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**Abstract**

Enterprise resource planning (ERP) is an increasingly widely utilized educational model globally. Several scholars have suggested that user satisfaction and intention to use can each effectively affect learning performance. However, whether user satisfaction and learning performance are related remains unclear. This study has the following four objectives: to examine the primary determinants of user learning satisfaction in an ERP environment; to determine how user satisfaction, intention to use, and learning performance are related to each other; to determine whether intention to use affects learning performance and mediates the relationship between user satisfaction and learning performance; and to evaluate the effectiveness of the proposed model in explaining the effects of the learner interface, interaction and attitude of the instructor toward the student on user satisfaction, supporting evaluation of mediation learning performance by intention to use. The results of SEM analysis indicate that the model that is proposed exhibits goodness-of-fit. Interface design and cognitive function significantly and positively influence learning performance. User satisfaction and intention to use both significantly and positively affect learning performance. Intention to use mediates the relationship between user satisfaction and learning performance.

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Elucidating how interface design and cognitive function affect learning performance in the ERP software system

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Abstract

ERP is an increasingly prevalent educational model worldwide. Many scholars have suggested that user satisfaction and intention to use can individually and effectively promote learning performance. However, whether user satisfaction and learning performance are related remains unclear. This study focuses on the following four objectives: investigate the primary determinants affecting student learning satisfaction in an ERP environment; determine how user satisfaction, intention to use, and learning performance are related; determine if intention to use fosters learning performance and plays a mediating role between user satisfaction and learning performance; and evaluate the effectiveness of the proposed model in explaining the relationships among user satisfaction, intention to use, and learning performance through empirical examination. SEM analysis results indicate that the research proposed model has goodness-of-fit. Additionally, interface design and cognitive function significantly and positively affects learning performance. Moreover, user satisfaction and intention to use have both significant and positive effects on learning performance. Furthermore, intention to use has a mediating effect between user satisfaction and learning performance.

Keywords: ERP, learning performance, cognitive function, interface design

1. INTRODUCTION

Many studies have asserted that the Enterprise Resource Planning (ERP) strategy is a highly promising means of fostering learning and increasing a company’s competitiveness (Han, 2004; Shehab et al, 2004; Laframboise & Reyes 2005; McAfee & Brynjolfsson, 2008; Björn, 2009; Michael, 2010; Constantinos, 2014). According to Forrester research, the industrial markets for enterprise resource planning (ERP) software are forecasted to increase from $45.5 billion in 2011 to $50.3 billion by 2015 (Leighton Jenkins, 2011). ERP software system is an enterprise-wide information system, in which the system concept is incorporated. ERP streamlines business processes to facilitate the provision of fully integrated business processes by using a common database and then offering data visibility as well as information from various viewpoints (Warfield, 2007; Xu, 2007; Li et al., 2008; Addo & Helo, 2011; Stefanou, 2012).

Most very large organizations and increasing number of small and medium sized enterprises (SMEs) worldwide have adopted ERP in recent years, owing to its cost effectiveness and a competitive nature (Klaus, 2000). Related research focuses on identifying and more thoroughly understanding a company’s internal and external operation factors, capable of increasing the business value and organizational performance of the ERP software system (Melville & Gurbaxani & Kraemer, 2007; Loukis & Michailidou & Sergi, 2008). These benefits include drastic
declines in inventory, breakthrough reductions in working capital, abundant information involving customer wants and needs, along with the ability to view and manage the extended enterprise of suppliers, alliances and customers as an integrated whole. In the manufacturing sector, ERP implementation has reduced inventories from 15 to 35% (Chen, 2001; Gupta, 2000).

While ERP has been recognized as having several advantages, insufficient learning performance is still a barrier to the successful adoption of ERP (So & Brush, 2008). Previous studies have established that learners had difficulty changing to ERP environments due to the possible problems in computers with Internet access, learning competency, attitudes, and beliefs in the use of technology, mixed course design, participant interaction, and mixed environments integration (Bonk, Olson, Wisher, & Orvis, 2002). Above determinants imply that an effective ERP environment should reflect the human and technology factors that affect learner performance with ERP, including individual attitudes, participant interaction, educational technologies, learner interface, instructor attitudes towards students, and course design (Wu & Tennyson & Hsia & Liao 2008a; Wang & Liao & Chu, 2011). Therefore, characteristics of instructor, student, technical, and contextual in ERP environments must be more carefully identified (EL-Deghaidy & Nouby, 2008; Selim, 2007). According to Su et al. (2013), successfully implementing the ERP program depends on the cognitive function and the flexibility of the interface design between them.

ERP software system in learning and teaching necessitates the transformation of how universities students learn by using more modern, efficient, and effective alternative technologies. The successful adoption of ERP in supporting learning motivates this study to explore the critical determinants that attract learners to use ERP and enhance their learning performance. The extent of student learning performance with ERP courses profoundly impacts the ability to estimate the effectiveness of ERP adoption. Thus, evaluating what determines student learning performance can provide managerial insight into developing effective strategies that allow educational institutes and instructors to create a new educational value and profits for their students. Because a typical classroom and an e-learning differ in ERP environments, a review of learning technology research demonstrates a lack of survey studies on the critical factors that determine the learning performance with ERP, including individual cognition, technological environments, and social contexts. More in-depth research is thus necessary to understand what determines student learning performance in a ERP environment and investigate how the determinants influence student comprehension of ERP contexts and their correlations.

