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AN EMPIRICAL EVALUATION OF USER SATISFACTION WITH A SCHOOL NURSING INFORMATION SYSTEM

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Abstract

The adoption of a school nursing information system is considered one of the most efficient ways in which to document health records as well as monitor health conditions electronically. However, despite the importance of computerized health records in school nursing practice, few studies have examined user satisfaction of a school nursing information system. The aim of this study is to investigate the critical factors effecting school nurses' satisfaction with a school nursing information system Utilizing a survey approach, questionnaires are distributed to nurses working in a primary or high school which introduces a new school nursing information system. The findings show several factors, including perceived usefulness, perceived of ease of use, training and workload are significant with user satisfaction. These results suggest that school nursing information system designers should comprehensively understand users' demands and perceptions about the system, which will further facilitate user satisfaction, decrease their workload, and ultimately enhance job performance.

Keywords: User satisfaction, School nursing information system, Perceived usefulness, Perceived ease of use, Training, Workload.

1 INTRODUCTION

School nurses are professionals who work in a school environment using adequate competence and skills to promote students' health (Bergren & Fahrenkrug, 2003). The mission of school nurses aims to develop a healthy school environment while facilitating close integration among the educational system, parents, and the community (Wainwright, Thomas & Jones, 2000). In order to achieve the promotion of students' health, school nurses need to conduct health assessments, track students' health conditions, and provide nursing interventions. As such, the adoption of a school nursing information system is considered one of the most efficient ways in which to document health records as well as monitor health conditions electronically (Bolton, 1994; Wainwright *et al.*, 2000).

The rapid development and expansion of information technology have resulted in various nursing information systems being designed and implemented to facilitate nurses' daily routines; these include electronic medical record systems, patient care information systems, laboratory results systems, and data collection systems that focus on improving patient-care quality, enhancing work efficiency, and promoting nursing competence (Dowling 1980; Hobbs 2002; Lee, Lee, Lin & Chang 2005). In Taiwan both primary and high schools are usually assigned one school nurse each. This school nurse is responsible for all students' health. They have to collect students' health data and track students' health problems. A city government in south Taiwan plans to introduce a new school nursing information system (a web based system) to its schools. In the past, nurses relied on paper work to collect the data of students and keyed in to their local computer. Then, they used the Microsoft Office 2003 to process their data for regular reports and to reply the requests of the city educational bureau. Now, school nurses can employ the school nursing information system to input and process the health data of students on net. However, the new school nursing information system can benefit nurses, but it will change the nurses' way of work. Nurses need to pay extra efforts to the new system, so they are concerned with tools that enable them to work effectively and efficiently.

Many researchers suggest the importance of information system effectiveness (DeLone & McLean, 1992, Palvia 1996, Seddon, 1997, Seddon., Staples, Patnayakuni & Bowtell, 1999, Hu, Clark & Ma, 2003, Venkatesh, Morris, Davis & Davis, 2003). Since information systems have become indispensable and important resources for organizations, their successful implementation into organizations and the computerization of working procedures are worth further discussion. Dillon, Blankenship, and Crew (2005) assert that to identify nurses' satisfaction and dissatisfaction is critical for effective information technology implementation of the system. However, despite the importance of computerized health records in school nursing practice, few studies have examined the effectiveness of a school nursing information system and the factors influencing nurses' satisfaction with this system. The purpose of this study is to explore user satisfaction with a school nursing information system (SNIS) and to investigate the factors facilitating user satisfaction. The findings could help designers create better information systems and ultimately improve the adoption benefits.

2 CONCEPT BACKGROUND AND HYPOTHESES DEVELOPMENT

Several instruments have been developed and validated to evaluate information system success. For instance, in the 1980s, Bailey and Pearson (1983) designed a 39-item instrument that Ives, Olson, and Baroudi (1983) subsequently revised into 13 brief items, including information on personnel's attitudes, the quality of services, the output of information system, training on the system, and users' participation in the system development. Igbaria (1992) focused on factors that influence user satisfaction, such as age, gender, computer training, and system efficiency.

