

Nurses' Satisfaction With Using Nursing Information Systems From Technology Acceptance Model and Information Systems Success Model Perspectives

A Reductionist Approach

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Nursing information systems can enhance nursing practice and the efficiency and quality of administrative affairs within the nursing department and thus have been widely considered for implementation. Close alignment of human-computer interaction can advance optimal clinical performance with the use of information systems. However, a lack of introduction of the concept of alignment between users' perceptions and technological functionality has caused dissatisfaction, as shown in the existing literature. This study provides insight into the alignment between nurses' perceptions and how technological functionality affects their satisfaction with Nursing Information System use through a reductionist perspective of alignment. This cross-sectional study collected data from 531 registered nurses in Taiwan. The results indicated that "perceived usefulness in system quality alignment," "perceived usefulness in information quality alignment," "perceived ease of use in system quality alignment," "perceived ease of use in information quality alignment," and "perceived ease of use in service quality alignment" have significantly affected nurses' satisfaction with Nursing Information System use. However, "perceived usefulness in service quality alignment" had no significant effect on nurses' satisfaction. This study also provides some meaningful implications for theoretical and practical aspects of design.

KEY WORDS: Alignment, Information systems success mode, Nursing information system, Technology acceptance model

Nursing information systems (NISs) provide technological assistance to nursing care services and are expected to create a significant improvement in the efficiency and quality of nursing care and nurses' information management.^{1,2} Thus, understanding the factors that influence nurses' use of NIS and designing better systems to create benefits for use of this technological device are important issues.

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Previous studies have shown that healthcare professionals' behaviors regarding the use of information systems are influenced by the factors of personal perception and technological functionality through theoretical perspectives, such as the Technology Acceptance Model (TAM)³ and Information Systems Success Model (ISSM).⁴ For instance, previous researchers have adopted the Davis-developed TAM to measure nurses' behavioral intention and actual use of healthcare information systems.⁵⁻⁷ They found that TAM has the power to explain technological acceptance and users' satisfaction as regards NIS implementation. Other studies have applied the theory of ISSM to explore the characteristics of success as regards healthcare technological functionality.⁸⁻¹⁰ Their work verified that ISSM is suitable for the evaluation of successful technological capability as regards the information processing requirements of healthcare organizations. These studies help achieve a more systematic understanding of individual and technological factors that influence users' behavior and performance with healthcare information systems from a holistic perspective of human-computer interactions.

As mentioned previously, NISs are implemented so that nurses can provide more effective and safe healthcare services. Previous literature indicates that performance and effectiveness are driven by the internal consistency or alignment between various patterns of relevant contextual, structural, and resource factors.^{11,12} That is, the results of high alignment in human-computer interactions can enhance the performance of individuals and organizations. On the basis of information processing view¹³ statements, an alignment between the users' needs and technological functionality of information processing, when achieved, can facilitate optimal performance of individuals and organizations.¹⁴ In this study, the concepts of perceived usefulness and perceived ease of use from the TAM were conceptualized as a contrast of user needs and expectations with actual performance perceptions. System quality, information quality, and service quality of ISSM were conceptualized as a contrast of technological functionality with success characteristics of NISs.

Previous researchers have suggested that, on the observation of alignment, one not only should consider the holistic perspective of any co-alignment between two or more

dimensions and how they influence performance but also must regard their bivariate patterns in a reductionist perception of alignment.¹⁵ This is because the degree of holistic alignment is determined by bivariate patterns in detail. Therefore, it is difficult for nursing departments to choose the correct NIS for enhancing nursing performance without understanding the impact of the bivariate pattern's alignment between nurses' perceptions and technological capabilities on nurses' satisfaction with NIS use.