This study focuses on the following four objectives: investigate the primary
determinants affecting student learning satisfaction in a ERP environment; determine how user satisfaction, intention to use, and learning performance are related; determine if intention to use fosters learning performance and plays a mediating role between user satisfaction and learning performance; and evaluate the effectiveness of the proposed model in explaining the relationships among user satisfaction, intention to use, and learning performance through empirical examination. The rest of this paper is organized as follows. Section 2 reviews pertinent literature and discusses six variables, as well as establishes the study hypothesis. Subsequent sections then describe the methodology, results, and analysis. Conclusions are finally drawn in Section 5, along with limitations and recommendations for future research.

2. BACKGROUND

2.1 Cognitive function and interface design

ERP software system architecture builds upon a database, an application, and a standard interface across the entire enterprise (Al-Mashari Al-Mudimigh, & Zairi, 2003). Many alternatives software packages differ only slightly in terms of functionality, capable of functioning as the user interface in which the purchasing factor makes end user satisfaction a decisive factor (Fethi & Ferah, 2004). Clearly, ERP software systems with multiple interfaces design for different levels of users can yield business and intangible benefits.

Meanwhile, Linda (2013) asserted that ERP software system involved with users are cognitively involved, engaged, and capable of producing better outcomes. According to Steven (2013), cognitive psychology is a scientific discipline that explores the mind. In addition to focusing on how an individual acquires, processes, and stores information, cognitive psychology examines studies how individuals view and understand the world. This discipline also attempts to identify user behavior through characteristics other than its obvious features (Willingham, 2007). Thus, Hewett (1999) introduced the user interface design of the ERP software system and the tools used to shape them, which require grounding in the fundamentals of cognitive psychology in order to adequately explore the user's task or situation for which a tool is designed.

Additionally, several studies have suggested that user satisfaction is a major factor leading to ERP software system success (Al-Khaldi & Wallace, 1999; Szajna & Scamell, 1993). Moreover, usability of interfaces can be viewed as a factor that influences end user satisfaction (Park and Lim, 1999).

User satisfaction refers to the expected benefits from assembling all of the benefits that an individual intends to accrue by using enterprise applications.
Therefore, more useful enterprise applications imply a greater likelihood that the user uses the ERP software system (Lai & Yang, 2007). Ramayah & Lee (2012) found that perceived usefulness, user satisfaction and system quality directly influence user intentions to continue using an online retail site. Restated, students feeling more satisfied with related ERP training courses are more willing to reuse the enterprise applications.

Above studies appear to suggest that ERP software system with cognitive function and interface design is the most feasible means of promoting user satisfaction and learning performance. Bollinger and Martindale (2004) subsequently identified three key factors central to user satisfaction: instructor, interaction, and technology. Later research confirmed the user satisfaction and intention to use both affect learning performance, ultimately influencing the level of ERP software system success (Rom and Rohde, 2007; Wu and Wang, 2007; Venkatesh and Bala, 2008).

2.2. User satisfaction

Previous studies have established that user satisfaction significantly affect the success of the ERP software system (Constantinos, 2014). According to Li & Marcowski & Xu & Markowski (2008), when business operations are concerned with prioritizing customer satisfaction in the center of the corporation, as well as how the ERP software system is related to the formulation of marketing strategies, how to distribute the products timely with the right arrangement, and how to supply the adequate amount of quality products. An ERP software system can inform what customers want and how to provide the product or service better than the competition (Muscatello et al., 2003; Ptak, 1999; Ollager and Selldin, 2003).

Most studies confer that as a psychological process, satisfaction evaluates perceived performance outcomes based on predetermined expectations (Egan, 2001; Chiu et al., 2005). Ahed et al. (2009) found that user satisfaction significantly affects ERP software system usage and has the strongest direct effect on individual performance.

Alternatively, user acceptance can be measured by a positive attitude towards a TAM-based system, explaining why satisfaction is a reliable surrogate for user acceptance and is often used to evaluate learner attitudes in learning-related studies (Chou & Liu 2005, Piccoli et al., 2001; Taylor and Todd, 1995). In this respect, above studies focus on identifying which users are satisfied with the systems they use. Above studies further suggest that user satisfaction affects user performance (Igbaria and Tan, 1997; Delone & Mclean, 2003). However, the system itself may affect user productivity and perception. Previous studies have also established a strong correlation between system, task, satisfaction and performance (Sears & Jacko, 2003).
The above literature review indicates that user satisfaction with the ERP software system learning is linked to the interaction between communication, curriculum design, a learning environment, and individual factors of computer self-efficacy as well as the ability to control the pace of individual learning. Moreover, Li et al. (2008) identified performance and a satisfactory orientation that increase user satisfaction with ERP learning. Given the above considerations, we conclude that perceived ease and perceived usefulness both affect user satisfaction, ultimately influencing the level of ERP success (Rom and Rohde, 2007; Wu and Wang, 2007; Venkatesh and Bala, 2008).

2.3. Learner interface and user satisfaction

Johannsen (2007) asserted that human centered designs are necessary for improved operational use of technical processes and their human-machine interaction. While studying the continued use of a web site, Lin & Wu & Tsai (2005) observed that perceived ease and satisfaction are directly related. Ali (2009) noted that perceived value, perceived ease of use, and positive learning climate directly affect student’s learning satisfaction; in addition, perceived value most significantly contributes to learning satisfaction. Restated, the ERP software system with an interface design for learners should be user-friendly and include the key functions to minimize user’s efforts in learning. Users are more likely to use the ERP system if it is worthwhile, enjoyable and simple, further increasing satisfaction. Based on the above findings, we hypothesize the following:

Hypothesis 1. Easy to use learner interface positively affects user satisfaction.

