

# FRAMEWORK AND VERIFICATION OF A BLENDED E-LEARNING SYSTEM BEHAVIORAL INTENTION MODEL AMONG CLINICAL NURSES

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## Introduction

Since the commercialization of the Internet and the development of information communication technology (ICT), numerous educational and training institutions these institutions also are educational, universities, enterprises, and hospitals have invested extensively in developing e-learning courses (Lee, 2010). Learners are provided with an information platform that enables communication, interactive learning, and multimedia teaching, thereby improving the self-learning ability of the learners (Wu, Tennyson, Hsia, & Liao, 2008). E-learning provides flexible use, enables learners to overcome restrictive learning spaces, and improves learning convenience and efficiency (Wu, Tennyson, & Hsia, 2010), thereby enabling learners to learn independently or cooperatively. However, disadvantages in e-learning have been identified. Peer contact and interactions are lacking, the costs of preparing multimedia teaching materials and maintaining and updating computer systems are high, and e-learning cannot satisfy the need for immediate support in learning (Wu et al., 2010; Wu et al., 2008; Yang & Liu, 2007). In response to learners' concerns regarding e-learning and their objections to this learning approach, educators have endeavored to formulate appropriate alternative learning approaches; blended e-learning systems (BELSs) are considered effective alternative learning approaches (Graham, 2006).

Recently, numerous universities have employed BELSs as their in-school e-learning platforms (Lin & Wang, 2012; Wu et al., 2010; Akkoyunlu & Soylyu, 2008). The learning platforms combine multiple learning approaches, including classroom face-to-face learning and synchronized digital learning or teaching. In other words, the platforms enable not only learning face to face but also digitalizing teaching materials and uploading them to networks. Learners can learn cooperatively through the functions provided by BELSs. However, whether learners continually use these systems affects the purpose of using these systems. Njenga and Fourie (2008) indicated that digital learning platforms facilitate establishing cooperative learning and relationships.



JOURNAL  
OF BALTIC  
SCIENCE  
EDUCATION

ISSN 1648-3898

**Abstract.** *As the various applications of Internet and information communication technology (ICT) grow rapidly, the education and hospital institutions provide more distance learning programs, which also makes the research on e-learning more important. However, disadvantages in e-learning have been identified. Blended e-learning systems (BELSs) are considered effective alternative learning approaches. This research proposes a conceptual model to explain the factors affecting nurses' behavioral intention to use a blended e-learning system (BELS). This research integrated perceived risk and the technology acceptance model to hypothesize a theoretical model for explaining and predicting learners' behavioral intention to use a BELS. Self-report questionnaires were distributed to local community hospitals, regional hospitals, and medical centers in Central Taiwan. To confirm this research hypothesis, data were collected from 682 nurses, with a response rate of 97.4%. Using structural equation modeling (SEM), the results show that perceived risk, perceived ease of use, and attitude influenced BELS behavioral intention. Perceived ease of use, and perceived usefulness substantially influenced use attitude. In addition, the path coefficient of perceived risk on attitude was non-significant. On the basis of the results, hospital institutions can devise better strategies for developing their blended e-learning system.*

**Key words:** *nurses education, blended learning, technology acceptance model, nurse perceptions, structural equation model.*

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Researchers have typically reported that digital learning platforms enable learners to collect, formulate, and share knowledge (Lin & Wang, 2012). BELSs exhibit numerous advantages such as diversified teaching, convenient learning approaches, personalized management, and easy modification (Lin & Wang, 2012; Wu et al., 2010). However, BELSs still display potential problems such as learner maladaptation to BELSs, connection problems in local computer networks or online, learners' personal attitudes toward the technology, mixed course designs, low participation, and the disorganization inherent to hybrid systems (Bonk, Olson, Wisher, & Orvis, 2002). Wu et al. (2008) maintained that, to enable basic, efficient BELS usage, individual psychological (e.g., personal innovativeness, attitudes, and participation in using information technology) and technical factors (e.g., course designs) must be considered and that the effects of these factors on usage intentions must be explored. Therefore, this research investigated the effect of innovativeness in information technology on BELS usage intention from the perspective of learners' individual psychological factors (personal innovativeness in information technology).

