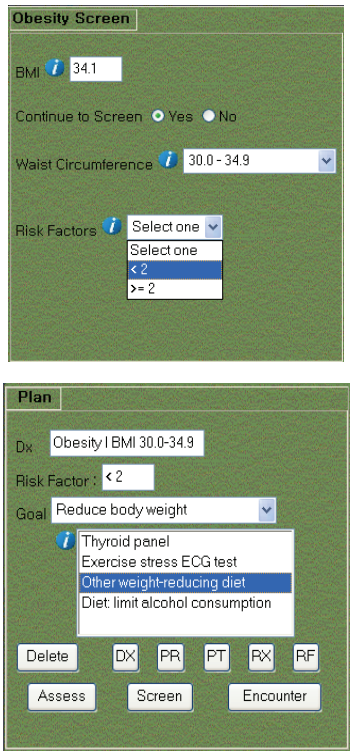
Handheld devices raise special interface design issues that do not occur with desktop applications, and this results in a formidable challenge for design and evaluation. In a systemic review of usability issues that involved the design and implementation of PDA-DSSs, user interface issues were classified as display, security, memory, Web browser, and communication issues [1]. Despite these obvious challenges, few studies have examined the special challenges of employing health care information systems on handheld devices, especially in health care settings. Therefore, studies are needed not only to assess user interface issues in the design and implementation of PDA-based information systems in a health care setting, but also to evaluate them through usability engineering methods. The purpose of this study was to identify usability problems in the Web-based prototype user interface for the PDA-DSS for the management of obesity through heuristic evaluation.

MODS-APN

The development and evaluation of a prototype PDA-DSS based on a clinical practice guideline (CPG) for the management of obesity is part of the Mobile Decision Support for Advanced Practice Nursing (MODS-APN) project. The goal of MODS-APN is to improve APN students' adherence to CPGs in three areas – obesity management, tobacco cessation, and depression screening. The DSS for the management of obesity is based on decision-rules and documentation templates, which remind APN students to document specific data for screening obesity and guide them to perform CPG recommendations. The system provides APN students with the appropriate obesity diagnosis based on the results of screening and a tailored plan of care based upon the patient's goal and the results of screening.

The development and evaluation of a Web-based user interface (Figure 1) of the PDA-DSS for the management of obesity was intended to get usability experts' quick feedback on the user interface (e.g., navigation, button labels, and drop down lists) before the full implementation on the PDA.

Figure 1 - Screen shots of the web-based prototype



Heuristic evaluation

Heuristic evaluation is a usability engineering method for finding usability problems in a user interface design and for structuring the critique of a system using a set of relatively simple and general heuristics [2]. Skillful experts can capture many system usability problems using heuristic evaluation, and this technique is effective, easy to learn, and relatively inexpensive [3].

Materials and methods

First, three experts who have experience related to the development of PDA-DSSs, heuristic evaluation, interface design or cognitive science and a doctorate in informatics or a related field were invited to participate via email. They were then given a general introduction to the heuristic evaluation protocol with five scenarios and a form for evaluating the application. The scenarios reflected all functions of the application and included the tasks to be tested. The evaluation survey form included seven principles of usability (Table 1) of relevance to the Web-based prototype user interface for the PDA-DSS for the management of obesity. These were derived from Nielsen's 10 heuristics and include sub-questions, yes or no questions to each sub-question addressing the adherence to heuristic principles, open-ended comments, and a severity rating (0-4) to rate the severity of usability problems for each heuristic.

The experts tested the Web-based prototype user interface independently with the scenarios for approximately 30-90 minutes in a usability laboratory. They were asked to verbalize what they were thinking, seeing, and trying to do while they were evaluating the application. During the evaluation, the experts were asked to identify the problems in the interface (e.g., navigation and labels of buttons or drop down lists), to rate the problems' severity using a severity rating scale, and to write additional comments on the heuristic evaluation survey form. The evaluation sessions were audio and video recorded.

The frequencies of adherence to usability principles were calculated according to the sub-questions of the seven usability principles. Total severity scores and mean severity scores were calculated for each heuristic principle. Evaluators' comments about usability problems were grouped and content-analyzed according to the usability principles.

Results

Experts responded that the usability principle was not violated in 14 of 19 sub-questions related to the seven usability principles. The overall severity scores of each heuristic ranged from 0 (No usability problem) for 2 of 7 heuristics to 2 (Minor usability problem) for 5 of 7 heuristics. Generally, the experts agreed that the navigation, terminologies, options, and abbreviations were clear and consistent, and that the system was easy to use.

Table 1 - Usability problems and mean severity scores

1. Match Between System and the Real World Location of button, Ambiguous instruction, Detailed information	0
2. User Control and Freedom Not to cancel, Radio button	.67
3. Consistency and Standards Less specified label/ instruction, Inconsistency in decimal points	.67
4. Help Users Recognize, Diagnose, and Recover from Errors Implicit warning message	.67
5. Recognition Rather Than Recall Long text in information, Necessary information display, Long lists in a pop-up list, More information	0
6. Aesthetic and Minimalist Design Too much text	.67
7. Error Prevention (mean severity score=.67) Small font, Unpreventable user's mistake in entering, Double negative statement	.67

Table 1 lists the sub-categories of the problems identified in the experts' narrative comments and the mean severity scores. The first and second experts mentioned seven problems each, and the third expert identified 11 problems. Most problems were related to detailed or less specific instructions or the information linked by Infobuttons, which provided users with information related to the screening of and planning for the treatment of obesity. Due to a lack of screen space, the information or instructions needed to be concise, and the display order of information was important. To resolve this issue, experts recommended specifying the labels and button names on some screens, as well as the titles of pop-up messages. User training was also an essential recommendation for improving usability problems.

Another problem that was identified for 'User Control and Freedom' was the irreversibility of the user interface once users decided whether or not to perform obesity screening. Not allowing users to reverse their responses can result in frustration, especially considering a PDA's interface constraints. The usability issues that were identified by the experts and potential design solutions were discussed with the project team members during the next step, the implementation of a PDA-DSS.

Conclusion

Heuristic evaluation using the scenarios was a useful method to find usability problems in the early phase prototyping a PDA-DSS. The findings of this study provided iterative feedback regarding the design and implementation of the PDA-DSS for the management of obesity. This approach had an important impact on making the system easier to use and more useful from the perspective of design and content in the proceeding iterations.

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Address for correspondence

Nam-Ju Lee, RN, DNSc
Columbia University
School of Nursing
630 West 168th Street, Mailbox 6
New York, NY 10032
e-mail: nl2027@columbia.edu