EFFECTS OF E-LEARNING MANAGEMENT SYSTEMS, SELF-EFFICACY, AND SELF-REGULATED LEARNING ON SYSTEM EFFECTIVENESS

Sean B. Eom

The quantity and quality of e-learning research in business education have increased dramatically during the past decade. The majority of e-learning empirical studies have focused on the two research streams: outcome comparison studies with classroom-based learning and studies examining potential predictors of e-learning success (Arbaugh et al. 2009). Over the past decade, numerous studies examined the factors that affect the learning outcomes and student satisfaction in asynchronous online learning courses (Peltier et al. 2003, Peltier et al. 2007, Marks et al. 2005, Eom et al. 2006). The conceptual framework of Piccoli, Ahmad and Ives (2001) postulates that human and design factors as antecedents of learning effectiveness. Human factors are concerned with students and instructors, while design factors characterize such variables as learning model, technology, learner control, course content, and interaction. All these studies empirically investigated the determinants of students’ satisfaction, learning outcomes in university online education. Peltier, et al. (2003, 2007) found that student-to-student interactions, student-to-instructor interactions, instructor support and mentoring, information delivery technology, course content, and course structure were to be significant predictors of the overall effectiveness of the online educational experience. The study of Marks et al. (2005) found that instructor-student interaction is most important, twice that of student-student interaction and that some student-content interaction is significantly related to perceived learning. The study indicated that distance education advantages/flexibilities, although significant, are less
important than other interactions. Eom, et al. (2006) found that all six factors—course structure, self-motivation, learning styles, instructor knowledge and facilitation, interaction, and instructor feedback—significantly influenced students’ satisfaction. Of the six factors hypothesized to affect perceived learning outcomes, only two (learning styles and instructor feedback) were supported. However, these empirical studies failed to include the technological dimension as an antecedent of effectiveness of e-learning systems. We noticed that the study of Peltier, et al. (2003) included information delivery technology in their model. However, the information delivery technology variable was only measured by the contents of instructor designed CD-ROMs.

The e-learning management system (e-LMS), despite its critical role in the e-learning process, has not received proper attention in e-learning empirical research. The purpose of this paper is to empirically investigate the effects of e-LMS, self-efficacy and self-regulated learning on learner satisfaction with the system and system effectiveness. Our research model is an extension of the information systems success model of DeLone and McLean (1992) and the virtual learning environment (VLE) effectiveness model of Piccoli et al. (2001). The DeLone and McLean (DM) model is one of the widely recognized information system (IS) success models based on a systematic review of 180 studies with over 100 measures. The DM model has been empirically tested using structural equation modeling in a quasi-voluntary IS use context (Rai et al. 2002) and in a mandatory information system context (Livari 2005). The study of Rai, et al. concluded that the DM model has explanatory power and therefore the model has merit for explaining IS success. The study of Livari concluded that perceived system quality and information quality are significant predictors of user satisfaction. But his study failed to support the positive association between system use and user satisfaction.

Our research focuses on the effects of the information technology (e-learning management systems), learner’s psychological variables (e.g., self-efficacy) and psychological learning process (e.g., self-regulated learning management) on student satisfaction with the e-learning management system and e-learning systems’ effectives.
Since our research model is built on the models of DeLone and McLean (1992) and Piccoli et al. (2001), we will briefly review them.

**The DM Model**

DeLone and McLean reviewed 180 empirical studies to formulate a more integrated view of the concept of information systems success. The DM model is widely validated, applied and extended in many different areas such as a quasi-voluntary IS use context (Rai et al. 2002), a mandatory information system context (Livari 2005), the university e-learning context using structural equation modelling (Freeze et al. 2010), e-commerce systems (Molla and Licker 2001), organizational memory information systems (Jennex et al. 1998), enterprise resource planning (Bernroider 2008), Health club industry (Skok et al. 2001), customer Relations Management (Avlonitis and Panagopoulos 2005, Wilson et al. 2002), enterprise resource planning Systems in China (Zhang et al. 2005), online community (Lin and Lee 2006), e-Government systems (Wang and Liao 2008), and Spanish executive information systems (Roldán and Leal 2003). Perhaps, this model is one of the most widely tested models in information systems.