As SNIS is a new information system implemented for school nurses, the training program and system functions may influence users' satisfaction in regards to whether or not they meet users' demands. Two critical antecedents—perceived usefulness and perceived ease of use—derived from the Technology Acceptance Model (TAM), have been widely used to measure user acceptance when

introducing a new system or technology (Davis, 1989, Bhattacharjee, 2001, Hsu & Chiu, 2004). These are consistent with Vessey's (2002) three major criteria to be considered in designing school nursing information systems: sophisticated functions, user-friendly interfaces, and reasonable technical specifications. Moreover, as previously mentioned, school nurses in Taiwan are responsible for many school nursing practices; as such, their workloads could be a possible factor affecting their satisfaction with the system. Lewis (2002) and Vessey (2002) both argue that the insufficiency of computer competence and unfamiliarity with the information technology may create negative attitudes and overestimated difficulties toward the system adoption among school nurses. Henry and Stone (1994) further indicate that both computer self-efficacy and outcome expectancy have direct and positive impacts on user satisfaction with a medical information system. Therefore, this study will utilize perceived usefulness, perceived ease of use, computer self-efficacy, job relevance, and workload to measure user satisfaction with SNIS.

2.1 Information System Success and User Satisfaction

A successful information system should meet the needs of users and organizations, including the improvement of work productivity, the inspiration of innovation, increased enterprise and customer benefits, and the effectiveness of managerial control (Torkzadeh & Doll, 1999). According to DeLone and McLean (2003), a successful information system means: (1) for system designers, the system is implemented and completed on time, and its functions and operations correspond to the original project; (2) for managers, the system is able to reduce risk and while utilising rare resources effectively; and (3) for users, the information system can help them improve their work performance.

User satisfaction is an important dimension for evaluating information system success through correlation to user behaviours and affective reaction to information technology (Zmud 1979, DeLone & McLean 1992, Henry & Stone 1994). Thus, user satisfaction is appropriate for use as an index to evaluate the system performance according to users' needs and to indicate users' perceptions of the information system, which may effectively reflect users' intentions to adopt the information system (Palvia 1996, Adams and Bond 2000). The outcome of user satisfaction can contribute useful information to improving the information system design and to examining the extent of impacts on organizational decision making, operational efficiency, and benefits (Melone 1990, Wixom & Todd 2005).

2.2 Perceived Usefulness and Perceived Ease of Use

In TAM, Davis (1989) proposes the concepts of perceived usefulness and perceived ease of use as two antecedents to predict users' attitudes toward information technology and its adoption. The definition of perceived usefulness refers to an individual's belief that using a particular technology will enhance his or her work performance. Perceived usefulness has been widely utilized in the information management field. According to Davis, perceived ease of use means that using a particular system would be free of effort. Perceived ease of use, system accessibility, availability, reliability and accuracy are highly related issues (Adamson et al. 2003). Igarria, Guimaraes and Davis (1995) believe that the ease of use of an information system determines the users' acceptance. Mahmood, Burn, Gemoets and Jacquez (2000) point out that users' perceptual value of an information system comes from its supporting degrees for making decisions.

The concepts of perceived usefulness and perceived ease of use are also noted in the research and practice of medical information systems. Dixon (1999) points out that perceived usefulness of medical information systems refers to the relative advantages in terms of cost effectiveness, work performance, patient care quality, and productivity. Users expect the advantages of these systems to improve their work performance in organizations. In regards to perceived ease of use, Dixon proclaims that understandable use, logical concerns, time requirements, and changes are all factors determining users' acceptance of the innovative information system. Moreover, Dillon, Lendin, Crews and Blankenship (2003) assert that the constructs of perceived usefulness and ease of use are critical as

evaluation measures in the early stages of clinical and administrative information system implementation. Hence we propose the following hypotheses:

H1: Perceived usefulness is positively related to user satisfaction with SNIS.

