EVALUATING POINT-OF-CARE TECHNOLOGY WITH THE IBM COMPUTER USABILITY SATISFACTION QUESTIONNAIRE

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ABSTRACT

In an effort to measure nursing satisfaction with a new point-of-care technology, a survey was distributed to gather demographic and computer experience information, and measure of the nurses’ satisfaction prior to the installation of a point-of-care electronic patient records system. The results showed a somewhat positive overall satisfaction with the point-of-care technology. The outcome of this research reinforces the notion that the nurses are accepting of new electronic patient systems and are somewhat supportive of technology in general.

Keywords: Computer usability, satisfaction, image profiles, implementation, predicting use

INTRODUCTION

As the technology pushes closer to the patient, it also expands the number of clinical personnel that must interact with it, broadens the user base, and increases the need for wider system acceptance and an understanding of system usability. Often problems are encountered during the implementation (when the new system is activated) (1). The development of an early evaluation measure may permit the application of a timely intervention that would enhance the implementation strategy and provide for a modification of individual and group behaviors (5) (3). This research introduces the IBM Computer Usability Satisfaction Questionnaire (8) into the healthcare field as a possible early evaluation measure.

Users want usable information technology products, and developers strive to produce them. It follows that an important part of system design, both hardware and software, must be the measure of computer usability (8). Measuring usability is particularly difficult because usability is not a uni-dimensional product or user characteristic, but emerges as a multidimensional characteristic in the context of users performing tasks with a product in a specific environment (2). If you are unable to measure usability, you can not judge the new system against the old. The proper measures for assessing usability and satisfaction are not obvious, and are an ongoing concern of human factors engineers and systems managers.

An implementation of information technology in a hospital setting requires attention to many people and organizational issues (5). These concerns often fall into four general categories; staff preparation and training, process changes, continuity of patient care, and IT and administrative support (1). As new systems are implemented, workers and organizations are being exposed to many new technologies that are implemented and adopted to varying extents (5). A key strategy to an effective implementation is the development of an evaluation measure.
that would permit an early implementation intervention (5) (7) and would identify the users’ intention to use the system (9). Identifying dissatisfied users and recognizing the general nature of their complaints would provide a better-organized strategic approach to implementation and ultimately enhance the adoption of the new technology.

Computer systems are now so prevalent that almost everyone among the working adult population has some experience with them. More frequent computer users may have encountered many different systems, some with substantial variation, purpose, or circumstance. Despite such variety, each individual inevitably develops a generalized impression of such computer systems. Personal experiences, such as work experience, gender, age, level of education, computer expertise, home computer ownership, effect a person’s perception of usability and satisfaction (10).

In addition, Hughes (6) identified education, past experiences, and computer skills as barriers and/or facilitators to use, though she did not relate these characteristics directly to usability or satisfaction.

**METHOD**

**Setting**

All nursing staff members at the regional hospital center are aware that a new point-of-care integrated clinical and administrative hospital-wide information system is currently being installed. Within thirty days the new systems will go “online” in most of the nursing units. The remaining units will go “live” in about 60 days following. The hospital administration has been preparing the nursing staff by offering periodic training sessions. The nursing staff is kept abreast of the implementation timetable via the nurse managers that supervise each unit and information printed in a hospital-wide newsletter.

**Data Collection Procedures**

Surveys were distributed, via home mail, to all part-time (minimum of 12 hours per week) and full-time members of the hospital nursing staff (i.e. over 600 staff members) prior to the implementation of an integrated clinical and administrative hospital-wide information system. All received an addressed envelope that contained 1) a cover letter that solicited the respondents’ cooperation and assured anonymity, 2) the survey instrument, 3) an entry form for a drawing ($100 gift certificate), and 4) a return envelope addressed to the research team. One hundred and forty surveys were returned prior to the drawing deadline. Ten of the 140 drawing-entries were selected randomly, the winning nurses were contacted, and prizes were delivered the following day. All hospital employees were informed of the drawing winners via the hospital newsletter.