Although NISs have been studied widely in the past decades, there is no limited literature that investigates the performance of NIS implementation from a reductionist perspective of alignment. To improve the understanding of this issue, the current study was undertaken to explain how performance is affected by the alignment of human-computer interactions through bivariate patterns of interlinkages between users' perceptions and success characteristics of technological functionality. This study used concepts from the TAM (ie, perceived usefulness and perceived ease of use) and ISSM (ie, system quality, information quality, and service quality) as two independent variables and considered the alignment of TAM and ISSM to be a latent variable for the various antecedent factors of performance with NIS use. Since an NIS is a necessary device in a nurse's duties, the implementation of NIS is not based on individual desires. Thus, this study adopted nurses' satisfaction with NIS use as a dependent variable to reflect the performance of the alignment of TAM and ISSM. As Petter and Fruhling⁹ documented, healthcare professionals' satisfaction is often used to evaluate a hospital information system's success or failure in the field of healthcare informatics.

This study attempted to examine the influences of co-alignment between bivariate patterns of the TAM and the ISSM on satisfaction with NIS use. Structural equation modeling via Smart PLS version 2.0¹⁶ (SmartPLS GmbH, Boenningstedt, Germany) was used to empirically test the research model and all hypothesized relations. The study aimed to provide insight into the effects of alignment between individual perceptions and success characteristics of technological functionality on users' satisfaction to better understand the determinants of NIS implementation.

THEORETICAL BACKGROUND

Technology Acceptance Model

The TAM is an information systems theory that explains computer use behavior and was developed by Davis.³ In the TAM, information technologies' adoption and implementation are determined by personal behavioral intention. The model is composed of six main constructs: external variables, perceived usefulness, perceived ease of use, attitude toward use, behavioral intention to use, and actual system use.³ The model also states that users' acceptance of a

specific information system is believed to be determined by their experiences and perceptions of use and postulates that perceived usefulness and ease of use are the two major beliefs that explain variance in user intentions.^{3,5} In the context of nursing informatics, the literature verified that both factors provide valid and reliable measures that predict nurses' implementation and acceptance of healthcare information technologies.^{5-7,17} Therefore, this study proposed that the perceived usefulness and perceived ease of use of TAM are a representation of human factors in the activities of human-computer interactions with NIS use. In this study, perceived usefulness is defined as a nurse's subjective evaluation of whether using an NIS will improve the performance of individual work.¹⁷ Perceived ease of use was defined as a nurse's subjective evaluation of whether using an NIS will require much effort.¹⁷

Information Systems Success Model

The ISSM is a comprehensive perspective of the information systems model used to measure the determinants of effective characteristics of technological functionality and was developed by DeLone and McLean.⁴ DeLone and McLean postulated six components of information technology success, including system quality, information quality, service quality, system use, user satisfaction, and net benefits, from a systematic review of 180 studies estimating information technology success.^{4,18} The model is considered to be one of the most influential theories in the contemporary management information systems (MIS) field and proposes that system, information, and service qualities are three major characteristics of technological functionality and affect users' satisfaction with a specific information technology.^{4,17} The model has been applied to measure the technological capabilities of information systems in healthcare.^{8-10,17} Thus, this study proposed that system, information, and service qualities are a reflection of the successful characteristics of technological functionality in the activities of human-computer interactions with NIS. In the current study, system quality was defined as the strength of the NIS by itself.¹⁷ Information quality was defined as information ambiguity, legibility, and uncertainty of the NIS outcome.⁹ Service quality was defined as the level of technical support and service.¹⁷

User Satisfaction

Nurses' satisfaction with NIS is an important nursing informatics issue for management because it is closely associated with the performance of individuals and organizations,¹⁹ which will influence the quality of nursing care and patients' safety. Selnes²⁰ defined satisfaction as a concept that refers to comprehensive evaluations of feelings and attitudes by one party with respect to another. Satisfaction has been tested on the basis of professional medical implementation and

acceptance of healthcare information systems in some empirical studies.^{9,10,19,21} They have consistently found that user satisfaction is based on technological functionality and user perceptions of usefulness and ease of use. This study assumed that user satisfaction with information systems plays a critical role in measuring the performance of human-computer interactions in the context of nursing management. In this study, nurses' satisfaction with NIS use was defined as how nurses' perceptions of the NIS met or exceeded their expectations.¹⁹