The DM model of information systems success (Figure 1) consists of six major categories of success measures which are interrelated and interdependent: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. Later, Seddon (1997) presented and justified a re-specified and extended version of the DeLone and McLean model. Seddon demonstrated that the term, “IS use” in the DM model can be interpreted in three different ways—as a variable that proxies for the benefits from use, as the dependent variable, and as an event in a process leading to individual or organizational impacts. The extended model clarified the meaning of IS use and introduced four new variables (expectations, consequences, perceived usefulness, and net benefits to society).
The VLE Effectiveness Model

Piccoli et al (2001) introduced the concept of VLE and presented a framework of VLE effectiveness. Figure 2 exhibits three major dimensions of VLE and their relationships. The design dimension of VLE effectiveness model includes learner control and technology as important determinants of learning effectiveness. The technology construct can be measured by quality and reliability, accessibility of e-LMS. Alavi and Leidner (2001) proposed a technology-mediated learning framework that posited that the internal psychological processes of learners are the mediating construct that directly affects learning outcomes. The psychological processes are influenced by information technology and instructional strategies in a given instructional context. These e-learning system technologies can play critical roles to support specific theoretical models of learning (e.g., objectivist, constructivist) (Leidner and Jarvenpaa 1995).
The theoretical foundation of our research is derived from the synthesis of the DM model and the VLE model. The VLE model is a broad framework of VLE effectiveness which postulated that human and design dimensions...
determine e-learning effectiveness. The design dimension consists of five constructs including technology and learner control. The DM model theorized that system quality and information quality singularly and jointly affect both use and user satisfaction, which in turn, are direct antecedents of system effectiveness (DeLone and McLean 1992). It has been widely accepted in the MIS community. Nevertheless, the DM model can only explain a small part of the VLE model. Our research model empirically tests the effects of three constructs (technology, learner control, and self-efficacy) on the effectiveness of e-learning management systems.

Research Model and Hypotheses

The research model (figure 3) was tested using the SEM-based Partial Least Squares (PLS) methodology for two reasons, because PLS is well suited to the early stages of theory building and testing (Chin 1998b). It is particularly applicable in research areas where theory is not as well developed as that demanded by LISREL (Fornell and Bookstein 1982) as is the case with this research study. The model in Figure 3 represents the relationships among seven constructs. The four independent constructs are system quality, information quality, self-efficacy, and self-managed learning. The two mediating constructs are system use and user satisfaction. The dependent construct is e-learning system effectiveness.
**System Quality and Information Quality**

The IS success model (DeLone and McLean 1992, DeLone and McLean 2003) and the e-learning success model (Holsapple and Lee-Post 2006) posit that the success of IS and e-learning systems is dependent on the intervening variables (user satisfaction and system use), which are in turn dependent on the quality of information, system, and service. Technology acceptance model (TAM) developed in the IS area has emerged as a useful model for explaining e-learning system usage and satisfaction (Landry et al. 2006). The TAM defines the relationships between systems use (dependent constructs) and perceived usefulness and perceived ease of use (two independent constructs). Therefore, the TAM theorizes that system use is determined by perceived usefulness and perceived ease of use. The TAM
model has been extended by many other researchers. The unified theory of acceptance and use of technology (UTAUT) is an extension of the TAM model. The TAM postulates that perceived usefulness and ease of use determine an individual’s intention to use a system, which in turn, determines actual system use. The theory posits that the four key constructs directly determine usage intention and behaviour (Venkatesh et al. 2003). We hypothesize the following.

H₁. System quality will be positively related to system use.
H₂. System quality will be positively related to user satisfaction.
H₃. Information quality will be positively related to system use.
H₄. Information quality will be positively related to user satisfaction.