**The Instrument**

In order to better ascertain the factors that may affect the nurses’ satisfaction and usability, the questionnaire began with demographic questions that identified the sex, age, level of nursing education, and full or part time employment. In addition, five questions were asked to
determine computer experience. Four questions requested that the nurse provide a subjective rating of expertise for general computer skills, and for specific skills in word processing, internet search, and e-mail. Each computer expertise question was followed with a five-point semantic differential rating scale (beginner, novice, average, experienced, and expert). The fifth question requested a response for computer ownership.

The second section of the questionnaire was designed to obtain the subject satisfaction and usability data of the new point-of-care integrated clinical and administrative hospital-wide information system. It contained the 18 questions found on the IBM Computer Systems Usability Questionnaire (8). The 18 questionnaire items were listed randomly and respondents circled a number on a seven-point semantic distance scale to show how well they felt each described the new point-of-care system. The extremes were labeled “Strongly Agree” and “Strongly Disagree”. Strongly Agree was corresponded with the number one and Strongly Disagree corresponded with seven. Sample questions were “Overall, I will be satisfied with how easy it will be to use the XXXX system” and “I will be able to complete my work quickly using the XXXX system.” The vendor and product name of a specific point-of-care integrated clinical and administrative hospital-wide information system was inserted in place of [XXXX].

**Validity and Reliability of the Data**

An attempt was made to provide content validity for all of the variables gathered. The satisfaction and usability questionnaire items were drawn from a previous study of similar design (8).

As can be seen in Table 1, Content validity was assessed by a factor analysis using principal components extraction and verimax rotation for the eighteen scale items (12). In the exploratory factor analysis three constructs were identified. One factor clustered the interface satisfaction items. A second factor clustered those items that identified the efficient completion of work. The third factor was a cluster of items that examined comfort and learn-ability. Four items (Satisfaction with ease of use, Overall satisfaction, Effective in helping complete work, and Simple to use) fell into more than one factor and were discarded.

The inter-item reliability for the IBM Computer System Usability Questionnaire was assessed by calculating a Cronbach alpha score to determine the internal consistency, based on the average inter-item correlation (12). The interface satisfaction items had a Cronbach alpha of .932, the efficient completion of work had score of .898, and the comfortable and learn-ability score had a Cronbach alpha of .898. These alpha scores are acceptable, indicating that the factors within each multi-item variable are highly inter-related.


Table 1 Construct Validities (Factor Analysis)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Factor Analysis</th>
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<tbody>
<tr>
<td>Interface is pleasant</td>
<td>.803</td>
</tr>
<tr>
<td>Like using the interface</td>
<td>.745</td>
</tr>
<tr>
<td>Clear error messages</td>
<td>.691</td>
</tr>
<tr>
<td>Easy to find information</td>
<td>.682</td>
</tr>
<tr>
<td>Clear organization of information</td>
<td>.654</td>
</tr>
<tr>
<td>Expected functions and capabilities</td>
<td>.648</td>
</tr>
<tr>
<td>Satisfaction with ease of use</td>
<td>.582</td>
</tr>
<tr>
<td>Effectively complete my work</td>
<td>.738</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>.732</td>
</tr>
<tr>
<td>Simple to use</td>
<td>.718</td>
</tr>
<tr>
<td>Computer my work quickly</td>
<td>.685</td>
</tr>
<tr>
<td>Easy to understand</td>
<td>.655</td>
</tr>
<tr>
<td>Effective in helping</td>
<td>.566</td>
</tr>
<tr>
<td>Efficiently complete my work</td>
<td>.626</td>
</tr>
<tr>
<td>Feel comfortable using</td>
<td>.829</td>
</tr>
<tr>
<td>Easy to learn</td>
<td>.740</td>
</tr>
<tr>
<td>Become productive quickly</td>
<td>.701</td>
</tr>
<tr>
<td>Recover easily and quickly</td>
<td>.500</td>
</tr>
</tbody>
</table>

RESULTS

T tests for independent samples were used to locate response differences for type of employment (full or part time), sex, and computer ownership. Analysis of variance (ANOVA) was used to determine response differences for age, level of nursing education, and self-described level of computer expertise, word processing ability, internet search ability and email ability.

