8-16-1996

ACCEPTANCE OF BEDSIDE COMPUTER TECHNOLOGY

Thomas W. Dillon
Western Kentucky University

Dorothea MsDowell
Salisbury State University

Fati Salimian
Salisbury State University

Denise Conklin
Peninsula Regional Medical Center

ACCEPTANCE OF BEDSIDE COMPUTER TECHNOLOGY

[*]Thomas W. Dillon, Ph.D., Western Kentucky University, Bowling Green, KY
Dorothea McDowell, MS, RN, Salisbury State University, Salisbury, MD
Fati Salimian, MS, Salisbury State University, Salisbury, MD
Denise Conklin, RN, Peninsula Regional Medical Center, Salisbury, MD

Abstract

Many new technologies are being developed to improve the efficiency and productivity of nursing staffs. A key to the success of these technologies is acceptance by the nurse. Davis' Technology Assessment Model (TAM - 1993) was developed to measure the likelihood that subjects will accept and use computer systems. This paper presents a discussion on nursing acceptance of computer systems, reviews the development of the Technology Acceptance Model (TAM), and reports findings of a study that examines nursing acceptance with TAM for bedside computer systems. Results of the study showed nursing staffs, in general, are accepting of bedside-computer technology. Though, those working full-time have a better attitude and are more accepting than those working part-time.

Keywords: Health care, Attitude Toward Computers, Satisfaction, Technology Acceptance Model, Nursing Research

Introduction

Since documentation captured at the bedside can improve nursing productivity (Hughes, 1988), an increasing number of hospitals are automating the documentation process with *bedside-computer technology*. A recent survey of health care organizations found that almost 30 percent have automated the documentation process with a computer-based patient record (Lohman & Sundeen, 1994). This trend is expected to continue since the minimum time for gathering and entering computerized documentation is less than half the minimum time for handwritten documentation (Minda & Brundage, 1994).

One important factor that can influence nursing staff to accept or reject a computer information system is the quality of the system. The quality is normally reflected in the convenience and ease of use (Perreault & Wiederhold, 1990). An unwillingness to accept a computer system can interfere with successful implementation (Mathieson, 1991). Yet, it is often difficult to measure and predict a user's acceptance toward a computer system. The Technology Acceptance Model (TAM) was developed by Davis to determine user acceptance with information technology (Davis, 1989; Davis, 1993). TAM uses two key constructs, "perceived usefulness" and "perceived ease-of-use" to gather user acceptance perceptions.

This paper describes a study that utilizes TAM to predict nursing staff acceptance of bedside-computer technology. Conclusions are then drawn from the results of the study to assist with the implementation of bedside-computer systems in hospital settings.

Statement of the Problem

The purpose of this study was to examine nursing acceptance of a bedside-computer system through the use of a questionnaire that gathered perceived ease of use, perceived usefulness, attitude, and subjective system use. A second purpose was to see if the acceptance of the bedside-computer system data fit the TAM theory. Recommendations are then made to assist with the implementation of bedside-computer systems.

Methodology

Prior to administering the questionnaire, bedside-computer systems had been implemented approximately two years in the critical care Unit (CCU) and four years in the Intensive Care Unit (ICU). One bedside-computer to serve no more than two patients was installed in each of the patient rooms, and one was located at each of the nurses' stations. All were wired to a central information server and printer. The monitor was positioned close to eye level and interaction was provided by mouse and keyboard. During the study period the capability to interface the bedside computers with the medical center's existing computer information systems was not provided.

Surveys were distributed to all half-time and full-time members of the nursing staff (i.e., 92 staff members) via individual mailboxes located within each of the two units. All received an addressed envelope that contained the survey instrument, an entry form for a drawing ($50 gift certificate), and a return envelope. Well-marked return boxes were placed in the staff lounge of each unit. Returned envelopes were collect daily for seven days. At the end of the return period, 65 surveys were returned. Five of the 65 drawing-entry forms were randomly selected and the winning nurses were contacted. Prizes were delivered the following day.