System Use

System use has been considered as a factor that influences the system success in the past decade (DeLone and McLean 1992, DeLone and McLean 2003, Holsapple and Lee-Post 2006, Rai et al. 2002). DeLone and McLean defined “Information Use” as “Recipient consumption of the output of an information system”. As shown in Figure 1, the DM model used “Use” rather than “system use” or “information use”. Therefore, the term “system use” in our model is to be interpreted as: (1) a behaviour using a measurement item “I depend upon the system.” Moreover, “system use” is also measured as frequency/extent of use using a measurement item “I frequently use the system.” We hypothesize the following.

H₅: System use will be positively related to e-learning system’s effectiveness.

Self-efficacy

Self-efficacy is an individual’s belief in his or her ability to accomplish a certain task and to produce designated levels of performance with the skills he or she has (Bandura, 1986; Bandura, 1991). Self-efficacy beliefs determine how people motivate themselves and behave (Bandura 1994). The original concept of self-efficacy is defined broadly as an individual’s belief/judgments/perceptions of his or her abilities to use skills/artifacts
including computers and information technologies. Later management information systems (MIS) researchers introduced the term, computer self-efficacy as an important MIS research construct. Compeau and Higgins (1995) defined it as “an individual’s perception of his or her abilities to use computers in the accomplishments of a task.”

Computer self-efficacy was positively linked to e-learning outcomes measured by average test scores in e-learning (Simmering et al. 2009). Johnson, Hornik and Salas (2008) found that e-learners’ self-efficacy and perceived usefulness of the system were positively related perceived content value, course satisfaction, and course performance. Other studies have examined attitudes and behaviours influencing course management system usage. Significant positive relationships were found between self-efficacy and e-learning system use intention. Computer self-efficacy, attainment value, utility value, and intrinsic value were significant predictors of individuals’ intentions to continue using Web-based learning (Chiu and Wang 2008). Significant positive correlations were found among the three e-learning variables (self-efficacy, e-learner satisfaction and perceived usefulness (Womble 2008). The term, “perceived usefulness,” is often used instead of “system use” (e.g., (Rai et al. 2002). Therefore, we hypothesize the following.

H₆: Computer self-efficacy will be positively related to system use.
H₇: Computer self-efficacy will be positively related to e-learner satisfaction with the system.

**Self-regulated Learning**

Self-regulation refers to self-managing behaviour, motivation, and cognition (Zimmerman 1995). Numerous research studies suggest that self-regulation in distance learning may be more important than in traditional face-to-face learning because of the changing role of students from passive learners to active learners (King et al. 2000, Jonassen et al. 1995). E-learning systems placed more responsibilities on learners than traditional face-to-face learning systems. Self-regulated learning requires changing roles of students from passive learners to active learners. Education psychologists found that the essential qualities that discriminate a self-regulated learner from others are the individual’s conscious choice of cognitive learning strategy and learning outcomes, and continuous monitoring and self-assessment of learning effectiveness and progress toward the learning outcome (Zimmerman 1986, Zimmerman 1989). Self-
regulated learners possess three self-regulatory attributes (self-efficacy, self-awareness, and resourcefulness), which drive learners’ self-regulatory processes (attributions, goal setting, and self-monitoring). Self-regulatory attributes, especially self-efficacy, are positively related to task persistence, effective study activities, and learning outcomes (Zimmerman 1989). A prior research study also suggests that learner satisfaction is a significant predictor of learning outcomes (Eom et al. 2006). The second self-regulatory attribute, resourcefulness, refers to the ability to control physical surroundings and to seek help from social sources including persons and non-human references (Zimmerman 1989). A self-regulated learner is an active and persistent seeker of information. Therefore, we hypothesize the following:

**H8**: Self-regulated learning will be positively related to system use.

**H9**: Self-regulated learning will be positively related to e-learner satisfaction with the system.

**User Satisfaction and E-learning Systems Effectiveness**

There are abundant prior research studies that examined the relationships between user satisfaction and individual impact (Doll and Torkzadeh 1988, Rai et al. 2002, Livari 2005) and user satisfaction and learning outcomes (Eom et al. 2006). These studies consistently indicated that there is a positive relationship between user satisfaction and learning systems effectiveness/learning outcomes.