Alignment

Alignment is defined as a mechanism by which the effects of intrinsic individual perceptions about an external environment or system interact to affect performance in general.²² The perspective of alignment has been adopted by previous empirical studies in relation to MIS research, which found that alignment affects the actual performance outcome.^{23,24} In this study, alignment was defined as the degree of fit between nurses' perceptions and NIS' technological functionality to achieve better satisfaction.²³

Alignment in matching is one of several alignment concepts.^{15,25} Alignment in matching is conceptually a selection approach and the result of natural choice, as well as being applicable to the reductionist perspective.²⁶ It is a theoretically defined match between two or more related variables without necessarily conceding a criterion variable.²⁶ The matching approach is appropriate for specifying bivariate alignment and was adopted to specify the various functional forms between any two related variables.²⁷ The deviation scores approach is the critical method used to examine alignment as matching.²⁵ In terms of the deviation scores analysis, alignment is determined by finding the absolute difference between the standardized score of two variables.²⁷ As discussed, this study adopted a deviation scores approach as an alignment evaluation method. The resulting alignment variable is then tested for performance (ie, satisfaction) affects.

RESEARCH AND HYPOTHESES

This study proposed a research model in the reductionist perspective of alignment with human-computer interactions. Six constructs are incorporated, such as perceived usefulness; perceived ease of use; system, information, and service qualities; and user satisfaction, based on the theoretical foundations of the TAM and the ISSM. In this model, the two concepts of TAM, perceived usefulness and perceived ease of use, are used as two intrinsic constructs of the reductionist perspective in users' perceptions. Conversely, the three concepts from the ISSM—system, information, and service qualities—are used as quality characteristics of a reductionist perspective as regards technological functionality. Previous studies have verified that the two perceptual concepts of

TAM are determined by the three quality concepts of ISSM^{17,28} in health informatics.

Many studies have found that beliefs about quality and self-perception of an intrinsic benefit affect end-user computing satisfaction.^{5–10,17} User satisfaction can be considered as a reflection of universal acceptance and use of technology. Conversely, bivariate alignment between technological capabilities and task needs also has been verified to make a great contribution to the effect on users' performance.^{12,23,26} That is, users determine the performance of information technology on the basis of positive perceptions of the co-alignment of human factor–computer capability. In the research context, this study assumed that NIS had a greater level of alignment between users' perceptions (TAM) and technological functionality (ISSM) and will consequently show a greater level of nurses' satisfaction with NIS use. Seven hypotheses based on the discussion of these concepts are shown in Table 1.

Figure 1 shows the research model as depicted in this study.

METHODOLOGY

Instrument Development

There were two parts to the questionnaire; one gathered the demographic characteristics of participants such as sex, age, NIS use, and experience. The second part collected participant evaluations of perceived usefulness, perceived ease of use, system quality, information quality, service quality, and user satisfaction with the NIS. Formulation of the initial items of each construct was developed from the existing literature in this field and informal interviews with three senior registered

Table 1. Summary of Hypotheses

Hypothesis	Relationship
H1	The alignment between TAM and ISSM has a significantly positive association with nurses' satisfaction.
H1-a	The alignment between perceived usefulness and system quality has a significantly positive association with nurses' satisfaction.
H1-b	The alignment between perceived usefulness and information quality has a significantly positive association with nurses' satisfaction.
H1-c	The alignment between perceived usefulness and service quality has a significantly positive association with nurses' satisfaction.
H1-d	The alignment between perceived ease of use and system quality has a significantly positive association with nurses' satisfaction.
H1-e	The alignment between perceived ease of use and information quality has a significantly positive association with nurses' satisfaction.
H1-f	The alignment between perceived ease of use and service quality has a significantly positive association with nurses' satisfaction.