2.4. Interaction and user satisfaction

In addition to suggesting that interactivity plays a major role in acquiring knowledge and developing cognitive skills, Ke & Sun & Yang (2012) noted that interaction is essential to effective instructional practice and individual discovery. Liaw (2008) observed that with more interactive and richer media available, a learner who prefers a self-directed and interactive learning style has more flexibility in meeting individual requirements. Dongsong & Lina & Robert & Jay (2006) also posited that an instructional method that provides a greater variety of interactions and richer media should be highly effective. Palloff and Pratt (1999) also emphasized that the learning process involves interactions among students, interactions between faculty and students, as well as collaboration in learning that results from these interactions. Moreover, according to Duke et al. (2007), the interaction factor encompasses feedback from the ERP software system. In computer-mediated environments, feedback that is emphasized as an important dimension of flow (Csikszentmihalyi, 1988) is often referred to as interactivity (Finneran and Ping, 2003).
Restated, learners whom believe that ERP training course provides effective student-student and student-instructor interactions and improves learning climate are highly satisfied with the ERP system. Based on the above findings, we hypothesize the following:

Hypothesis 2. More interaction positively affects user satisfaction.

2.5. Instructor attitude towards students and use satisfaction

While using the TAM model as a foundation to add to teacher’s perspective, Chen and Tseng (2012) examined factors that influence intentions to use in-service training conducted through web-based e-learning. Volery and Lord (2000) noted that the factors leads to student satisfaction are instructor friendly behavior with students, understandability of student problems, proper understanding of IT, and persuasive interaction between students. Furthermore, Ali (2009) empirically demonstrated that both student-student and student-instructor interactions significantly contribute to the level of student learning and satisfaction in a technology-mediated environment. Owing to the physical separation of learners from the instructor and other learners, technology provides a learning experience compatible with a face-to-face class, thus providing further support to findings that promote interaction in instruction as a major element for student learning and satisfaction (Liang & Koubek, 1997; Arbaugh, 2000; Chou & Liu, 2005; Sun & Zhan, 2006; Trentin, 2000).

Consequently, learners who increase their interaction with instructors and students subsequently raise their likelihood of nurturing their own knowledge because a significant amount of learning occurs within a social context; the process includes the mutual construction of understanding (Liaw & Huang, 2007). Based on the above findings, we hypothesize the following:

Hypothesis 3. Instructor attitude towards students positively affects user satisfaction.

2.6. User satisfaction and intention to use

According to Chiu et al. (2005), the ERP software system with satisfaction can significantly and positively impact continuance intention. Juan & Chiu & Francisco (2006) demonstrated that perceived ease of use is the most important antecedent of continuance intention. Additionally, managers can increase the usage intention of users by increasing their confidence in how the ERP software system can enhance their performance and effectiveness. Therefore, from a technological perspective, a user friendly system should encourage individuals to reuse it, because users tend to experience cognitive absorption when technologies are visually appealing and accessible. Alternatively, Bhattacherjee (2001a) found that usage of online banking services demonstrates the significance of satisfaction as a predictor of ERP software...
system continuance; satisfaction significantly impacts the intention to continue using a portal site, and the continuance intention of users is determined based on satisfaction (Allard et al., 2001; Juan & Chiu & Francisco, 2006). Based on the above findings, we hypothesize the following:

Hypothesis 4. User satisfaction positively affects learner intentions to use.

2.7. User satisfaction and learning performance

Ramayah and Lee (2012) noted that user satisfaction is widely accepted as a desirable outcome of any product or service experience, owing to that it is a significant criteria for measuring the success of the ERP software system. Zaied (2012) argued that satisfaction is an overall affective response to a perceived discrepancy between prior expectations and perceived performance of the user. Sears and Jacko (2003) indicated that the system may affect user productivity and perception. Previous studies have also established strong correlations between system, task, satisfaction and performance. Therefore, according to the empirical results of Wu & Tennison & Hsia (2010), performance expectations and learning climate are two strong determinants of learning satisfaction with a blended ERP software system. Overall, both performance expectations and positive learning climate directly affect learning satisfaction; performance expectations contribute the most to learning satisfaction.

Given the above situation, user satisfaction is an effective means of reviewing previous studies on IS and user performance. These studies identify the conditions under which users are satisfied with the systems they use. Above studies demonstrate that user satisfaction affects user performance (Ahed & Louis & Poropat, 2009). Based on the above findings, we hypothesize the following:


2.8. Intention to use and user satisfaction and learning performance

Venkatesh and Davis (2000) found a strong correlation between behavior intention and actual behavior. This finding implies that the usage of skill applications with a higher level of perceived usefulness is successful only if users believes in a positive use performance relationship. Hence, as is generally assumed, the building of strong relationships with students and the instructor to develop openness and receptiveness to change as well as smoothens the way for learning course processes also affects the behavior intention to use the system (Soto, 2013).