**H10**: User satisfaction will be positively related to system use.

**H11**: User satisfaction will be positively related to system effectiveness.
Survey Instrument and Sample

The survey questionnaire is selected from a multi-dimensional model for assessing e-learning systems success (ELSS) from the perspective of the e-learner developed by Wang, Wang, and Shee (2007). Based on DeLone and McLean’s (2003) updated IS success model, Wang, et al. developed and validated the ELSS model. The model conceptualized the construct of e-learning systems success, provided empirical validation of the construct and its underlying dimensionality. The survey instrument consisted of 35 items using a seven point Likert scale ranging from “strongly disagree” to “strongly agree.” In this study, all constructs are reflective constructs. In addition, respondents were asked six demographic-type questions. The population was undergraduate and graduate students that were enrolled in an online course at a large university located in the Midwest United States. We collected the e-mail addresses from the student data files archived with every online course delivered through the online program of a university in the Midwestern United States. The survey URL and instructions were sent to all valid e-mail addresses. Invitations to reply to the survey were administered online at the time of log-in to 2,156 unique students. Of those students invited, 809 students volunteered responses with 674 surveys being complete and usable for a response rate of 31.3%. The 674 sample consists of 140 business students and 534 non-business students. This paper focuses only on business students.

In the absence of formative indicators in the model, the sample size required for this analysis is equal to ten times the largest number of structural paths directed at the dependent (endogenous) construct, use, in figure 3. (Chin and Nested 1999, Hair et al. 2011). Thus, the minimum sample requirement is 50. To establish adequate power of .80 ($\alpha = .05$) in order for the effect to become significant, the required sample size is 91 (a medium effect size). With a larger effect size, it drops significantly to 42 (Cohen 1988, Green 1991). Therefore, our sample size of 140 is adequate to produce statistically significant results.

Measurement Model Estimation and Validation

The first step in data analysis involved model estimation. The test of the measurement model includes an estimation of the internal consistency and the convergent, discriminant, and factorial validity of the instrument items, as suggested by Straub et al. (2004)
Factorial Validity

In PLS, factorial validity is established when the square root of each construct’s average variance extracted (AVE) significantly larger than its correlation with other constructs (Chin 1998a). Table 1 clearly shows the factorial validity of the model constructs.

Table 1: Correlation among construct scores and factorial validity of the model construct (square root of average variance extracted in the diagonal)

<table>
<thead>
<tr>
<th></th>
<th>SQ</th>
<th>IQ</th>
<th>SE</th>
<th>SRL</th>
<th>SU</th>
<th>US</th>
<th>SEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Quality (SQ)</td>
<td>0.845</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Quality (IQ)</td>
<td>0.853</td>
<td>0.898</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy (SE)</td>
<td>0.517</td>
<td>0.540</td>
<td>0.914</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self Regulated Learning (SRL)</td>
<td>0.400</td>
<td>0.405</td>
<td>0.599</td>
<td>0.893</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Use (SU)</td>
<td>0.492</td>
<td>0.566</td>
<td>0.660</td>
<td>0.456</td>
<td>0.949</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User Satisfaction (US)</td>
<td>0.812</td>
<td>0.851</td>
<td>0.454</td>
<td>0.382</td>
<td>0.520</td>
<td>0.941</td>
<td></td>
</tr>
<tr>
<td>System Effectiveness (SEF)</td>
<td>0.839</td>
<td>0.849</td>
<td>0.559</td>
<td>0.427</td>
<td>0.536</td>
<td>0903</td>
<td>0.948</td>
</tr>
</tbody>
</table>