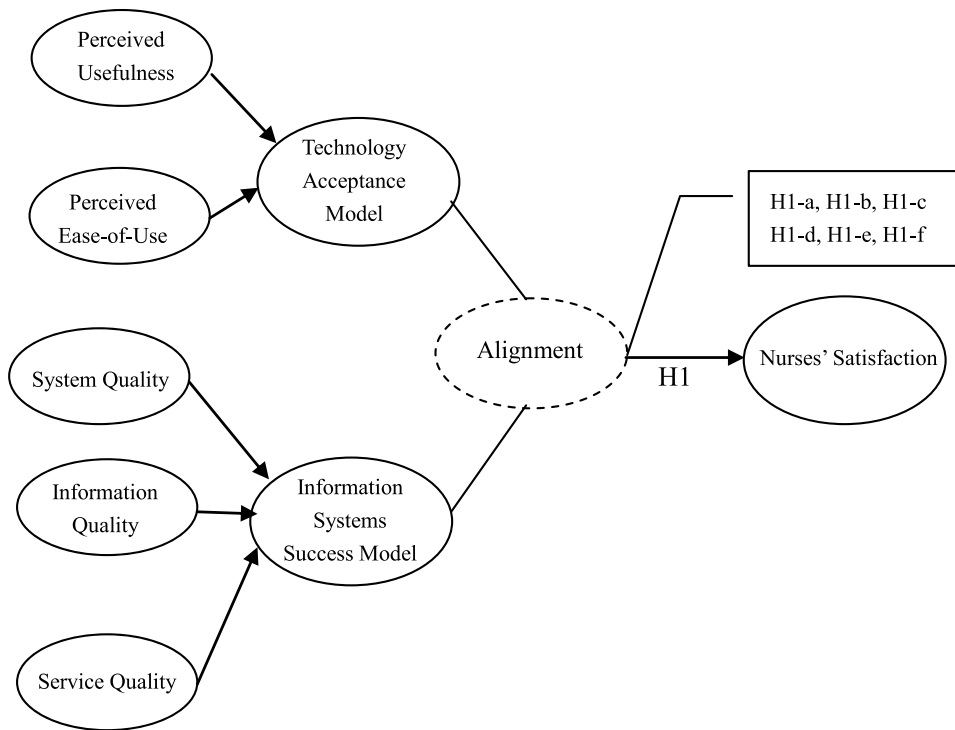


FIGURE 1. Research model. Note: The research model was adapted for use with permission from both previous authors.^{3,4}

nurses and a faculty member of a department of healthcare management at a university. Recommendations from the registered nurses and faculty regarding the questionnaire's item progression and word choice were solicited to ensure that the questionnaire was easy to understand. Items for measuring perceived usefulness and perceived ease of use of TAM were adapted from Davis.³ System, information, and service quality measures were adapted from Petter and Fruhling.⁹ Items to measure satisfaction with NIS use were adapted from Chen et al.²⁹ A 5-point Likert scale was used for all questionnaire items, with 1 being “strongly disagree” and 5 being “strongly agree.”

Straub³⁰ suggested that instrument validation is essential because validity may not persist in other contexts. Thus, pretests were conducted with 30 registered nurses before the questionnaire was distributed to the target population.

Reliability and Validity

This study adopted confirmatory factor analysis to measure the reliability and validity of multi-item scales. All the values of composite reliability were greater than the threshold of 0.7, and the average variance extracted (AVE) exceeded 0.5³¹; composite reliability values ranged from 0.794 to 0.889, and the AVE values ranged from 0.533 to 0.714, indicating that all constructs had good reliability. Correlation values and AVE square root values were compared to evaluate discriminant validity. All items have significant factor

loadings of at least 0.7; they ranged from 0.733 to 0.881. The results implied that the instrument has a favorable outcome for convergent validity.³² Cronbach α ranged from .748 to .914, showing that all values were greater than the minimum requirement of Cronbach α coefficients at .7.³² As presented in Table 2, the results indicated that all constructs had good reliability. Table 3 shows the AVE square root values on the diagonal line, which surpassed the values on the nondiagonal line that were correlation coefficients between interconstruct correlations. The results implied that the measurement model has acceptable convergent validity and discriminant validity.³¹