Learning performance also determines the intention to use. Many studies have established that the confidence that a user has in use computers at work positively influences user satisfaction and learning performance (Hattis & Becker, 2001; Hasan, 2006; Hasan & Ali, 2007; Sun & Cheng, 2007). According to Prieto & Revilla (2006), a positive learning climate encourages and stimulates the exchange of ideas, opinions, information, and organizational knowledge, ultimately improving
learning satisfaction and their desire to learn. Of course, user satisfaction is also
determined by learning performance. Ramayah and Lee (2012) empirically
demonstrated that the extent to which information quality impacts intention to use
is fully mediated by user satisfaction. Related literature suggests that intention to use
is positively related to user satisfaction and learning performance in an ERP software
system. Based on the above findings, we hypothesize the following:


Hypothesis 7. Intention to use has the mediating effect on the relationship
between user satisfaction and learning performance.

As stated above, learners can reflect their learning and modify their problem
solving strategies to learn more effectively during the problem solving process
between interface design and cognitive function. A learning environment should
frequently utilize those modes of representations to facilitate significant learning to
the learners (Chen et al., 2009). Based on the TAM model and D&M updated model,
this study proposes an integrated model for evaluating the success of the ERP
software system. Table 1 shows the relationship between each hypothesis, and is
supported by previous literature.

Table 1 Hypotheses and selected literature references

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Casual path</th>
<th>Support from previous literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Easy to use learner interface is positively related to user satisfaction</td>
<td>Lin &amp; Wu &amp; Tsai (2005); Johannsen (2007); Ali (2009)</td>
</tr>
<tr>
<td>H3</td>
<td>Instructor attitude towards students is positively related to user satisfaction</td>
<td>Liang &amp; Koubek, (1997); Arbaugh, (2000); Volery and Lord (2000); Trentin, (2000); Chou &amp; Liu, (2005); Sun &amp; Zhan, (2006); Liaw &amp; Huang, 2007; Ali (2009); Chen and Tseng (2012)</td>
</tr>
<tr>
<td>H4</td>
<td>Satisfaction is positively related to learners intentions to use</td>
<td>Bhattacherjee (2001a); Allard et al, (2001); Chiu et al (2005); Juan &amp; Chiu &amp; Francisco (2006)</td>
</tr>
<tr>
<td>H5</td>
<td>Satisfaction is positively related to learning performance</td>
<td>Sears and Jacko (2003); Ahed &amp; Louis &amp; Poropat, (2009); Wu &amp; Tennyson &amp; Hsia (2010); Ramayah and Lee (2012); Zaied (2012)</td>
</tr>
<tr>
<td>H7</td>
<td>Intention to use mediates the relationship between user satisfaction and learning performance</td>
<td></td>
</tr>
</tbody>
</table>

3. EXPERIMENT
3.1. Methodology

By combining the TAM model and D&M updated model tests, this study estimates the relationships between learner interface, interaction, instructor attitudes towards students, user satisfaction, intention to use, and learning performance, which were designed based on the principles of ERP software system; both functional of interface design and cognitive functional information were contained as well. Figure 1 shows the research model for this study, as adapted from Wang & Liao & Chu (2011).

From a theoretical perspective, this study adopted the theory of technology
acceptance model (TAM) (Fishbein & Ajzen, 1975; Davis, 1989). Also, DeLone & McLean updated the success model (DeLone & McLean, 2003). By using TAM, Kwasi and Salam (2004) postulated that computer usage is determined by behavioral intention to use a system. Additionally, the intention to use the system is jointly determined by an individual’s attitude towards using the system and its perceived usefulness. A more thorough understanding of these factors enables us to design effective organizational interventions, possibly increasing both user acceptance and the use of new ERP software systems. Moreover, according to Claus et al. (2013), evaluators chose the DeLone and McLean updated framework, owing to that it is well-validated, and its six dimensions ensure an evaluation of the ERP consequences over an extensive period. The six constructs of the D&M IS updated success model, include system quality, information quality, service quality, user satisfaction, intention to use, and performance (i.e. net benefits).

3.2. Data collection and measurement

Data were collected from July to September 2013. Study participants were university students who had taken courses via the ERP software system. Totally, 230 students who enrolled in ERP software system courses at a southern private university in Taiwan were selected to participate in the quantitative survey.

A questionnaire was designed based on the six constructs of the conceptual model. All measures for each construct were taken from previously validated instruments and modified based on the ERP context. For instance, the measures for learner interface were selected from Wang (2003) and Ong et al. (2004). Measures for interaction were adapted from Liu et al. (2010) and Ke et al. (2012). The measures for instructor attitudes towards student were developed from the study of Sean et al. (2006) and Jennifer (2011). The measures for user satisfaction were taken from Liaw (2008) and Wang et al. (2007). The measures for intention to use were taken from
Bhattacherjee (2001b) and Liaw (2008). Finally, the measures for the learning performance were selected from Young et al. (2003) and Erina et al. (2008). The questionnaire items were measured on a nine-point Likert-type response with a format ranging from “very low satisfaction” to “very high” satisfaction. Appendix A shows the six constructs with 15 items in total for use in this study.

4. Results
4.1. Reliability and validity analyses

Two-step structural equation modeling was used for model evaluation. Maximum likelihood was used for all parameter estimation with Amos. First confirmatory factor analysis (CFA) was conducted to evaluate the model used to determine the modeled constructs. CFA allows for evaluation of the reliability, convergent validity and discriminate validity of the measurement model. Next, the reliability and internal validity of the measurement model was examined by calculating the composite reliability (CR) and average variance extracted (AVE). Table 2 indicates that all of the constructs have acceptable composite reliability coefficients, owing to that they exceed 0.6 (Bagozzi and Yi, 1988; Hair et al., 1998). AVE of each measure accounts for more than 0.50 of the variance, as suggested by Bagozzi and Yi (1988), indicating that the variance captured by the construct exceeds that due to the measurement error (Fornell and Larcker, 1981). Therefore, the measurement model has adequate internal validity.