Perceived risks and the technology acceptance model (TAM) were combined to form a new research model for explaining the intentions of learners in using BELSs. Taylor and Todd (1995a; 1995b) indicated that the TAM provided two types of attitudinal beliefs, namely perceived ease of use (PEOU) and perceived usefulness (PU). These attitudinal beliefs are vital antecedents that affect attitudes according to the theory of planned behavior. In addition, the new learning systems and technology provided by BELSs are typically used voluntarily by learners. However, the personal attitudes of healthcare personnel also exhibit a critical effect on those who use BELSs. Moreover, perceived risks are a crucial factor affecting the use of new products and technology (Erdem, 1998). The levels of perceived risk influence consumers' evaluations of products and their purchasing behaviors; when a new technology cannot be experienced or sampled by consumers in advance, the perceived risk of the technology increases (Campbell & Goodstein, 2001).

As explored in this research, blended learning involves an approach that combines face-to-face learning and learning over a computer network. Learners can use BELSs to view teaching materials and acquire related course information, such as course assignments and additional discussion questions. Numerous researchers have been conducted on behavior models for information system usage, but no standard model has been established. If the behavior models of previous researchers were verified and compared to identify the optimal BELS model, then the causal relationship between learners and usage BELS behavioral intention could be more accurately understood and the projected costs and risks could be lowered. Although BELS usage has been investigated in previous researchers (Lin & Wang, 2012; Wu et al., 2008), perceived risk and TAM theory have not been incorporated into the discussion. Therefore, this research attempted to combine these two theories to explain the usage BELS behavioral intentions of nurses and to perform an empirical evaluation of the key factors affecting these behavioral intentions. The results of this research further perfect the research on learners' usage BELS behavioral intentions. Furthermore, industry and hospital managers can further understand learners' usage BELS behavioral intentions, thereby facilitating the establishment of more suitable BELS criteria. Accordingly, this research established two primary goals:

1. Integrate perceived risk and TAM theory by establishing key factors for BELS usage, identifying the assessment factors affecting usage BELS behavioral intention, employing structural equation modeling to create a causal relationship model between nurses and BELS usage intention, and verifying the applicability of the model to nurses' e-learning.
2. Analyze the relationships among the key factors affecting nurses' usage BELS behavioral intentions and provide hospital managers with a reference for assessing future developments in e-learning systems.

## Theoretical Framework

### *Blended E-learning System*

Blended e-learning (BEL) or BELSs combine the advantages of e-learning systems and conventional face-to-face learning, facilitating a type of learning approach that incorporates both conventional classroom learning and virtual education (Lin & Wang, 2012; Wu et al., 2010; Akkoyunlu & Soylu, 2008; Graham, 2006). In addition to acquiring knowledge from face-to-face learning, learners can use online learning platforms for self-learning and cooperative learning, as well as for interacting with teachers and other learners. In addition, learners can access classroom information and the latest information, as well as submit assignments through the online platforms (Graham, 2006). Graham (2006) defined BELSs as a learning approach that incorporates two types of learning environments, namely classrooms and networks. Graham (2006) stressed that computer technology (e-learning



systems) plays a critical role in BELSs by improving on classroom teaching and learning activities through the principles of practicality and flexibility, thereby changing the learning approach of learners. So and Bonk (2010) maintained that blended learning facilitates the mutual construction of knowledge and the establishment of interpersonal relationships and planning management; in addition, blended learning promotes efficiency and flexibility in learning processes. In summary, we defined BELSs as a learning approach that combines learning over a computer network with face-to-face learning and integrates conventional classroom learning in a physical environment with digital learning.

Some BELSs offer various functions for enabling learners to learn. For example, Web CT ([www.webct.com](http://www.webct.com)) combines teaching materials (audio files, images, and texts) with emails, online chats, and online discussions. Other systems similar to BELSs enable simultaneous (synchronous) or separated (asynchronous) learning and discussions among learners, thus providing learning activities, approaches, and interactions and learning resources that provide more flexibility and variation for overcoming the restrictions of classroom and digital learning. Therefore, when teachers and learners cannot mutually agree on class times and locations, online learning systems potentially become a favorable option (Pituch & Lee, 2006). Recently, BELSs have garnered increasing attention and developed into primary learning platforms, with the usage BELS behavioral intentions of nurses becoming a critical topic.