H2: Perceived ease of use is positively related to user satisfaction with SNIS.

2.3 Training

Training is one of the indicators in Bailey and Pearson's (1983) user satisfaction instrument and normally determines users' attitude toward an information system. According to Lewis (2002), the lack of familiarity with information technology is a primary factor that hinders school nurses from adopting school nursing information systems. Amoako-Gyampha and Salam (2004) indicate that the purpose of training is to instruct users how to operate an information system properly and smoothly. More specifically, training plays a key role in influencing the results of information system implementation by introducing users to the basic framework, operative skills, and specific knowledge about the information system (Saga & Zmud, 1994, Palvia, 1996). As Hobbs (2002) points out, computer knowledge and skills dominate nurses' acceptance of a medical information system. Thus, the enhancement of nurses' computer competence will not only improve their work performance but also increase their satisfaction with the system (Wilson, Bulatao & Rascati, 2000). Since SNIS is an innovative tool in school nurses' work, training is likely to extend users' abilities in using the system. Furthermore, it is expected to decrease school nurses' resistance to the system while increasing their acceptance and satisfaction with it, the following hypothesis is proposed:

H3: Training is positively related to user satisfaction with SNIS.

2.4 Computer Self-Efficacy

The notion of self-efficacy stems from cognitive psychology, referring to an individual's belief that he or she has the ability to accomplish a given task and further affect his or her behaviour and decisions (Bandura, 1986; 1997). According to Bandura, when individuals believe they have the ability to carry out a given task successfully, they tend to be satisfied with the outcome of their behaviour. Compeau and Higgins (1995a) extended the concept of self-efficacy to the field of information technology, proposing the concept of Computer Self-Efficacy (CSE). CSE means that individuals believe they have the ability to use a computer or an information system well in specific situations (Compeau & Higgins, 1995b; Marakas, Yi & Johnson, 1998). A number of researchers have found that individuals' confidence in applying information technologies to accomplish specific tasks influences their acceptance of the information system. Henry and Stone (1994) indicated that previous computer experience, management support, and ease of system operation impact users' satisfaction with a medical information system through CSE. In addition, Dillon et al. (2003) found that the level of nursing education, computer experience, and computer competence predicted the self-efficacy in regards to system usage and further affected users' perceptions of the system adoption. Thus we propose the following hypothesis:

H4: Computer self-efficacy is positively related to user satisfaction with SNIS.

2.5 Job Relevance

Job relevance refers to how an information system assists users to familiarize them with their work environments and features of their tasks by enabling people to realize their abilities and then accelerating their efficiency and effectiveness in work. Eventually, the information system becomes an indispensable tool in users' jobs. Thompson, Higgins and Howell (1991) revealed the importance of fit between the use of an information system and users' job requirement, focusing on the promotion of work performance, improvement of work quality, and reduction of operational efforts. Goodhue and Thompson (1995) demonstrated that, when an information system is highly relevant to users' jobs,

users express higher satisfaction toward the system. Accordingly, an information system should be designed to meet users' job-related needs.

The notion of fit between the information system and work procedures is an important dimension that influences nurses' acceptance and satisfaction with the system (Ammenwerth, Iller & Mahler, 2003, Moody, Slocumb, Berg & Jackson, 2004). Stricklin, Bierer and Struck (2003) indicated that sufficient time for professional tasks, opportunities to improve patient care, easier working procedures, paperwork reduction, and the quality of nurse-patient interaction are all crucial to the nurses' attitudes toward information technology adopted in their daily work routine. Hence, SNIS is anticipated to be functionally related to nurses' jobs and to help school nurses familiarize themselves with the operation in order to increase their work performance and productivity in practice. We propose the following hypothesis:

H5: Job relevance is positively related to user satisfaction with SNIS.