Convergent validity evaluates the correlation between two observed variables used to evaluate the same construct and is expected when the estimated pattern coefficient on the underlying construct factor of the estimated pattern of each coefficient is significant. Items have factor loadings exceeding 0.45 (Jöreskog & Sörbom, 1996). Table 2 lists the convergent validity outcome of each latent variable. The standardized factor loadings of each sub-dimension all exceed 0.45 and are significant. In this study, convergent validity was thus achieved for all of the study constructs. Discriminate validity was assessed using the approach suggested by Fornell and Larcker (1981). Closely examining AVE for each of the latent constructs and comparing this with the squared correlations among the constructs revealed that the shared variance among any two constructs (i.e. the square of their inter-correlation) was always less than the average variance explained by the construct, implying discriminate validity. Table 3 lists the outcome of discriminate validity. Moreover, discriminate validity was accessed based on a study on the correlations. According to Hair, Anderson, Tatham, and Black (1998), the r-value between each pair of independent variables in the correlation should not exceed 0.90. If a case like this still exists, it may be suspected to have multicollinearity (Hair et al., 1998). According to Table 4, the highest value of the coefficient is 0.760, i.e. less than 0.90. Hence,
multicollinearity did not exist among the various constructs in the measurement model (Hair et al., 1998; Lee, Lam et al., 2010).

Table 2 Construct reliability and convergent validity coefficients

<table>
<thead>
<tr>
<th>Construct</th>
<th>Variable</th>
<th>Factor</th>
<th>Cronbach 'α</th>
<th>Construct reliability</th>
<th>Average variance extracted</th>
</tr>
</thead>
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<tr>
<td>Learner interface</td>
<td>A1</td>
<td>0.787</td>
<td>0.837</td>
<td>0.742</td>
<td>0.589</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>0.748</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Interaction</td>
<td>B1</td>
<td>0.767</td>
<td>0.769</td>
<td>0.687</td>
<td>0.524</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>0.678</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor attitude towards student</td>
<td>C1</td>
<td>0.833</td>
<td>0.901</td>
<td>0.808</td>
<td>0.514</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>0.683</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C3</td>
<td>0.676</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4</td>
<td>0.663</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User satisfaction</td>
<td>D1</td>
<td>0.816</td>
<td>0.888</td>
<td>0.787</td>
<td>0.555</td>
</tr>
<tr>
<td></td>
<td>D2</td>
<td>0.779</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D3</td>
<td>0.626</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention to use</td>
<td>E1</td>
<td>0.869</td>
<td>0.776</td>
<td>0.793</td>
<td>0.658</td>
</tr>
<tr>
<td></td>
<td>E2</td>
<td>0.749</td>
<td></td>
<td></td>
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<tr>
<td>Learning performance</td>
<td>F1</td>
<td>0.730</td>
<td>0.864</td>
<td>0.693</td>
<td>0.531</td>
</tr>
<tr>
<td></td>
<td>F2</td>
<td>0.727</td>
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</table>

*Rotation sums of squared loadings=83.963; Overall reliability =0.948; Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0.933(KMO)

Table 3 Discriminate validity coefficients.

<table>
<thead>
<tr>
<th>variables</th>
<th>LI</th>
<th>IT</th>
<th>IATS</th>
<th>US</th>
<th>ITU</th>
<th>LP</th>
</tr>
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<tr>
<td>Learner interface (LI)</td>
<td></td>
<td>0.768</td>
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<tr>
<td>Interaction (IT)</td>
<td>0.624</td>
<td>0.724</td>
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<tr>
<td>Instructor attitude towards student (IATS)</td>
<td>0.721</td>
<td>0.685</td>
<td>0.717</td>
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<tr>
<td>User satisfaction (US)</td>
<td>0.678</td>
<td>0.629</td>
<td>0.740</td>
<td>0.745</td>
<td></td>
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<tr>
<td>Intention to use (ITU)</td>
<td>0.425</td>
<td>0.575</td>
<td>0.537</td>
<td>0.512</td>
<td>0.811</td>
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<tr>
<td>Learning performance (LP)</td>
<td>0.615</td>
<td>0.660</td>
<td>0.676</td>
<td>0.718</td>
<td>0.621</td>
<td>0.729</td>
</tr>
<tr>
<td>Mean</td>
<td>6.61</td>
<td>6.55</td>
<td>6.51</td>
<td>6.59</td>
<td>6.41</td>
<td>6.23</td>
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<tr>
<td>Standard deviation</td>
<td>1.50</td>
<td>1.19</td>
<td>1.24</td>
<td>1.34</td>
<td>1.26</td>
<td>1.39</td>
</tr>
</tbody>
</table>

*Diagonal elements (bold) are the square root of average variance extracted (AVE) between the constructs and their measure. Off-diagonal elements are correlations between constructs.
**p-value<0.10, ***p-value<0.05, ****p-value<0.01

Table 4 Inter-construct correlations as discriminate validity

<table>
<thead>
<tr>
<th></th>
<th>A1</th>
<th>A2</th>
<th>B1</th>
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</table>
We conclude that all of the measures exhibit construct validity. Based on all of the reliability and validity analysis, the construct scale appears to exhibit satisfactory measurement qualities and is adequate.