#### *Perceived Risk*

Accompanying the increase in the Internet's popularity, concerns over the various risks involved in network activities and transactions have emerged (Wu & Wang, 2005). Risks are a crucial characteristic of consumer psychology and involve the negative outcomes that occur in consumers' minds (Dholakia, 2001). The concept of perceived risk was conceived by Bauer (1960) and applied in researchers on marketing. Bauer (1960) indicated that unpredictable results may emerge in consumers' purchasing activities; consumers perceiving this uncertainty may feel a sense of unpleasantness because of the unsatisfactory purchasing activity. Featherman and Pavlou (2003) urged the necessity of combining perceived risk and TAM theory in researchers. When consumers purchase products or receive services, they assess perceived risks subconsciously. Igbaria (1993) reported that using information systems causes anxiety or maladjustment in employees or consumers. Using the Internet evokes increased uncertainty and additional potential risks, which are referred to as perceived risks that affect PU (Dowling & Staelin, 1994). Previous researchers (Al-Gahtani, 2011; Lee, 2009) have also addressed the effect of perceived risks on PEOU, attitudes, and behavioral intentions. This research intended to examine whether higher perceived risk of BELS can lower its influence on PEOU, PU, attitude, and behavioral intention. In summary, this research maintained that perceived risk was correlated with the effect of PEOU, PU, attitude, and behavioral intention on BELSs and established the following hypotheses:

Hypothesis 1: Perceived risk negatively affects perceived usefulness of BELSs.

Hypothesis 2: Perceived risk negatively affects attitude toward using a BELS.

Hypothesis 3: Perceived risk negatively affects perceived ease of use of BELSs.

Hypothesis 4: Perceived risk negatively affects behavioral intention to use a BELS.

#### *Technology Acceptance Model (TAM)*

Davis (1989) conceived TAM theory, an extension of the theory of reasoned actions (Fishbein & Ajzen, 1975). Davis (1989) indicated that TAM theory facilitates further explaining the receptive behaviors of learners. According to TAM theory, PEOU and PU are two key factors affecting technology acceptance. PEOU indicates the extent of people's belief that using a certain system reduces their psychological and physical burdens, and PU illustrates the level of people's belief that using a certain system increases work efficiency (Davis, 1989). Specifically, both PEOU and PU influence people's attitudes toward using systems. When combined with the theory of reasoned actions, these two factors are critical to defining system usage intention. TAM theory has commonly been applied in researchers on learners' acceptance of various new technologies such as email, Internet, health care, medical education, digital learning, and green information technology (Akman & Mishra, 2015; Mohammadi, 2015; Chow, Herold, Choo, & Chan, 2012; Lin & Wang, 2012; Wu et al., 2011; Lee, 2010; Davis, 1989)

BELS learners must regard BELSs as practical tools for improving their individual learning efficiency and their communication with colleagues, friends, and other people. Therefore, BELS learners must believe that using these



systems is highly convenient. In addition, TAM theory strongly indicates that PU influences the attitudes and intentions of learners directly, with PEOU indirectly affecting them through PU (Davis, 1989). In other words, PU mediates the effect of PEOU on learners' attitudes and behaviors. Numerous previous empirical researchers have supported this argument (Akman & Mishra, 2015; Mohammadi, 2015; Yang et al., 2015; Wu et al., 2011; Lee, 2010; Wu & Chen, 2005; Venkatesh & Davis, 2000). Accordingly, the following hypotheses were formulated:

Hypothesis 5: Perceived ease of use positively affects perceived usefulness of BELSs.