Construct Validity

Construct validity is assessed through establishing both convergent and discriminant validities. Convergent validity refers to the extent to which...
a set of indicator variables are load together and they load highly (loading >0.50) on their associated factors. Individual reflective measures are considered to be reliable if they correlate more than 0.7 with the construct they intend to measure. Table 2 shows most of the loadings were above 0.8 for the six constructs, higher than the threshold value .7. When indicator variables do not cross-load on two or more constructs, each construct is said to be demonstrating discriminant validity. In PLS, discriminant validity was assessed using two methods. First, by examining the cross-loadings of the constructs and the measures; Second, by comparing the square root of the average variance extracted (AVE) for each construct with the correlation between the construct and other constructs in the model (Fornell and Larcker 1981, Chin 1998b). All constructs in the estimated model fulfilled the condition of discriminant validity (see Table 2).

**Reliability**

Reliability is concerned with the measurement accuracy within a construct while construct validity applies to the measurement between constructs. The composite reliability of a block of indicators measuring a construct was assessed with two measures - the composite reliability measure of internal consistency and average variance extracted (AVE). The internal consistency is a measure of the extent to which a set of indicators of a latent construct are highly interrelated and therefore measure the same latent construct (Hair et al. 2010). All reliability measures were above the recommended level of 0.70 (Table 2), thus indicating adequate internal consistency (Nunnally and Bernstein 1994, Fornell and Bookstein 1982). The average variance extracted scores (AVE) were also above the minimum threshold of 0.5 (Fornell and Larcker 1981, Chin 1998b) and ranged from 0.72 to 0.913 (see Table 2). When AVE is greater than .50, the variance shared with a construct and its measures is greater than error. This level was achieved for all of the model constructs. Overall, the measurement model results provided support for the factorial, convergent, and discriminant validities and reliability of the measures used in the study.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Factor Loading</th>
</tr>
</thead>
</table>

**Table 2: Validity and reliability of the model constructs**
<table>
<thead>
<tr>
<th>Survey Dimension</th>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System quality</strong></td>
<td>Q1. The system is always available.</td>
<td>0.795</td>
</tr>
<tr>
<td></td>
<td>Q2. The system is user-friendly.</td>
<td>0.876</td>
</tr>
<tr>
<td></td>
<td>Q4. The system has attractive features that appeal to users.</td>
<td>0.869</td>
</tr>
<tr>
<td></td>
<td>Q5. The system provides high-speed information access.</td>
<td>0.835</td>
</tr>
<tr>
<td><strong>Information quality</strong></td>
<td>Q6. The system provides information that is exactly what you need.</td>
<td>0.903</td>
</tr>
<tr>
<td></td>
<td>Q7. The system provides information that is relevant to learning.</td>
<td>0.901</td>
</tr>
<tr>
<td></td>
<td>Q8. The system provides sufficient information.</td>
<td>0.936</td>
</tr>
<tr>
<td></td>
<td>Q9. The system provides information that is easy to understand.</td>
<td>0.899</td>
</tr>
<tr>
<td></td>
<td>Q10. The system provides up-to-date information.</td>
<td>0.851</td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
<td>Q29. I feel confident using a web browser.</td>
<td>0.923</td>
</tr>
<tr>
<td></td>
<td>Q30. I feel confident taking online tests or quizzes.</td>
<td>0.873</td>
</tr>
<tr>
<td></td>
<td>Q31. I feel confident uploading/downloading files.</td>
<td>0.945</td>
</tr>
<tr>
<td><strong>Self-managed learning</strong></td>
<td>Q25. When it comes to learning and studying, I am a self-directed person.</td>
<td>0.831</td>
</tr>
<tr>
<td></td>
<td>Q26. In my studies, I am self-disciplined and find it easy to set aside reading and homework time.</td>
<td>0.919</td>
</tr>
<tr>
<td></td>
<td>Q27. I am able to manage my study time effectively and easily complete assignments on time.</td>
<td>0.907</td>
</tr>
<tr>
<td></td>
<td>Q28. In my studies, I set goals and have a high degree of initiative.</td>
<td>0.915</td>
</tr>
<tr>
<td><strong>System Use</strong></td>
<td>Q11. I frequently use the system.</td>
<td>0.951</td>
</tr>
<tr>
<td>Question</td>
<td>Score</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Q12. I depend upon the system.</td>
<td>0.946</td>
<td></td>
</tr>
<tr>
<td>User Satisfaction (IC = 0.939, AVE = 0.886)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15. I think the system is very helpful.</td>
<td>0.936</td>
<td></td>
</tr>
<tr>
<td>Q16. Overall, I am satisfied with the system.</td>
<td>0.946</td>
<td></td>
</tr>
<tr>
<td>System Effectivess (IC = 0.964, AVE = 0.899)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q17. The system has a positive impact on my learning</td>
<td>0.944</td>
<td></td>
</tr>
<tr>
<td>Q18. Overall, the performance of the system is good</td>
<td>0.956</td>
<td></td>
</tr>
<tr>
<td>Q19. Overall, the system is successful.</td>
<td>0.944</td>
<td></td>
</tr>
</tbody>
</table>