The variance inflation factor of the research model ranged from 1.833 to 5.070. The variance inflation factor values were less than 10, which implied no multicollinearity in the research model.³³

Data Collection

Data were collected from six hospitals in Taiwan. These hospitals implemented NIS to support the quality of nursing services, patient safety, and efficiency in administrative affairs. The participants were selected using a purposive sampling approach; all participants had previously used NIS. The survey was conducted for 9 weeks, from October to December 2014. The questionnaires were distributed to 800 registered nurses. A total of 557 questionnaires were returned. Among them, 26 were incomplete. The valid sample size was 531,

Table 2. The Results of Items Used to Measure the Constructs

Construct	Items	Factor Loadings	Composite Reliability	Average Variance Extracted	Cronbach α
Perceived usefulness (PU)	PU1	0.868	0.861	0.673	.831
	PU2	0.808			
	PU3	0.783			
Perceived ease of use (PEU)	PEU1	0.778	0.794	0.562	.878
	PEU2	0.737			
	PEU3	0.733			
System quality (SysQ)	Sys Q1	0.881	0.889	0.668	.848
	Sys Q2	0.823			
	Sys Q3	0.795			
	Sys Q4	0.766			
Information quality (IQ)	IQ1	0.830	0.850	0.653	.854
	IQ2	0.815			
	IQ3	0.779			
Service quality (SerQ)	Ser Q1	0.868	0.882	0.714	.748
	Ser Q2	0.845			
	Ser Q3	0.821			
Nurses' satisfaction with NIS use (NSNU)	NSNU1	0.873	0.861	0.673	.914
	NSNU2	0.804			
	NSNU3	0.782			

with a response rate of approximately 66.4%. Table 4 shows the demographic data for the respondents. Hair et al³² suggest that a descriptive statistics analysis of the sample size must ensure that the minimum number is from 100 to 150. The sample size was 531 and met the sample size requirement. To test for the sample selection bias, there was a comparison of selected items from the early and late respondents that comprised 25% of all responses, as Armstrong and Overton³⁴ recommended. The results of the test demonstrated no significant difference between the two groups; this may imply an absence of a nonresponse bias in the research data. To estimate same-source bias, Harman's one-factor test was used to detect the presence of common method variance.³⁵ This study identified three constructs with eigenvalues greater than 1, with the first construct accounting

for 34.1% of the total variance. The results indicated no problem with common method variance in this study.

RESULTS

Structural Model Assessment

Since partial least squares could not provide a measure of the goodness of fit of the model, it was thus found to be appropriate to use the R^2 value to be a measure of goodness of fit between the model and data, as suggested by Bentler and Bonett.³⁶ The proportions of the R^2 value were 31.7% for nurses' satisfaction. Maria Correia Loureiro et al³⁷ stated that an R^2 value greater than 10% was acceptable; this value will indicate the goodness of fit of the model. In the study, the R^2 value was 32.6%, and, thus, the result indicated that the research model is a model of goodness of fit. Moreover,

Table 3. Construct Correlations and Square Roots^a of AVE

Constructs	Mean (SD)	PU	PEU	SysQ	IQ	SerQ	NSNU
Perceived usefulness (PU)	3.660 (0.779)	0.820					
Perceived ease of use (PEU)	3.788 (0.980)	0.364 ^b	0.750				
System quality (SysQ)	3.767 (0.618)	0.482 ^b	0.203 ^c	0.817			
Information quality (IQ)	3.707 (0.724)	0.477 ^b	0.259 ^c	0.549 ^b	0.808		
Service quality (SerQ)	3.831 (0.503)	0.489 ^b	0.159 ^d	0.617 ^b	0.568 ^b	0.845	
Nurses' satisfaction with NIS use (NSNU)	3.656 (0.794)	0.500 ^b	0.232 ^c	0.653 ^b	0.578 ^b	0.683 ^b	0.821

^aThe square root of AVE for each latent construct is displayed in bold.