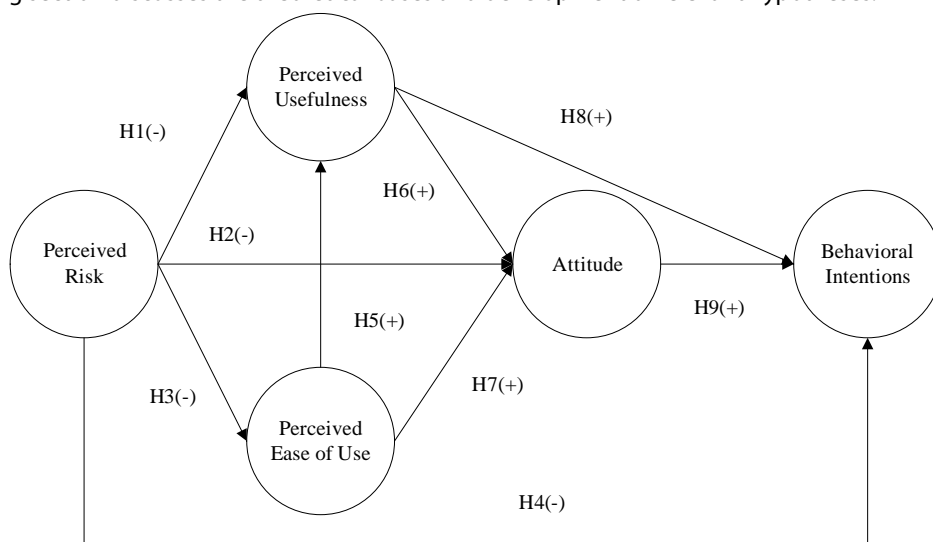
Hypothesis 6: Perceived usefulness positively affects attitude toward BELSs.

Hypothesis 7: Perceived ease of use positively affects attitude toward BELSs.

Hypothesis 8: Perceived usefulness positively affects behavioral intention to use a BELS.

Hypothesis 9: Attitude positively affects behavioral intention to use a BELS.

According to the preceding discussion, a pictorial depiction of the research framework was developed (Figure 1). The following section discusses the theoretical bases and development of relevant hypotheses.



**Figure 1: Research model and hypotheses.**

## Methodology of Research

### Participants

The participants were nurses who had taken courses through BELS. This research investigated three types of hospitals (medical centers, regional hospitals, and district hospitals), as classified by the Taiwan Joint Commission on Hospital Accreditation. This research distributed 700 questionnaires to nine target hospitals (including medical centers, regional hospitals, and district hospitals) in Central Taiwan. Based on the sampling frame, which was a list of hospitals, a probability-proportionate-to-size sampling method was used to systematically draw a random sample of hospitals. Seventy to eighty nurses were randomly selected from each sample hospital. All the target hospitals had implemented BELS courses. Because of the conventional expectation of low survey response rates, this research endeavored to assign a local contact person for each target hospital to be in charge of questionnaire distribution. All 700 questionnaires were returned. Eighteen responses were incomplete and thus discarded. This left 682 valid responses for statistical analysis, and a valid response rate of 97.4% of the initial sample. Of the valid responses, 206 were from district hospitals, 435 from regional hospitals, and 42 from major medical centers. The average respondent age was 34.4 years (the standard deviation was 7.5 years). The main employment positions of the sample population were N1 (37.8%) and N2 (37.2%). Among the respondents, 88.0% had a faculty degree or bachelor's degree (Table 1).

**Table 1. Profiles of Respondents (N=682).**

Factor/ Level	N	%	Factor/ Level	N	%
<i>Formal Education</i>			<i>Position</i>		
Nursing College	30	4.4	N1	258	37.8
Faculty degree/ bachelor degree	632	92.7	N2	254	37.2
Master degree or above	20	2.9	N3	119	17.4
<i>Type of Hospital</i>			N4	51	7.5
Medical centers	206	30.2			
Regional hospitals	435	63.8			
Local hospitals	42	6.0			

#### *Data Collection Tools*

Data was collected by conducting a survey. The instrument was a two-part questionnaire. The first part elicited respondents' perceptions of perceived risk, TAM (including perceived usefulness, perceived ease of use, attitude, and behavioral intention). The second part addressed the respondents' basic information, and involved using a nominal scale. The basic information included age, formal education, hospital position, and type of hospital employed at. Hospitals were categorized as a medical center, regional hospital, or district hospital according to organizational characteristics.