4.2. Structural model and hypothesis testing

According to Hair et al. (1998), goodness-of-fit of the SEM analysis is indicated by how well it reproduces the observed co-variance matrix among the indicator items. A variety of fit indices are used to assess the model fit and, then, it allows the researcher to propose and subsequently test propositions about the interrelationships among variables in a multivariate setting. The first assessment of goodness of fit for the model is performed for the overall model (Table 5). It provides the extent to which the specified indicators (i.e. variables) represent the hypothesized constructs (i.e. consolidated utility factors). Three useful overall model fit measures are absolute, incremental and parsimonious ones.

First, absolute fit indices determine the extent to which the overall model (i.e. structural and measurement models) estimates the observed covariance or correlation matrix. Simultaneously, the chi-square measure is limited in that it is too sensitive to sample size differences. With an increasing sample size (i.e. 230 samples in this study), this measure has a greater tendency to indicate that significant differences are found for any specified model. Wheras $\chi^2(211.790)$ cannot determine the fitness of the proposed model. However, according to our results, although the model did not have a good fit to the data, CMIN/DF value 2.681 of the proposed model was found within some threshold limits 1.0 ~ 5.0. The value of GFI 0.899 is close to the recommended level of 0.9. The value of RMSEA (0.086) is higher than the recommended value of 0.08; Second, incremental fit are measures that compare the proposed model with a baseline model, which is normally referred to as the null model. The null model should be a realistic model in which all other models should be expected to exceed. The null model is normally a single-construct model with all indicators perfectly determining the construct. Here, the value of NFI is 0.920; the value of NNFI is 0.931; the value of CFI is 0.948; and the value of IFI is 0.948. Notably, these values are higher than the recommended value of 0.90. The value of RFI 0.895 is close to the recommended level of 0.9; Finally, parsimonious fit indices determine the goodness-of-fit of the model to the number of estimated coefficients required in order to achieve this level of fit. Their basic objective is to diagnose whether the model fit has been achieved by over fitting the data with too many coefficients. The value of PNFI is 0.692 and that of PGFI is 0.592. Both of the values
are higher than the recommended value of 0.5.

Given the above considerations, although the values of GFI and RMSEA are higher than the recommended values, RFI is less than the recommended values. According to our results, the data was correlated with several competing models. Additionally, measures of goodness of fit for the final model were obtained as follows: \( \chi^2 / df = 2.681 \), GFI = 0.899, AGFI = 0.846, NNFI/TLI = 0.931, CFI = 0.948, and RMSEA = 0.086. Thus, they are still valid and reflect a reasonably an acceptable model (Hair et al., 1998).

### Table 5: Overall fits of the research model

<table>
<thead>
<tr>
<th>Goodness-of-fit measure</th>
<th>Recommended value</th>
<th>Observed value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Fit Measures</td>
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</tr>
<tr>
<td>( \chi^2 )</td>
<td>( P \geq \alpha )</td>
<td>211.790 (p=0.000)</td>
</tr>
<tr>
<td>( \chi^2 / df )</td>
<td>1-5</td>
<td>2.681</td>
</tr>
<tr>
<td>GFI</td>
<td>( \geq 0.9 )</td>
<td>0.899</td>
</tr>
<tr>
<td>RMR</td>
<td>( \leq 0.1 )</td>
<td>0.086</td>
</tr>
<tr>
<td>RMSEA</td>
<td>( \leq 0.08 )</td>
<td>0.086</td>
</tr>
<tr>
<td>AGFI</td>
<td>( \geq 0.8 )</td>
<td>0.846</td>
</tr>
<tr>
<td>Incremental Fit Measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NFI</td>
<td>( \geq 0.9 )</td>
<td>0.920</td>
</tr>
<tr>
<td>NNFI/TLI</td>
<td>( \geq 0.9 )</td>
<td>0.931</td>
</tr>
<tr>
<td>CFI</td>
<td>( \geq 0.9 )</td>
<td>0.948</td>
</tr>
<tr>
<td>RFI</td>
<td>( \geq 0.9 )</td>
<td>0.895</td>
</tr>
<tr>
<td>IFI</td>
<td>( \geq 0.9 )</td>
<td>0.948</td>
</tr>
<tr>
<td>Parsimonious Fit Measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PNFI</td>
<td>( \geq 0.5 )</td>
<td>0.692</td>
</tr>
<tr>
<td>PGFI</td>
<td>( \geq 0.5 )</td>
<td>0.592</td>
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</table>