Part One of the questionnaire contained demographic and classification items, such as unit, gender, age, and education. In addition, it contained two items measuring system use. The first was a measure of frequency that contained the instructions, "On the average, I use a bedside computer (pick the most accurate answer)." These instructions were followed by a choice of six items. They were: "a. less than once a week, b. about once a week, c. several times a week, d. about once each day, and e. several times a day, and f. many times a day." The second measure of system use was an open-ended question that asked the nurse to approximate how many hours per week he/she used a bedside computer. These two measures are typical of the metrics used in other information systems research (Davis, 1993; Mykytyn & Green, 1992). Self-reported time estimates are not true estimates of time on task, but evidence suggests that self-reported time is an accurate estimate of job activity (Hartley, Brecht, Pagerly, Weeks, Chapanis, & Hoecher, 1977). By estimating job activity, the nurse also estimates system use.

The data gathered from these two items were handled individually and were transformed to create one variable for system use. The weekly-computer-use data were transformed with logarithms and re-scaled to the same range as the daily frequency-of-use data (Davis, 1993). The mean of the weekly-computer-use data and the frequency-of-use data was then calculated to generate the system use variable (Davis, 1993).

Part One of the questionnaire also contained five standard seven-point semantic differential rating scales to measure attitude (Ajzen & Fishbein, 1980). The attitude measure was taken from Davis (1993) and consisted of the leading phrase, "All things considered, my using a bedside computer is:" followed by five attitude measures. The five measures were: Good-Bad, Wise-Foolish, Favorable-Unfavorable, Beneficial-Harmful, and Positive-Negative. Positive items had a rating of 1, neutral a rating of 4, and negative items a rating of 7.

The second part of the questionnaire contained nine items related to the perceived usefulness of bedside computers and nine items addressing the perceived ease-of-use of bedside computers. A tenth item requesting the subject's overall impression of each, usefulness and ease-of-use was also included. These twenty ease-of-use and usefulness items were randomized with 45 other satisfaction related questions.

Results

This section presents the results of the study. The reliability and validity of the instruments are discussed, results of comparisons are presented, and the relationship among perceived ease-of-use, perceived usefulness, attitude, and system use is demonstrated.

The study used Cronbach alpha to assess the inter-item reliability for each multi-item section of the instrument in the study: perceived ease-of-use, perceived usefulness, and attitude (Straub, 1989). As can be seen in Table 1, Cronbach alpha scores were .76 for the perceived ease-of-use, .93 for perceived usefulness, and .86 for attitude. These reliability scores are acceptable, but slightly lower than those reported by Davis (1989 & 1993).

Factor validity was assessed by Confirmatory Factor Analysis of the perceived ease-of-use and perceived usefulness scale items using principal components extraction and oblique rotation (Davis, 1989). The two-factor solution for the data is consistent with two distinct scales, one for perceived ease-of-use and one for perceived usefulness.

The general descriptive statistics for the perceived ease-of-use, perceived usefulness, frequency-of-use, and hours-worked and system use (i.e., frequency-of-use and weekly-computer-use combined) items are presented in Table 2. Overall, mean scores for all of the variables are favorable, showing a relatively positive outcome for perceived ease of use, usefulness, and attitude about bedside-computer technology.

T-tests for independent samples were used to locate response differences for nursing unit (ICU or CCU), and type of employment (full-time or half-time). Significant differences were found for attitude between each nursing unit (ICU and CCU) and type of employment (full-time or half-time). Nurses working in the ICU have a significantly better attitude for bedside-computer systems than those working in the CCU ($F = 10.946$, $p = .002$). While those working full-time have a significantly better attitude for bedside computer systems than those working half-time ($F = 7.79$, $p = .007$).

Table 3 shows how well TAM fits the data. The table gives the variance explained, the regression weights, and the significance for each equation in the model. As in Davis (1993) Perceived ease-of-use (EOU) explains a significant amount of the variance in perceived usefulness (U). Our findings show that perceived ease-of-use explains 54% of the perceived usefulness ($F = 24.9$, $p = .000$). Those nurses surveyed believe that an easy-to-use bedside-computer system will also be useful. However, perceived ease-of-use (EOU)($F = 3.65$, $p = .06$) and perceived usefulness (U)($F = 1.93$, $p = .15$) did not quite make significance as a contribution to the nurse's attitude (A) and attitude (A)($F= 1.86$, $p = .121$) and perceived usefulness (U)($F =.63$, $p = .723$) did not reach significance for system use (SU). The bedside-computer system data did not adequately fit the TAM theory.