This research scale development followed the recommendations of MacKenzie, Podsakoff, and Podsakoff, (2011) and the standard psychometric scale development procedures suggested by Devellis (2003). The four measurement items of perceived risk constructs were adapted from measurements developed by several previous researchers (Al-Gahtani, 2011; Bauer et al., 2005; Wu & Wang, 2005; Featherman & Pavlou, 2003). The measurement items for the TAM constructs, adapted from previously developed measurements (Chow et al., 2012; Lin & Wang, 2012; Wu et al., 2011; Lee, 2010; Venkatesh & Davis, 2000; Davis, 1989; Fishbein & Ajzen, 1975), were perceived usefulness, perceived ease of use, attitude, and behavioral intention, which contained five, four, three, and five items, respectively. In total, this research measurement instrument comprised 21 items measuring five structural model constructs. Items were measured using five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree). To reduce any potential ceiling (or floor) effects, this research induced monotonous responses to the items designed to measure the same construct.

#### *Data Analysis*

Structural equation modeling (SEM) was used in a comprehensive, combined analysis of both the measurement and structural models. The structural equation model enables explicit modeling of measurement error, estimates both direct and indirect relationships among latent variables, and provides various indices of global model fit. The research hypotheses of this research were tested using the Linear Structural Relational software package Version 8.72 (LISREL 8.72) and SPSS Version 18.0 (SPSS 18.0) to analyze the measurement items. SEM using the maximum-likelihood estimation method was applied to the sample data by using LISREL 8.72. We also analyzed the psychometric properties of the variable measurement scales and handled missing data through list-wise deletion. This research included five variables (one dependent variable and four independent variables) and each of the constructs comprised three to five measurement items.

#### **Results of the Research**

The relationships between the observed variables (manifest variables or indicators) and latent variables (measured constructs). Assessing the measurement model through linear structural relational estimations and traditional alphas revealed three indices: (1) all item loadings ( $\lambda$ ), (2) investigation of reliability (Cronbach's alpha) and composite reliability (CR) coefficients, and (3) average variance extracted (AVE) (Bagozzi & Yi, 2012; Hair, Black, Babin, & Anderson, 2010; Jöreskog & Sörbom, 2005; Fornell & Larcker, 1981).



*Measurement Model Evaluation*

Table 2 shows the reliability and convergent validity indices for the scale. The standardized item loadings ranged from 0.80 to 0.97; all item loadings were larger than 0.70 and were significant at the 0.01 level (Hair et al., 2010). The Cronbach's  $\alpha$  coefficient ranged from 0.86 to 0.95, suggesting high reliability. In addition, all the constructs displayed Cronbach's  $\alpha$  coefficients that were higher than the 0.70 benchmark suggested by Hair et al. (2010). CR is a set of latent construct indicators that are consistent in their measurements. These CR coefficients ranged from 0.86 to 0.95. The constructs also exhibited CR that was higher than the 0.6 benchmark advised by Fornell and Larcker (1981).

Convergent validity was examined using AVE. In this research, all the constructs exhibited AVE values between 0.67 and 0.79, exceeding the 0.5 minimum recommended by Fornell and Larcker (1981). Overall, the AVE of the constructs demonstrated satisfactory reliability and validity. In summary, the internal reliability and validity results were acceptable, enabling us to proceed estimating the structural model.

**Table 2. Construct reliability results.**

Construct	Cronbach's $\alpha$	AVE	CR
Perceived risk (PR)	0.90	0.70	0.90
Perceived usefulness (PU)	0.91	0.69	0.90
Perceived ease of use (PEOU)	0.86	0.67	0.86
Attitude (A)	0.91	0.76	0.90
Behavioral intentions (BI)	0.95	0.79	0.95

Discriminant validity refers to the degree of distinctive concept measurements and implies that within the same scale, and correlations among constructs should be higher than those of constructs among different constructs. Discriminant validity is evident when the AVE for each construct is greater than the squared correlation between that construct and any other construct in the model (Fornell & Larcker, 1981). Table 3 presents the discriminant results. The correlation matrix between the constructs showed that the square roots of the AVEs were higher than the correlation coefficients with other constructs. The constructs demonstrated satisfactory overall convergent validity and discriminant validity.