2.6 Workload

Workload has been widely discussed regarding human resource management in an organization. Workload refers to the amount of effort one needs to accomplish a task. McNeese-Smith (1999) studied nursing staffs' job satisfaction and job dissatisfaction, indicating that the cognitive workload impacted job satisfaction. Adams and Bond (2000) investigated 834 nurses in Britain, demonstrating that cognitive workload is an important factor influencing work satisfaction as well. Healy and McKay (2000) examined work pressure facing Australian nurses; they found that such pressure is positively related to nurses' emotions at work. Greater work pressure facing nursing staffs leads to less satisfaction (Greenglass & Burke, 2001). In Taiwan, heavy workload is one factor of the work stress and a reason to reject continuing education (including e-learning) (Hsu, Kung, Huang, Ho, Lin & Chen; 2007; Yuab, Chena, Yanga, Wanga & Yenb, 2007).

The workload in the nurse's practice relate to three factors. First, many assignments or tasks must be completed simultaneously. Second, the workload is affected by the task itself; for instance, an unfamiliar or difficult work results in an unwillingness to finish it. Finally, getting along with colleagues and lacking of supports from others further affect workload (Gaudine, 2000). In the context of Taiwan, a single nurse is responsible for all relevant nursing tasks in the school, including dealing with students' wounds or diseases as well as administrative tasks. Introducing SNIS may further increase nurses' work through training, typing, and computer skill needs. Thus, workload may influence school nurses' acceptance of and satisfaction with the nursing information system, the following hypothesis is proposed:

H6: Workload is negatively related to user satisfaction with SNIS.

3 RESEARCH METHODOLOGY

3.1 Data collection

A survey design was adopted. The samples are nurses working in a primary or high school of a city in Taiwan. In total, 150 questionnaires were distributed to all nurses in a meeting which is held by the education bureau. 106 returned questionnaires were examined by researchers, with one being dropped due to incomplete responses. Thus, 105 completed and usable questionnaires were used for statistical analysis, representing a response rate of 70.0 %.

3.2 Instrument development

The survey questionnaire contains three parts: general demographical questions, one open-ended question and perceptual scales of each construct. Table 1 provides a summary of the 7 constructs and 29 prompts. Except for computer self-efficacy, the other six constructs are on a seven-point Likert

scale ranging from strongly disagree (= 1) to strongly agree (= 7). Computer self-efficacy is measured using a percentage scale comprised of 10-point increments, ranging from 0 percent (not at all confident) to 100 percent (totally confident). As for the open-ended question, the respondent was free to write down any ideas about SNIS.

Construct	Number of items	Source
Perceived usefulness	6	Davis, 1989
Perceived ease of use	6	Davis, 1989
Training	4	Nelson <i>et al.</i> , 1987
Computer self-efficacy	4	Compeau and Higgins, 1995b, Marakas <i>et al.</i> , 1998
Job relevance	5	Thompson, 1991
Workload	4	McNeese-Smith, 1999; Adams and Bond, 2000; Gaudine, 2000
User satisfaction	4	Ives <i>et al.</i> , 1983; DeLone and McLean, 1992

Table 1. *Constructs and measurements*

3.3 Ethical considerations

The project was approved by the education agency of the city government and permission was granted to distribute the questionnaire to the school nurses. The questionnaire was started with an introductory paragraph outlining the background and purpose of the survey and a statement that the responses would be coded to ensure anonymity.

4 DATA ANALYSIS

The Microsoft Excel was also used to analyze the demographics of participants. The regression analysis was used to test the significance of the hypotheses. In addition, construct validity and reliability were tested an exploratory factor analysis by the SPSS.

4.1 Construct Validity and Reliability

An exploratory factor analysis was first performed to examine the construct validity. Using the Principle Components Analysis method with Varimax rotation, all items loaded on their expected constructs were greater than the threshold loading of 0.55 at samples over 105 (Hair, Anderson, Tatham & Black, 2002). A Cronbach’s alpha coefficient was assessed to examine the internal consistency of the items for each construct. The Cronbach’s alpha for all 7 constructs were above the 0.7 recommended by Nunnally and Bernstein (1994). Thus the validity and reliability for 7 constructs are acceptable in present research.