Conclusions

Two objectives were established in this paper; (1) to determine nursing staff acceptance of bedside computer

TABLE 1

INSTRUMENT RELIABILITIES (Cronbach's Alpha)

Measure	Alpha
Ease of Use	.76
Usefulness	.93
Attitude	.86

TABLE 2

Descriptive Statistics for TAM
n = 65

Standard

Variable	Mean	Deviation
Ease of Use	1.796	.506
Usefulness	1.561	.594
Attitude	1.168	.32
Frequency of Use	4.935	1.389
Weekly Computer Use	20.782	14.752
System Use	12.850	7.53
_____		

TABLE 3

THE RELATIONSHIPS AMONG THE TAM DATA

Variable	beta	R2	Adj-R2	Prob
U=EOU	.542	.29	.29	.0001
A=EOU+U	.239	.06	.06	.06
	.777	.06	.004	.15
SU=A+U	-.221	.05	.05	.121
	-.048	.05	.005	.723

Usefulness-U, Ease/ Use-EOU, Attitude-A, System Use-SU

systems and (2) to see how well the bedside-computer system data fit the TAM theory. In addition, conclusions are drawn to assist with the implementation of this new technology.

Since significant differences were found for attitude between the two nursing units (ICU and CCU), analysts responsible for the implementation of bedside-computer systems should examine closely the requirements of each unit. Training sessions and implementation procedures were roughly the same for each unit. So we can assume that, though very similar in activity and responsibility, each nursing unit is different. We agree with Murphy, Maynard, and Morgan (1994), that it is worthwhile to examine attitudes as a method of evaluation when introducing bedside-computer technology. The input of the

nursing staff, the largest group of professionals using bedside-computer technology, is key to successful implementation.

Type of employment (full-time or half-time) also showed a significantly different responses in the survey. Those working full-time have a better attitude for bedside-computer systems than those working half-time. Findings have shown that familiarity eventually leads to comfort with computer systems (Adaskin, Hughes, McMullan, McLean, & McMorris, 1994). So, the attitude difference may be a temporary finding. However, since the bedside-computer technology has been in use for at least two years in both units, additional effort should be made for define the advantages of this technology to the half-time nursing staff. Often those working less than full-time are not fully aware or are unable to take advantage of all support systems. Care should be taken to adequately train employees working less than full-time, not only in the bedside technology, but also how this technology effects the care of the patient and the operation of the unit and hospital.

Contrary to Mathieson (1991) TAM was not successful at explaining system use and does not provide a quick and inexpensive way to gather general information about the nursing staff's perceptions of bedside-computer systems. The pattern of results is similar to the results originally observed by Davis (1993) and Davis et al. (1993) for explaining perceived usefulness. The inability to reach significance when determining the contribution of usefulness and ease of use for attitude may be attributed to a small sample size (e.g., 65 respondents). But, it is clear that usefulness did not contribute to system use.

Since we did not find a significant relationship among perceived ease-of-use, perceived usefulness, and attitude toward the use of bedside-computer systems, we concluded that some other factor was affecting our results. One explanation could be that all earlier administrations of the ease-of-use, usefulness, attitude, and system use questionnaire items were to determine the acceptance of common software packages or technologies (i.e., word processing, E-mail, and spreadsheets). Our application, bedside-computer systems, was not common. Where as common software is somewhat elective in nature, a bedside-computer is necessary for quality care. For example, a user can elect to use E-mail or some other communication device, such as a telephone or traditional mail. In order to properly document patient care nursing staff must use the documentation process provide by the organization, in this case, a bedside-computer system.

In closing, we found that ICU and CCU nursing staff perceived the bedside-computer system was easy to use and useful. In addition, both also had a relatively positive attitude about bedside-computer systems. However, we were unable to fit these variables to TAM and can not recommend TAM as a quick and inexpensive method of gathering post-implementation acceptance data.

(References available form the first Author.)