**Table 3. Discriminant validity using average variance extracted.**

	Mean	S.D	PR	PU	PEOU	A	BI
PR	2.73	0.80	0.70*				
PU	3.51	0.56	-0.29	0.69			
PEOU	3.37	0.52	-0.33	0.60	0.67		
A	3.59	0.62	-0.16	0.69	0.51	0.76	
BI	3.60	0.64	-0.21	0.72	0.52	0.80	0.79
(correlation) <sup>2</sup>			0.11	0.52	0.36	0.64	0.64

Note: \* Average variance extracted (AVE). Convergent validity =  $AVE \geq 0.5$ . Discriminant validity coefficient =  $AVE / (\text{Correlation})^2$ , where  $(\text{Correlation})^2 = \text{highest } (\text{Correlation})^2$  between factor of interest and remaining factors.

*Structural Model Estimation*

The proposed model comprised one exogenous variable (perceived risk) and four endogenous variables (perceived usefulness, perceived ease of use, attitude, and behavioral intention). The constructs and their hypothesized relationship in our structural model were tested simultaneously. The SEM obtained from the theoretical model included a chi-square goodness-of-fit test, chi-square/degree of freedom (d.f.) ratio, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), root mean square error of approximation (RMSEA), and comparative fit



index (CFI) (Bagozzi & Yi, 2012; Hair et al., 2010; Jöreskog & Sörbom, 2005). Table 4 provides the indices for fitness measurement of the structural model. The results of the structural equation model obtained from the theoretical model revealed a chi-square of 624.61 with 143 d.f. ( $p < 0.001$ ), chi-square/d.f. ratio of 4.37, GFI of 0.91, AGFI of 0.88, RMSEA of 0.07, and CFI of 0.98.

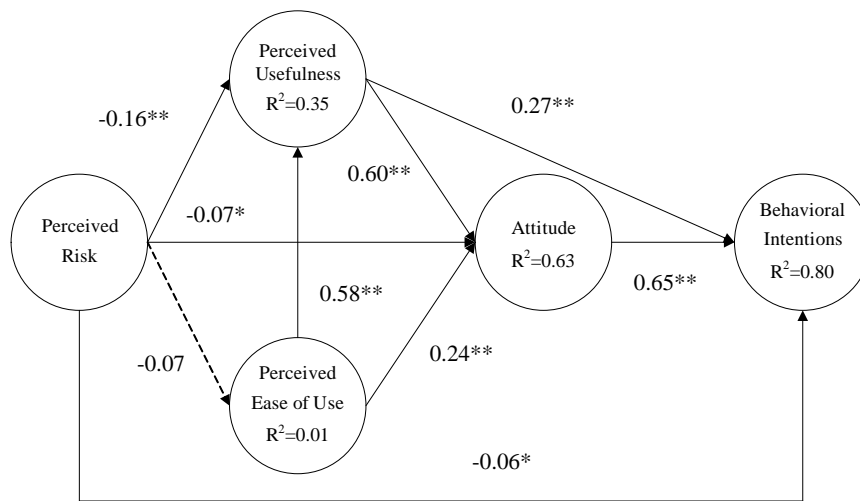
The chi-square p value did not meet its recommended 0.000 value because of the relatively large sample size employed (682 respondents). A chi-square/d.f. ratio lower than 5:1 is considered to indicate an acceptable fit, and the chi-square value should be as low as possible. Goodness-of-fit index and comparative fit index values exceeding 0.90 are preferable. The more liberal cutoff of 0.80 has been used to indicate good model fit (Hair et al., 2010). An RMSEA value of 0.08 or less is preferable, and Raykov (2001) considered all values between 0.08 and 0.1 to be moderate. Most indices in our structural model exhibited a reasonably high goodness of fit.

**Table 4. Measures of model fit and reported values for the structural model.**

Fit index	Recommended values	Model values	Model fit
Chi-square	$P \geq 0.05$	624.61 ( $P=0.000$ )	Poor fit
Chi-square/ d.f.	$\leq 5$	4.37(df=143)	Good fit
GFI	$\geq 0.9$	0.91	Good fit
AGFI	$\geq 0.9$	0.88	Moderate fit
RMSEA	$\leq 0.08$	0.07	Good fit
CFI	$\geq 0.9$	0.98	Good fit

*Interpretation of Structural Model Results*

Figure 2 shows the model path coefficients (loading and significance) and  $R^2$  for each value, which support the hypothesized model. The model also explained a substantial proportion of variance for all the endogenous variables: 35% for perceived usefulness, 1% for perceived ease of use, 63% for attitude, and 80% for behavioral intention.