Owing to that all of the fit indices of the structural model satisfy the recommended criteria, this study examines the path coefficients of the structural model, as shown in Fig. 2. As for the hypothesis tests, all of the hypothesized relationships are supported for the estimated structural model. According to our results, learner interface is a positive antecedent user satisfaction (path coefficient=0.186, \( t = 2.001 \)) at the 99% significance level. Therefore, Hypothesis 1 is supported. The result of Hypothesis 2 with respect to how interaction influences user satisfaction is supported (path coefficient=0.365, \( t = 2.967 \)) at the 99% significance level. Hypothesis 3 examines whether instructor attitudes towards students (path coefficient=0.442, \( t = 3.731 \)) have a significant positive effect on user satisfaction at the 99% significance level. Hypothesis 4 examines how user satisfaction impacts the intention to use. Analysis results indicate that user satisfaction positively affects the intention to use at the 99% significance level (path coefficient=0.603, \( t = 7.649 \)). Hypothesis 5, which examines how user satisfaction impacts learning performance, is supported at the 99% significance level (path coefficient=0.752, \( t = 8.065 \)). Hypothesis 6, which examines how intention to use impacts learning performance, is supported at the 99% significance level (path coefficient=0.391, \( t = 3.975 \)). Table 6 summarizes the details of direct, indirect, and total effect for each individual path.
Simultaneously, for the mediation analyses, user satisfaction significantly and positively affects both intention to use (path coefficient=0.480, t=9.001) and learning performance (path coefficient=0.378, t=7.050). Moreover, the intention to use also significantly and positively affects learning performance. Hence, Hypothesis 7, which examines how the intention to use mediates the influence of user satisfaction (path coefficient=0.559, t=11.141), has a significantly positive effect on learning performance, as shown in Fig. 3. However, as Mackinnon et al. (2002) and Preacher & Hayes (2004) suggest, Baron & David (1986) neglected the role of mediation in indirect effect. Therefore, to ensure that the empirical results demonstrate actual needs, further empirical studies are necessary to estimate the indirect effects by using the Sobel test (1982). The former undertook an approximate significance test to evaluate how the independent variable indirectly affects the dependent variable via the mediator. Figure 4 describes the testing formula. As |z| > 2, its indirect effect is significant. The latter is calculated using 95% confidence interval for the indirect
effect. If the 95% confidence interval does not include zero, then the indirect effect is not zero. The variable thus exerts a mediating effect. The testing formula is \((ab - 1.96 \times se(ab), ab + 1.96 \times se(ab))\). Analytical results indicate that \(z = 5.53 > 1.96\) € (0.117, 0.245). Above results demonstrate that intention to use mediates how user satisfaction influences learning performance. Hypothesis 7 is thus supported. A summary of the results in Table 7 demonstrates that the entire hypothesis is validated.

Table 7 Measurement results of the final SEM model.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Casual path</th>
<th>Path coefficient</th>
<th>t-value</th>
<th>Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Easy to use learner interface is positively related to user satisfaction</td>
<td>0.186</td>
<td>2.001</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>More interaction is positively related to user satisfaction</td>
<td>0.365</td>
<td>2.967</td>
<td>Supported</td>
</tr>
<tr>
<td>H3</td>
<td>Instructor attitude towards students is positively related to user satisfaction</td>
<td>0.442</td>
<td>3.731</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>Satisfaction is positively related to learners intentions to use</td>
<td>0.603</td>
<td>7.649</td>
<td>Supported</td>
</tr>
<tr>
<td>H5</td>
<td>Satisfaction is positively related to learning performance</td>
<td>0.752</td>
<td>8.065</td>
<td>Supported</td>
</tr>
<tr>
<td>H6</td>
<td>Intention to use is positively related to learning performance</td>
<td>0.391</td>
<td>3.975</td>
<td>Supported</td>
</tr>
<tr>
<td>H7</td>
<td>Intention to use mediates the relationship between user satisfaction and learning performance</td>
<td>0.559</td>
<td>11.141</td>
<td>Supported</td>
</tr>
</tbody>
</table>

5. DISCUSSION

5.1. Discussion and conclusions

Similar to earlier studies (Wang, Liao, & Chu, 2011), this study combined both the TAM model and D&M updated model to explore how to use the cognitive function and interface design in order to enhance the learning performance of the user ERP software system. Results of this study significantly contribute its use as a valuable theoretical model in elucidating behavioral intention to use of the ERP software system. Based on those results, we conclude that the proposed model accurately represents the gathered data, based on the results of a goodness-of-fit test. Based on an exhaustive literature review, this study proposes the hypotheses H1–H7.
Analytical results support all of these hypotheses. However, based on the empirical discussions of the test results, we conclude the following:

User satisfaction or intention to use positively affects learning performance (Avner et al., 2006; Christy & Matthew, 2011; Filiz & Nhung, 2013). This study demonstrates that user satisfaction or intention to use positively affects ERP learning performance. These analytical results correlate with those obtained by Wang et al. (2011), and Duke et al. (2007) in ERP training system studies. These results may be owing that educators and academic institutions implementing user satisfaction or intention to use strengthen the learner interface and interaction. Additionally, instructors should try to maintain user satisfaction with the use of the portal in order to continue using them (Avner et al., 2006), helping them to modify business operating patterns and responding to user feedback. These factors are more responsive to changes in internal and external user needs, thus reducing uncertainty in the learning process and improving learning performance.

(1) An exhaustive literature review revealed a lack of academic research on the correlations between user satisfaction and intention to use in the ERP training learning performance. According to our results, user satisfaction is an antecedent of intention to use. Intention to use mediates how user satisfaction and learning performance are related. The results of intention to use thus differ from those of use satisfaction and play an important mediating or moderating role (Juan, 2006). This finding suggests that use satisfaction offers a holistic and systematic cognitive attitude for learning performance in order to foster perceived ease of use in the learner interface (Xin, 2012), thus creating an interaction platform and enhancing the instructor attitude towards students in the ERP training course and interrelated information system environment. Arbaugh and Duray (2002) found that students feel more satisfied with related online learning activities and are willing to reuse with them if they have had previous online learning experiences. Analytical results also indicate that the value criterion ERP training provided for the user also require closes coordination between the easy to use interface and stronger intention to use the learning, ultimately promoting user satisfaction and learning performance.