We found no significant differences for type of employment, gender, computer ownership, level of nursing education, and self-described level of computer expertise. Only word processing ability, email ability and internet search ability were found to significantly affect the three satisfaction factors of 1) interface satisfaction, 2) efficient completion of work, and comfort and learn-ability.

Word processing ability had a significant main effect (F 2.998, df = 132, sig. = .0215) for efficient completion of work and a significant main effect (F 4.897, df = 132, sig. = .001) for comfort and learn-ability. Post hoc comparisons of the comfort and learn-ability factor showed a significant satisfaction differences between absolute beginners and those that self-reported to be average users (sig. = .03) and beginners and those that self-reported to be expert users. Because of a small expert sample size (4 nurses self-report this level of ability) results are suspect.

Internet search ability had a significant main effect (F 3.398, df = 132, sig. = .011) for interface satisfaction, a significant main effect (F 6.001, df = 132, sig. = .000) for comfort and learn-ability, and a significant main effect (F 3.449, df = 132, sig. = .010) for efficient completion of work. Post hoc comparisons for the comfort and learn-ability factor showed a
significant satisfaction differences between absolute beginners and those that self-reported to be average users (sig. = .027), experience users (.019), and expert users (.001). Because of a small expert sample size (4 nurses self-report this level of ability) these results are suspect.

E-mail ability had a significant main effect (F 4.105, df = 132, sig. = .004) for interface satisfaction, a significant main effect (F 6.564, df = 132, sig. = .001) for comfort and learnability, and a significant main effect (F 4.479, df = 132, sig. = .011) for efficient completion of work. Post hoc comparisons for the interface satisfaction factor showed a significant satisfaction difference for self-reported average-ability users and those that self-rated as experienced (sig. = .045) and expert (.038).

In addition, significant post hoc findings were found for the comfort and learn-ability factor and the efficient completion of work factor. Each significant finding was associated with the self-reported expert category and because of a small expert sample size (4 nurses self-report this level of ability) these results were suspect.

DISCUSSION AND CONCLUSIONS

Based on this research, it appears that there are three major factors that influence how quickly nurses adapt to new technology. These factors are: experience with word processors, use of the Internet, and experience with e-mail. As we, as a society, become more computer literate the adoption process for integrated clinical and administrative systems should be more rapid.

Recommendations for the management of the hospital include;

- Encourage the use of word processing, email, and Internet at work and at home.
- Provide incentives for the staff to purchase home computers through reduced price or low cost loans. (Word processing, email, and Internet search software should be included in the purchase process.)
- Managers should encourage professional development activities, such enrollment in community-college computer courses. (Employee benefit packages should include reimbursed.)

In addition, managers should encourage nurses to conduct their research of nursing topics via the Internet. Also, when hospitals purchase their nursing drug guides (e.g. Lippincott, Prentice Hall's, etc.), they may want to consider purchasing an on line accessible version rather than purchasing them in a hard copy format. Not only will this increase nurses comfort level with computers, but also since the online version are more easily updated, this will help ensure that the information the nurses are referencing is current.

Nurses should be encouraged to use email on the job, rather than hardcopy documents, to communicate in both their professional and personal lives. In the same vain, the hospital should convey messages to the nursing staff via email.
Hospital managers should be encouraged to have the hospital serve as an Internet service provider when possible. If it is not possible for the hospital to serve as an ISP then, as a part of the nurse’s benefit package, the hospital should cover, or reimburse, the cost of this service when provided by outside vendor.

As nurses gain competency and experience using these three software applications; satisfaction with new point-of-care integrated clinical and administrative hospital-wide information systems satisfaction should improve.

REFERENCES

6) Hughes, J.A. (1999) factors that impact nurses’ use of electronic mail (E-mail), Computers in Nursing, 17(6), 251-258.