^b $P < .001$.

^c $P < .01$.

^d $P < .05$.

Table 4. Demographic Characteristics of Participants (N = 531)

Measure	Items	Frequency	%
Sex	Male	37	7.0
	Female	494	93.0
Age, ^a y	21–30	216	40.7
	31–40	159	29.9
	41–50	101	19.0
	>51	43	8.1
	Miss	12	2.3
Job position	Supervisor	127	23.9
	Staff	404	76.1
NIS use experience, ^b y	<2	11	2.1
	2–5	89	16.8
	6–9	271	51.0
	>10	160	30.1

^aMean (SD), 35.7 (8.4)years.

^bMean (SD), 8.2 (4.3)years.

the co-alignment of TAM and ISSM has a significant influence on nurses' satisfaction with NIS use ($\beta = 0.249$, $P < .001$). Hence, hypothesis 1 was supported.

The Reductionist Perspective of Alignment as Matching

Previous researchers have suggested that using a matching approach is appropriate for specifying bivariate alignment; it was used to specify the various functional forms between two related variables.²⁵ Moreover, the most commonly adopted technique for measuring the matching perspective is the deviation score method.³⁸ This method has been widely used in various fields of management science research.^{15,25,38}

Deviation score analysis is based on a mean premise that the “absolute difference between the standard scores of two variables presents a lack of alignment,” as Venkatraman³⁹ stated. That is, alignment or lack of alignment is demonstrated by one independent variable being deducted from another. Thus, the author conducted linear hierarchical regression analyses to assess the incremental contribution of the proposed independent variables to the predicted nurses' satisfaction.

The usefulness of an antecedent variable in explaining the variance in performance was determined from the increment in R^2 , after each given variable was added to the regression equation.⁴⁰ Hence, the hierarchical procedure required that the independent variables were integrated into the regression model in a specific order. In this study, the performance factor was initially regressed on two variables of TAM (perceived usefulness and perceived ease of use). Next, the three variables of ISSM (system, information, and service qualities) were added to estimate their incremental contribution to the performance factor. Finally, the TAM-ISSM of the alignment variable was added to the prior regression equation for testing nurses' satisfaction.

The results of the hierarchical regression analysis are demonstrated in Table 5. The independent variable is an important predictor of performance and is indicated by a ΔR^2 symbol; it demonstrates the increments in the unique variable that it explains. The table shows that the perceived usefulness in system quality alignment ($\beta = -0.201$, $P < .01$), perceived usefulness in information quality alignment ($\beta = -0.316$, $P < .001$), perceived usefulness in service quality alignment ($\beta = -0.140$, $P > .05$), perceived ease of use in system quality alignment ($\beta = -0.187$, $P < .001$), perceived ease of use in information quality alignment ($\beta = -0.293$, $P < .001$), and perceived usefulness in service quality alignment ($\beta = -0.166$, $P < .05$) are all significant determinants (adjusted $R^2 = 0.317$, $F = 21.177$, $P < .001$) of nurses' satisfaction with NIS use. Thus, hypothesis 1-a, 1-b, 1-d, 1-e, and 1-f were supported; however, hypothesis 1-c was not supported by the tests. The total of results of hypothesis testing is shown in Table 6.