IC is internal consistency measure; AVE is average variance extracted.

**Structural Model Results**

Since PLS makes no distributional assumptions in its parameter estimation procedure, traditional parameter-based techniques for significance testing and model evaluation are considered to be inappropriate (Chin 1998b). LISREL and other covariance structure analysis modelling approaches involve parameter estimation procedures, which seek to reproduce as closely as possible the observed covariance matrix. In contrast, PLS has its primary objective the minimization of error (or equivalently the maximization of variance explained) in all endogenous constructs. One consequence of this difference in objectives is that no proper overall goodness-of-fit measures exist for PLS.

Consistent with the distribution free, predictive approach of PLS (Wold 1985), the structural model was evaluated using the R-square for the dependent constructs, and the size, t-statistics and significance level of the structural path coefficients. The t-statistics were estimated using the bootstrap resampling procedure (100 resamples). The results of the structural model are summarized in Table 3.
R-Square for Dependent Constructs

The results show that the structural model explains 50.9 percent of the variance in the system use construct, 75.4 percent of the variance in the user satisfaction construct, and 82.1 percent of the variance in the system effectiveness outcomes construct. The percentage of variance explained for these primary dependent variables were greater than 10 percent implying satisfactory and substantive value and predictive power of the PLS model (Falk and Miller 1992).

Structural Path Coefficients

As can be seen from the results, of the four antecedent constructs hypothesized to affect user satisfaction with e-LMS, only two (systems quality and information quality) are significant, suggesting that only two technological variables affect the perceived e-learner satisfaction with e-LMS, while both learner’s psychological variables (self-efficacy) and psychological learning process (self-regulated learning management) failed to show positively relationships with e-learner satisfaction with the system. Furthermore, the three antecedent constructs (information quality, self-efficacy, and self-regulated learning) hypothesized to affect system use are significant, suggesting that the quality of information produced by e-learning systems, and self-efficacy of the students and students’ self-managed learning philosophy affects the perceived use of e-learning systems positively. Nevertheless, our model failed to support the hypothesis that system quality affects the systems use.
Table 3: Structural (inner) model results

<table>
<thead>
<tr>
<th>Effect on System Use (R-square = 0.509)</th>
<th>Path Coefficient</th>
<th>Observed t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Quality</td>
<td>-0.137</td>
<td>+0.8009</td>
</tr>
<tr>
<td>Information Quality</td>
<td>+0.245</td>
<td>+1.388</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>+0.485</td>
<td>+4.4248</td>
</tr>
<tr>
<td>Self-managed learning</td>
<td>+0.052</td>
<td>+0.7104</td>
</tr>
<tr>
<td>User Satisfaction</td>
<td>+0.183</td>
<td>+1.4537</td>
</tr>
</tbody>
</table>