\* $p < 0.05$

**Figure 2: Structural equation model for explaining nurses' using BELS behavioral intention (Standardized Analysis Values).**



**Table 5. Estimation results for Hypotheses 1-9.**

Hypotheses	Path from/to	Standardized coefficient	t-value	Test results
Hypothesis 1	Perceived risk → Perceived usefulness	-0.16*	-4.38	Accepted
Hypothesis 2	Perceived risk → Attitude	-0.07*	-2.18	Accepted
Hypothesis 3	Perceived risk → Perceived ease of use	-0.07	-1.74	Rejected
Hypothesis 4	Perceived risk → Behavioral intentions	-0.06*	-2.57	Accepted
Hypothesis 5	Perceived ease of use → Perceived usefulness	0.58*	14.81	Accepted
Hypothesis 6	Perceived usefulness → Attitude	0.60*	13.77	Accepted
Hypothesis 7	Perceived ease of use → Attitude	0.24*	6.19	Accepted
Hypothesis 8	Perceived usefulness → Behavioral intentions	0.27*	6.89	Accepted
Hypothesis 9	Attitude → Behavioral intentions	0.65*	14.96	Accepted

\* $p < 0.05$ 

Standardized beta-coefficients from the estimated structural model are reported in Table 5, with the associated t values for each construct. All nine causal paths were specified in the hypothesized model; eight were statistically significant and supported. As posited in Hypothesis 1, the estimated negative coefficient estimates for the paths from perceived risk to perceived usefulness were significant (standardized beta-coefficient of -0.16, t value of -4.38,  $p < 0.05$ ). In Hypothesis 2, the negative relationship between perceived risk and attitude was significant (standardized beta-coefficient of -0.07, t value of -2.18,  $p < 0.05$ ). However, Hypothesis 3 was not supported, with no significant relationship found between perceived risk and perceived ease of use. A significant negative relationship was observed between perceived risk and behavioral intention (standardized beta-coefficient of -0.06, t value of -2.57,  $p < 0.05$ ), supporting Hypothesis 4. Perceived usefulness was influenced by perceived ease of use (standardized beta-coefficient of 0.58, t value of 14.81,  $p < 0.05$ ), supporting Hypothesis 5. Contrary to our expectation, the constructs of perceived usefulness and perceived ease of use were significant determinants of attitude (standardized beta-coefficients of 0.60 and 0.24 and t values of 13.77 and 6.19, respectively; both  $p < 0.05$ ), supporting Hypotheses 6 and 7. Finally, perceived usefulness and attitude were both revealed to be crucial antecedents of behavioral intention (standardized beta-coefficients of 0.27 and 0.65 and t values of 6.89 and 14.96, respectively; both  $p < 0.05$ ). Therefore, Hypotheses 8 and 9 were supported.

## Discussion

BELs have generally been used as alternative learning systems (Akkoyunlu & Soylu, 2008; Graham, 2006; Lin & Wang, 2012; Wu et al., 2010), serving as system interfaces in e-learning systems. By combining perceived risk with TAM theory, we formulated a new model to explore the usage BELs behavioral intentions of nurses. The data were collected through a questionnaire survey and verified using SEM, with an acceptable overall structural model being created (Figure 2). The results indicated that this research exhibited satisfactory reliability, validity, path coefficients, and explained variances ( $R^2$ ), which increased our confidence in the research results. We believe that the results provide BELs manufacturers with a reference for adjusting their systems and improving learners' usage intentions. As shown by the empirical results in this research, the variance explained by the proposed model's dependent variables were .80 for behavioral intention ( $R^2 = 80\%$ ), .63 for attitude ( $R^2 = 63\%$ ), .35 for PU ( $R^2 = 35\%$ ), and .01 for PEOU ( $R^2 = 1\%$ ). These data indicated that the study's theoretical model was capable of explaining the nurses' usage BELs behavioral intentions.