4.2 Participant Demographics

Participant demographics are the first part analysis. Table 2 illustrates the sample demographic statistics. Among the 105 respondents, all were women, and more than half (n = 72, 68.6%) were younger than 45 years old. The majority (n = 87, 82.9 %) had completed an associate or baccalaureate degree, and most (n = 44, 41.9 %) had worked in nursing for at least 2 but less than 10 years. Approximately half (n = 54, 51.4%) had 3 to 7 years of computer experience. In terms of school level and students served by the respondents, the majority of nurses (n = 64, 61%) came from a primary school, and over half (n =60, 57.1%) were responsible for over 900 students (but less than 1,500).

Characteristic	Category	Frequency	Percentage (%)
Sex	Female	105	100
Age (years)	21-30	9	8.6
	31-35	21	20
	36-40	26	24.8
	41-45	16	15.2
	> 45	33	31.5
Level of education	High school diploma	6	5.7
	Associate degree	38	36.2
	Baccalaureate degree	49	46.7
	Master's degree	12	11.4
Working experience (years)	< 1	21	20
	2-5	21	20
	6-10	23	21.9
	11-15	9	8.6
	16-20	27	25.7
	> 20	7	6.7
Experiences of the computer use (years)	< 2	8	7.7
	3-4	17	16.2
	5-7	37	35.2
	8-10	17	16.2
	> 10	26	24.8
School level	Preschool	4	3.8
	Primary school	64	61
	Junior high school	21	20
	Senior high school	16	15.2
Student numbers served	≤ 300	30	28.6
	301-900	16	15.4
	901-1100	37	35.2
	1101-1300	12	11.4
	1301-1500	11	10.5
	≥1501	22	21

Table 2. Demographic characteristics of the samples

4.3 Hypotheses Testing

In order to validate the hypothesized relationships among the research constructs, multivariate regression analysis method was performed. Multicollinearity was examined in the regression analysis by returning the Variance Inflation Factor (VIF) value. VIFs for all constructs were below the common cut off threshold of 10, indicating that multicollinearity is not a concern.

The six hypotheses were tested using the standardized coefficient (see Table 3). The coefficients of perceived usefulness (H1), perceived ease of use (H2), training (H3) and workload (H6) were significant, indicating their impact on user satisfaction with SNIS. However, computer self-efficacy (H4) and job relevance (H5) were not significantly related to user satisfaction. The total variance accounted for user satisfaction was 58.1% (adjusted R-square). These results will be discussed in more detail in the next section.

Hypotheses and Independent Variables	Dependent Variable (User satisfaction)			
	Standardized Coefficients (Beta)	Significance level	VIF	Results
H1: Perceived usefulness	0.413	0.000**	1.78	Supported
H2: Perceived ease of use	0.329	0.000**	1.43	Supported
H3: Training	0.161	0.069*	1.80	Supported
H4: Computer self-efficacy	0.105	0.178	1.53	Not supported
H5: Job relevance	-0.111	0.100	1.53	Not supported
H6: Workload	-0.121	0.073*	1.55	Supported
R-Square	59.3%			
Adjusted R-Square	58.1%			
* $p < 0.1$, ** $p < 0.05$				

Table 3. Hypotheses testing results

5 DISCUSSION

Results reveal that perceived usefulness, perceived ease of use, training and workload significantly influence user satisfaction. Perceived usefulness and perceived ease of use are two factors frequently utilised to explain and predict users’ intention and behaviours in adopting an information system (Legris, Ingham & Colletette, 2003). In the current study, it is evident that the respondents expect their efforts to adopt SNIS to lead to improved school nursing practice. Moreover, the respondents’ suggestions regarding the system interfaces and functions prove that perceived ease of use is particularly important. For example, some school nurses underscored the importance of emergent issues such as interfaces, layout of relevant items, data conversion from legacy systems, and data uploading flexibility. From these respondents’ opinions, SNIS still needs improvement in regards to interfaces, functions, and operations in order to increase usefulness and ease of use.