Effect on User Satisfaction (R² = 0.754)

<table>
<thead>
<tr>
<th>Effect on Systems Effectiveness (R² = 0.821)</th>
<th>Path Coefficient</th>
<th>Observed t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Quality</td>
<td>+0.319</td>
<td>+2.726</td>
</tr>
<tr>
<td>Information Quality</td>
<td>+0.591</td>
<td>+4.6119</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>-0.062</td>
<td>+0.9127</td>
</tr>
<tr>
<td>Self-managed learning</td>
<td>+0.052</td>
<td>+0.8203</td>
</tr>
</tbody>
</table>

p-values:  **** <0.001,  *** <0.010,  ** <0.050,  * <0.100,  ns = not significant

Discussion and Conclusion

This study empirically tested an extended model of the DeLone and McLean in a university e-learning context using structural equation
modelling. Four hypotheses (H₂, H₄, H₆, and H₁₁) in this study received full support. Seven hypotheses were not supported.

Effects on systems use: All latent variables except self-efficacy failed to provide statistically significant evidence to support positive relationships to system use. Use of e-LMS was not positively related to system quality, information quality, self-managed learning, and user satisfaction. System use as a success variable has been continuously debated. Some argued for the removal of system use as a success variable in the causal success model (Seddon 1997). In a rebuttal, DeLone and McLean (2003) state that system use is an appropriate measure of success in most cases. They suggest that frequency of system use alone is insufficient without incorporating the nature, extent, quality, and appropriateness of system use. Future research need to include appropriate indicator variables to capture the complexity of system use variables, in addition to the frequency of system use.

Effects on user satisfaction: our findings strongly support the previous works of Rai, et al (2002), Livari (2005), and freeze, et al. (2010). These three studies found strong positive relationships between information quality and user-satisfaction and between systems quality and user-satisfaction in a voluntary or mandatory use context. This research solidifies their findings that information quality and systems quality are both significant predictors of the success of information systems, regardless of the nature of systems use.

On the other hand, this research failed to support statistically significant positive relationships between user satisfaction self-efficacy and between user satisfaction and self-managed learning. Contrary to other research finding (Womble 2008), which reported significant positive correlations among the three e-learning variables (Self-efficacy, e-learner satisfaction and perceived usefulness), no significant relationships were found between user satisfaction self-efficacy and between user satisfaction and self-managed learning. A possible reason for this aberration is due to different research methods and research setting. Womble used three different instruments (Mungania 2004, Davis 1993, Wang 2003). Their participants were 440 government agency employees in the Southwestern United States. Participants completed mandatory e-learning courses in training and development.

Effects on system effectiveness: Perceived user satisfaction is a very strong predictor of system effectiveness. This is in accordance with the findings and conclusions discussed in the literature on student satisfaction (Freeze et al. 2010, Eom et al. 2006, Rai et al. 2002, Livari 2005). But, no
statistically significant evidence is found to suggest a positive relationship between system use and system effectiveness.

The results of our study suggest that the DM model, despite its huge success in many different settings, may have a very limited explanatory power to understand the learner satisfaction with the system, system’s effectiveness in e-learning context. This is because the results of this and other research reviewed indicated that we failed to reach unequivocal consensus and that their results still seemed inconclusive in regard to the paths to system use from both information quality and systems quality and the paths from system use to user satisfaction.

Finally, no statistically significant evidence to suggest students’ psychological variables (e.g., self-efficacy) and psychological learning process (e.g., self-regulated learning management) had effects on student e-learning satisfaction. A prior research found a positive relationship between student motivation, core of self-regulated learning, and on-line course satisfaction (Eom et al. 2006). This study and the study of Eom, et al. are similar but they do not deal with exactly the same construct. This study aims to find the user satisfaction with e-LMS. Eom, et al (2006) focused on e-learners’ satisfaction with web-based courses. Therefore, this study made a new contribution to e-learning literature by providing new empirical evidence that e-learners’ self-regulated learning behavior may not lead to a higher level of e-learners’ satisfaction with e-LMS, but it may lead to a higher level of satisfaction with web-based courses.