Table 5. The Results of Hierarchical Regression Analysis

Independent Variable	Dependent Variable: Nurses' Satisfaction		
	Step 1	Step 2	Step 3
Technology Acceptance Model			
Perceived usefulness	0.237 ^a	0.203 ^b	0.188 ^c
Perceived ease of use	0.243 ^a	0.210 ^a	0.192 ^b
Information Systems Success Model			
System quality		0.272 ^a	0.243 ^a
Information quality		0.227 ^b	0.201 ^b
Service quality		0.170 ^c	0.044, NS
Alignment			
Perceived usefulness, system quality alignment			-0.201 ^b
Perceived usefulness, information quality alignment			-0.316 ^a
Perceived usefulness, service quality alignment			-0.140, NS
Perceived ease of use, system quality alignment			-0.187 ^a
Perceived ease of use, information quality alignment			-0.293 ^a
Perceived ease of use, service quality alignment			-0.166 ^c
R²	0.204	0.242	0.330
ΔR^2		0.038	0.088
Adjusted R²	0.199	0.235	0.317
F	38.055 ^a	26.446 ^a	21.177 ^a

Abbreviation: NS, not significant.

^a $P < .001$.

^b $P < .01$.

^c $P < .05$.

Table 6. The Results of Research Hypotheses

Hypotheses	Result
H1: The alignment between TAM and ISSM → nurses' satisfaction	Supported
H1-a: The alignment between perceived usefulness and system quality → nurses' satisfaction.	Supported
H1-b: The alignment between perceived usefulness and information quality → nurses' satisfaction.	Supported
H1-c: The alignment between perceived usefulness and service quality → nurses' satisfaction.	Not supported
H1-d: The alignment between perceived ease of use and system quality → nurses' satisfaction.	Supported
H1-e: The alignment between perceived ease of use and information quality → nurses' satisfaction	Supported
H1-f: The alignment between perceived ease of use and service quality → nurses' satisfaction.	Supported

Moreover, the value of $\Delta R^2 = 0.088$ in step 3 is better than $\Delta R^2 = 0.038$ of step 2 since it hints that there is a better explanatory power of variances of the various alignment variables on nurses' satisfaction.

DISCUSSION

This study proposed a research model that is based on TAM by Davis³ and DeLone and McLean's⁴ ISSM to provide an insight as to how the alignment between users' perception and technological functionality affects users' satisfaction in the context of nursing informatics through a reductionist perspective of alignment as matching. As discussed previously, the study revealed the following three important results: (1) the alignment of nurses' perception-technology capability is a critical determinant of their satisfaction with using NIS; (2) the alignment between perceived usefulness and two subconstructions of ISSM, system quality and information quality, significantly affects nurses' satisfaction, while service quality does not; and (3) the alignment between perceived ease of use and the three subconstructions of ISSM significantly affected nurses' satisfaction. On the basis of these findings, this study provides some theoretical and practical implications for future research in the following section.

Implications for Theory and Practice

As regards the theoretical implications, although literature in this field has used user satisfaction to measure the performance of information systems use in the health informatics field,^{9,10,19} few studies have been conducted to examine how user satisfaction perceives the alignment of human-computer interaction. This study is one of the first studies to examine the alignment between user perceptions and technological functionality in the use of NIS. This is one of the main contributions of this study. Second, TAM and ISSM have been widely used to understand the intrinsic and extrinsic factors of information systems use in the health information

management field. These studies have only identified the relations between TAM and ISSM from a holistic perspective.^{17,28} However, in this study, the author proposes the perceived usefulness and perceived ease of use of TAM as human factors and system quality, information quality, and service quality of ISSM as the technological factors used to find an insight on the effect of bivariate alignment of human-computer interactions on users' satisfaction from a reductionist perspective and to contribute to the current knowledge on the subject.

From a practical perspective, alignment between users' perception and technological functionality has a significant positive relationship on nurses' satisfaction with NIS use. The results implied that the alignment of users' perception technology functionality is a more important factor than the individual factors of users' perceptions or technological capability with respect to users' satisfaction in using an information system; it determines the users' satisfaction. Thus, the author suggests that supervisors in nursing departments should understand nurses' perceptions of NIS use and functionality features of NIS, as well as understand the degree of alignment between nurses' perceptions and technological functionality of NIS to ensure satisfaction with NIS use so that the effectiveness and quality of work improve.