(2) Further, there are important differences regarding other aspects of the studies. These results lend some credence to the hypothesis that another important finding pertains to the mediating effects of the intention to use between user satisfaction and learning performance. The results show that a positive intention to use will occupy partial mediating role between user satisfaction and learning performance. It can be inferred that the attempts for promoting user satisfaction can evoke learning performance not only in a direct way, but also in a indirect way through
positive intention or favorite for ERP software system with a specific system, contrary to Wang et al. (2011) findings.

(3) Moreover, this study finds that intention to use also differ in other aspects of the studies. These results confirm the hypothesis that another important finding pertains to the mediating effects of the intention to use between user satisfaction and learning performance. Analytical results indicate that a positive intention to use occupies a partial mediating role between user satisfaction and learning performance. We can infer that the attempts for promoting user satisfaction can evoke a learning performance not only directly, but also indirectly through positive intention or a favorite for the ERP software system with a specific system, which is in contrast to the findings of Wang et al. (2011).

5.2. Theoretical and managerial implications

(1) The proposed model is promising for use as a decision making tool to orient what academic institutions must emphasize in order to increase system usage and user satisfaction, including the following: (i) this study empirically tested reliable constructs, which were found significant in predicting intention to use an ERP software system; (ii) this study introduced the TAM model and DeLone and McLean updated success model as a central portion of the proposed model; and (iii) this study empirically demonstrated that factors that influence intention to use or user satisfaction, can significantly influence learning performance.

Users enhance learning performance. User satisfaction that incorporates educators and academic institutions improves instructor characteristics, interaction, and learner interface. This finding also reveals that academic institutions identify the areas of ERP training in which they invest, and the areas requiring improvements. However, the degree of implementation of the basic elements of user satisfaction influences learning performance. This study, which incorporates elements of user satisfaction such as the ERP software system, is easy to use (factor loading=0.787). Additionally, interacting with the ERP software system does not require much mental effort (factor loading=0.748), which is of priority concern in terms of satisfaction with the ERP training system. The ERP training system effectively reinforces these elements in terms of its understandability or usefulness or access and usability via information or communication technology systems.

(2) Intention to use improves learning performance. Most of the information system industry is aware that changes in user perception and competitor activities are important for ERP. The ERP software system must also educate and train instructors continuously to detect and understand such a change. Furthermore, sharing user and training information within the ERP fulfills user requirements and expectations with new solutions.
(3) User satisfaction obviously affects intention to use. Intention to use has a mediating effect on the relationship between user satisfaction and learning performance. This finding demonstrates that user satisfaction offers a rich array of tools that educators and academic institutions can transform to achieve the intention to use. Intention to use can contribute to ERP software system design and offer a service mix in which users perceive as superior satisfaction, ultimately enhancing the learning performance. The ERP software system requires close coordination between their easy to use interface and stronger intention to use the learning system. The system not only incorporates user satisfaction strategies, but also strengthens behavior intention strategies to satisfy user requirements in ERP management systems.

5.3. Limitations of this study and implications for future research

(1) This study was based on cross-sectional data. The following question arises: Does user satisfaction or intention to use positively affect long term learning performance? A major gap is found in longitudinal studies. Our results suggest that subsequent researchers perform longitudinal studies based on long-term observations or interviews regarding implementation in the ERP software system to provide further insight into probable causations.

(2) This instruction tool is still in the experimental stage and warrants further investigation. Human-machine interaction and implementation in ERP software system education also warrant further study. Future research should provide a descriptive basis for additional research. Additionally, an adequate theoretical framework must be developed for the implementation of discourse analysis in ERP. This study demonstrates that ERP software system teaching is required and should be prioritized in ERP programs. Correspondingly, ERP training must be strengthened and more effective delivery of ERP software system courses is necessary for information system students. However, whether this approach is also applicable to ERP contexts in other countries cannot be determined based on the results of this study. Further research is this warranted for application of the ERP system in different teaching contexts.

References
Environment. Journal of Interactive Online Learning, 8(2), 1541-4914.


Leighton, Jenkins.(2011). New ERP Vendors and Trends drive Growth. ERP


Appendix A. Questionnaire items
All of 15 items were measured on a nine-point Likert scale ranging from 1 (very low satisfaction) to 9 (very high satisfaction).
Learner Interface:
(A1) The ERP software system is easy to use
(A2) Interacting with the ERP software system does not require a lot of my mental effort
Interaction:
(B1) I discuss relevant ERP software system topics with others on the discussion board
(B2) This system raises interaction with teacher
Instructor attitude towards student
(C1) Teachers confident collaborating with colleagues to provide coherent reaching programs for students.
(C2) The instructor provided helpful timely feedback on assignments, exams, or projects.
(C3) The instructor was very knowledgeable about the course.
(C4) Teachers would have an overall positive attitude including this student in the classroom
User satisfaction:
(D1) I am satisfied with using the ERP functions.
(D2) You think that the perceived utility about the ERP software system is high.
(D3) You are satisfied with the ERP system intention to use.
Intention to use:
(E1) I intend to use ERP software system as an autonomous learning tool
(E2) I intentions are to continue using my ERP software system rather than any alternative means.
Learning performance:
(F1) The use of ERP software system has led to a better learning experience.
(F2) I desire to learn more about the ERP software system.