**Practical Implications and Future Research**

The findings from the current study have significant implications for distance educators, students, and administrators. We have focused on the effect of e-learning management systems on user satisfaction, and the relationship between user satisfaction and e-learning outcome. This research provides empirical evidence to support that E-learner satisfaction is an important predictor of e-LMS effectiveness and further that system quality and information quality have significant direct impacts on the perceived satisfaction of e-learners.

Findings of this study may be useful information for all entities involved in the e-learning process. First, university administrators must continuously invest to upgrade the information systems infrastructure so that e-LMS exhibit faster response time, better systems accessibility, higher system reliability and flexibility, and ease of learning. By doing so, e-LMS can provide e-learners with the information that are accurate, precise, current,
reliable, dependable, and useful. This study provided a basis for justifying technological expenditures at the administrative level. Moreover, both information quality and systems quality have strong positive effects on e-learner satisfaction. However, the information quality in e-learning is determined by e-LMS and the instructor. The role of the instructor is more important than that of e-LMS in creating the contents of e-learning materials that are useful and essential for gaining necessary knowledge for the students.

This research focused on “How do e-learning management systems affect student satisfaction and system’s effectiveness?” and “How do students’ psychological variables (e.g., self-efficacy) and psychological learning process (e.g., self-regulated learning management) affect student e-learning satisfaction and e-LMS effectiveness?” In doing so, we developed a hybrid model of the IS success model and the conceptual model of VLE. Online education can be a superior mode of instruction if it is targeted to learners with specific learning styles (visual and read/write learning styles) (Eom et al. 2006), learners with specific personality characteristics (Schniederjans and Kim 2005) and with timely, helpful instructor feedback of various types. Computer self-efficacy was positively linked to learning outcomes measured by average test scores in e-learning (Simmering et al. 2009, Colquitt et al. 2000, Gist et al. 1989, Gist et al. 1991).

Our future research will extend the current research model to a unifying framework that can help identify critical success factors of e-learning systems and weave these factors together to make their interrelationship unequivocal. The future research is necessary to present a framework that links various past empirical research, from adoption of e-learning initiative, to critical success factors of e-learning systems satisfaction, and finally to critical success factors of e-learning outcomes that are comparable or superior than traditional face-to-face learning systems.
## Appendix A: Student Characteristics

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>13</td>
<td>9.29%</td>
</tr>
<tr>
<td>20-24</td>
<td>80</td>
<td>57.14%</td>
</tr>
<tr>
<td>25-34</td>
<td>25</td>
<td>17.86%</td>
</tr>
<tr>
<td>35-44</td>
<td>13</td>
<td>9.29%</td>
</tr>
<tr>
<td>45-54</td>
<td>8</td>
<td>5.71%</td>
</tr>
<tr>
<td>&gt;54</td>
<td>1</td>
<td>0.71%</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

### Gender

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>49</td>
<td>35.00%</td>
</tr>
<tr>
<td>Female</td>
<td>91</td>
<td>65.00%</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

### Year in School

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>6</td>
<td>4.29%</td>
</tr>
<tr>
<td>Sophomore</td>
<td>22</td>
<td>15.71%</td>
</tr>
</tbody>
</table>
Junior  34  24.29%
Senior  64  45.71%
Graduate  14  10.00%
Total  140  100.00%

Area of Study (Major)
Accounting  34  24.29%
Management  31  22.14%
Marketing  21  15.00%
Organizational administration  18  12.86%
MIS  8  5.71%
Business Education  8  5.71%
Finance  7  5.00%
MBA  5  3.57%
International Business  3  2.14%
Administrative Systems Management  3  2.14%
Economics  2  1.43%

140  100.00%

References


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