The empirical results revealed that perceived risk, PEOU, and attitude exhibited a statistically significant effect on behavioral intention. Particularly, the effect of attitude on behavioral intention was the strongest, whereas perceived risk and PEOU exhibited relatively lesser effects. Therefore, the hypotheses in this research were supported. The study's findings regarding the effect of perceived risk on behavioral intention corresponded with those of previous researchers (Bauer et al., 2005; Lee, 2009), which resulted from most of the research participants being university graduates belonging to levels N1 and N2. These participants have used the Internet and e-learning systems in their universities. Because of their familiarity with e-learning, these participants were accepted BELs





more willingly. These participants understood the potential risks of using BELSs; the users' higher perceived risk reduced their BELS usage intentions. Perceived risk exhibited a significantly negative effect on the PU and attitude of the users. Therefore, hospital managers can promote BELSs and use them for interpersonal communication with their colleagues, thereby reducing the perceived risk of using BELSs and enabling users to develop sufficient skills in using these systems and to benefit from their use.

In this research, PU was defined as a secondary variable for behavioral intention. Some interesting phenomena surfaced when the results of this research were compared with those of other researchers on TAM theory. The previous researchers indicated that PU affected behavioral intention more significantly than attitude did (Davis, 1989; Taylor & Todd, 1995a; 1995b); however, the effect of attitude on behavioral intention in this research was more significant than that of PU, contradicting the results of the previous researchers (Al-Gahtani, 2011; Davis, 1989; Lee, 2010). This contradiction resulted from all of the nurses acknowledging the advantages that BELSs offer work and learning efficiency. However, after busy work shifts, the nurses had to participate in educational training during their off-duty hours, preventing them from resting sufficiently. Therefore, we suggest that hospital management should extend the usage time of each BELS course to enable nurses to use the systems more flexibly during holidays and off-duty hours, thereby improving the nurses' behavioral intentions. If nurses expressed satisfactory BELS appraisals and favorable learning attitudes and intentions, then their usage BELS behavioral intentions would increase. Therefore, the nurses' attitudes toward BELSs are a critical mediating factor in the relationship between PU and behavioral intention.

### Conclusions and Further Research

In this research, a causal model of nurse behavioral intention (BI) toward the use of BELS was proposed to provide assessment results that convey the importance of BI toward the use of BELS to hospital operators. Nurses' perceived risk, perceived usefulness, (PU), and attitude toward BELS were improved to elevate their BI toward using such system. This research showed that nurses' perceived risk significantly positively influenced PU, attitude, and BI, and that the direct effect of perceived risk on BI was greater than its indirect effect. Therefore, nurses' PU, attitude, and BI toward using BELS can be significantly improved by reducing the perceived risk of the system. In addition, attitude was a crucial mediator of the relationship between PEOU and PU, and BI. When nurses perceive that BELS is a system that is worth using, their attitude toward the system must be enhanced to thereby improve their BI toward using such system.

This research analyzed the factors affecting the usage BELS behavioral intentions of nurses. However, this research had several limitations, and several topics within the study's research scope require further investigation. First, most of the participants selected to participate in the research questionnaire were nurses at the hospital level or at higher local medical institutions in Central Taiwan that adopted BELSs. Because all of the participants were from the same region, the status of BELS usage among nurses could be inferred only for nurses at the aforementioned medical institutions, with only limited extrapolation possible. Collecting samples from different regions and from healthcare institutions with different characteristics (e.g., departmental hospitals, foundation hospitals, and Ministry of Education hospitals) could improve the accuracy of the results in this research and the comprehensiveness of researchers on nurses and e-learning. Secondly, a self-report scale was used as the verification tool in this research. Consequently, the respondents may have answered questionnaire items in a reserved manner or avoided expressing their true intentions, resulting in incomplete or invalid responses. The possibility of these errors is typical in researchers using this approach, a problem that must be considered when explaining the data. Thirdly, this research provides direction for further investigation on factors affecting usage BELS behavioral intentions. Adopting a longitudinal research design to examine the relationships among the known variables might yield additional findings. Finally, learning effectiveness is not improved through technology alone but by combining technology and social cognitive theory. Bandura (1986) stressed that reciprocity and interactions between people are enabled on the basis of cognitive factors, the environment, and behaviors. Future researchers could incorporate social cognitive theory in exploring the factors affecting nurses' usage satisfaction and intentions with BELSs, as well as the effect of BELS quality on usage intention. Thus, research on e-learning management and BELS applications for nurses could be further developed.



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Received: September 09, 2015

Accepted: November 15, 2015

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