Second, as regards perceived usefulness, “perceived usefulness in system quality alignment” and “perceived usefulness in information quality alignment” were found to significantly affect nurses' satisfaction. The results implied that, when nurses feel that system features and information contents are more fitting to their needs, their perceptiveness of usefulness and satisfaction with NIS use will be higher. Thus, supervisors in nursing departments should emphasize that system functions of NIS include the availability of hardware and software, accessibility, online response time, ubiquitous computing, storing, and transferring. For example, NIS, as a communication device used to deliver and exchange information from/to peers, should have a system design that should install more interactivity-oriented functions (eg, messenger, discussion board, and chat room) in NIS to improve the response time from/to other team members and to encourage nurses to feel that NIS is more useful.⁴¹ Moreover, information quality is concerned that information content should be established with a nursing-centric design rather than comply with traditional medical classifications,¹⁷ such as abundant and real-time updated information. These designs can assist nurses to better understand patients' conditions and increase administration affairs' efficiency and effectiveness, allowing nurses to further feel that NIS is useful.

However, “perceived usefulness in service quality alignment” has no significant impact on nurses' satisfaction in this study. A possible reason to explain this situation is that an NIS implemented by a nursing department for the performance of

nursing care and daily administrative affairs can be improved. That is, nurses use NIS to achieve their specific task aims but are not dependent on it for their voluntary use settings. Thus, nurses' perceived value of the usefulness of NIS may be based on the capability of technological function and information management and how it helps them achieve their task aims rather than how desk engineers and service administrators provide service items or attitude.

Third, with regard to perceived ease of use, "perceived ease of use in system quality alignment," "perceived ease of use in information quality alignment," and "perceived ease of use in service quality alignment" were found to significantly affect nurses' satisfaction. The results implied that nurses' satisfaction with NIS use would be positively and directly affected by the degree of alignment between nurses' perceived ease of use and system quality, information quality, and service quality. Therefore, supervisors in nursing departments should inquire whether NIS offers more convenient ways of system, information, and service operation to satisfy the nursing staff's needs of perceived ease of use. For example, system design should strive to develop a friendlier interface and a fool-proof function that allows worry-free operation of NIS. Information content should have a unified nursing language, automatically draw diagrams to explain patients' health, and update to help with the nursing care decision-making process; nurses will thus be able to more easily understand and absorb information. Instructions and solutions for nurses to troubleshoot problems with NIS use are the service quality aspects that healthcare institutions should ask desk engineers to provide immediately, thus increasing nurses' perceptions of its ease of use.

LIMITATIONS

Although this study makes several meaningful theoretical and practical contributions, there are three limitations that must be acknowledged. First, this study focuses on the nursing department, which is not wide enough to represent all possible departments in healthcare institutions. It is important to note this because different departments have their particular needs with respect to computer system functions to complete their work. Second, owing to the purposive sampling method used to select the study participants, potential selection bias may have influenced the findings of the study. Future studies should consider using other data collection methods (eg, random sampling) to improve the reliability of the results. Third, national cultural differences play an important role in user behavior with information system use.⁴² Nurses' perceptions of NIS use may be affected by national and cultural differences in this study. Thus, the author suggests that further studies should be conducted to examine similar issues within different cultural environments and to compare their findings with the results of this study.

CONCLUSIONS

Generally speaking, the results of this study revealed that the alignment of human-computer interactions is a determinant of users' satisfaction in the context of nursing informatics. The results further indicate that supervisors in nursing departments should adopt a surface approach when observing nurses' satisfaction with NIS use; however, they should not ignore the use of a deep approach to measure the degree of users' perception-technology functionality alignment. Accordingly, supervisors should be able to correctly evaluate and manage NIS acceptance. The results of this study should be helpful to nursing supervisors in selecting an appropriate NIS so that they are able to enhance the satisfaction rate for adopting NIS in their nursing departments.

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