The current study’s results regarding the importance of training are consistent with previous research. Wilson *et al.* (2000) assert that training programs will reduce the nurses’ resistance to the information system. Through the training programs, school nurses are able to understand the functions, procedures, and characteristics of the information system. Training programs are believed to promote users’ operative skills, increase users’ satisfaction with SNIS, and improve users’ work performance both efficiently and effectively. Consequently, school nurses can accept the new system with confidence while simultaneously increasing their satisfaction with the information system. In addition, workload is an obvious factor when a new system is implemented as workers are usually exposed to ineffectiveness and burden. Similarly, most school nurses in our study agreed that workload will influence their willingness to adopt the information system. Several respondents suggested that the adoption of SNIS should not be considered until it is integrated in the procedures so as not to increase their workload.

Although job relevance and computer self-efficacy did not demonstrate a significant statistical effect on users’ satisfaction, certain issues should be discussed. According to Bandura (1986), people’s self-efficacy will be improved after operating the new technology practically, even if they might doubt their ability in the beginning. Guskey (1988) also suggests that an innovation might initially bring some negative impacts to users. Once they have become accustomed to the new technology, users’ self-efficacy will gradually improve. Therefore, although computer self-efficacy does not indicate a significant effect on user satisfaction in the current study, it is an important factor in user satisfaction after sufficient training and practical operation. With regard to job relevance, 90.5% of the respondents agreed that SNIS is important and necessary for school nursing (12.4% somewhat agree; 34.3% agree; 43.8% strongly agree). Although they agreed that job relevance are important, this factor did not indicate significance. One possible explanation for this may be that those respondents have been forced to use SNIS by the city government despite their higher or lower personal evaluation.

6 CONCLUSIONS

In the era of information economy, information systems have become the basis of daily routines for school nurses. Information processing affairs are an important part of nursing work. However, nurses usually need to deal with numerous tasks. Introducing a new system may decrease school nurses' workload while adding to in regards to learning new skills and changing work processes. Therefore, it is more important to determine how to implement an information system effectively while minimizing the effort needed to learn the system, thereby increasing their work efficiency and effectiveness.

This study investigated school nurses' satisfaction as users of a nursing information system as well as the potential factors affecting this satisfaction. Research findings indicated that perceived usefulness, perceived ease of use, training and workload significantly influence school nurses' satisfaction with the nursing information system. As only one school nurse deals with all students' health problems and collects all relevant data in a school, most school nurses in this study expected it to be easy to overcome the usage barrier with SNIS, assisting them to facilitate their work practice and improve their performance. Thus, a user-friendly interface and the usefulness of the information system are of most concern for the participants. Moreover, sufficient training programs are essential for users to familiarize themselves with the functions of the information system and be able to operate the system with confidence. These results provide implications for system designers, who should note users' needs and their understanding of the information system in order to improve their work performance and reduce their workload. Meanwhile, the integration of interfaces and the convenience of the system operation should receive more attention as well (Ammenwerth, Iller & Mahler, 2006). Finally, school administrators should understand that, when introducing a new system, they should involve practical users in the development processes so they can share their experiences.

There are some limitations in present study. We collected the samples in a city of Taiwan, and investigated school nurses' satisfaction as users of a nursing information system as well as the potential factors affecting this satisfaction. To generalize the findings to others systems or populations, researchers should consider the differences with this study such as the functions of system and the context of samples. For future search, a longitudinal study to investigate the nurse usage of the SNIS system might provide more insights. In addition, this study has identified several important factors of user satisfaction which may apply to other fields.

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