WHAT DETERMINATES STUDENT LEARNING SATISFACTION IN A BLENDED E-LEARNING SYSTEM ENVIRONMENT?

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Abstract

This paper presents a learning satisfaction model that examines the determinant factors for student learning satisfaction in a blended e-learning environment. Conformation factor analysis was performed to test the reliability and validity of the measurement model. The partial least squares method was used to evaluate the causal model. The results indicated that the learning climate, perceived value and perceived ease of use significantly affected learning satisfaction. Computer self-efficacy had a strong impact on perceived behavioral control; computer self-efficacy, perceived behavioral control and social interaction had significant effects on perceived ease of use. System functionality, content feature and social interaction significantly affected perceived value. Social interaction had a significant effect on learning climate. This paper provides initial insights into those factors that are likely significant antecedents for planning and implementing a blended e-learning system to enhance student learning satisfaction.

Keywords: Blended e-learning system, Learning satisfaction, TAM, E-learning
1. INTRODUCTION

Traditional face-to-face learning typically occurs in a teacher-directed environment with interpersonal interaction in a live synchronous environment. This learning environment is costly with less access flexibility. On the other hand, the electronic learning (e-learning) environments that have grown and expanded dramatically as new technologies have expanded the possibilities for communication, interaction and multimedia input. Although the e-learning may increase access flexibility and improve cost effectiveness, it suffers from a lack of social interaction between learners and instructors (Wu et al. 2008).

With the rapid emergence of technological innovations in information and communication, people have searched for another instructional delivery solution to relieve the above problems. The term blended learning has been discussed as a promising alternative. Blended learning refers to courses that combine face-to-face classroom instruction with online learning. In recent years blended e-learning has become part of the educational landscape. Several blended e-learning systems (BELS), such as WebCT (www.webct.com) and Cyber University of NSYSU (cu.nsysu.edu.tw) have been recently developed that integrate a variety of functions to facilitate the learning activities. For example, these systems can be used to integrate instructional material (via audio, video, and text), e-mail, live chat sessions, online discussions, forums, quizzes and assignments. With this kind of system, instructional delivery and communication between instructors and students can be performed at the same time (synchronously) or at different times (asynchronously). Such systems provide a variety of instructional aids and communication methods, and offer learners or instructors great flexibility as to the time and place of instruction. As a result, these online learning systems may better accommodate the needs of learners or instructors who are geographically dispersed and have conflicting schedules (Pituch & Lee 2006).

While we have recognized a number of advantages in employing BELS, insufficient learning satisfaction has long been an obstacle to the successful adoption of BELS (So 2006). The explosion of BELS in supporting learning has made it extremely significant to probe the determinants crucial that would entice learners to use BELS and enhance their learning satisfaction. Comprehending the essentials of what determines student learning satisfaction can provide great management insights into developing effective strategies that will allow universities to create new opportunities and value for their students and instructors. Generally, the essential characteristics of BELS differ greatly from the traditional teaching and e-learning system. Thus, any model developed for e-learning or business systems may not apply to a BELS environment. BELS may need to consider BELS-specific factors, such as the social factor. Hence, the goal of this study is to present a research model for assessing student learning satisfaction in a BELS environment. The theory of reasoned action (TRA) and technology acceptance mode (TAM) serve as the theoretical basis for this study that are integrated with factors such as individual differences, system characteristics, and social factors. We also validate the factors that determine learning satisfaction and examined the relationships among those latent variables.

2. BASIC CONCEPTS AND THEORETICAL FOUNDATION

2.1 Blended e-learning environments

In contrast with traditional instructions, e-learning provides more learning resources and more opportunities to allow learners and instructors to communicate, collaborate, and interact with and among each other without regard to temporal or physical location. Prior research (e.g., Kinshuk & Yang 2003, Yang & Liu 2007, Wu et al. 2008) indicated both positive and negative aspects of the e-learning environments. Among the positive aspects were that e-learning stretched the spatial and temporal barriers, provided greater flexibility and student convenience,
more positive overall learning experience, and improved access/interaction with the instructor. However, some negative aspects and disadvantages of e-learning were pointed out such as lack of peer contact and interaction, high initial costs for preparing multimedia content of learning materials and also substantial costs for its maintaining and updating, as well as the need for flexible tutorial support. With the above concerns and dissatisfaction with e-learning in prior studies, people have searched for another instructional delivery solution. Blended e-learning has been discussed as a promising alternative (So 2006).

Graham (2006) defined the blended e-learning as the combination of instruction from two historically separate models for teaching and learning: traditional face-to-face learning system and e-learning system. It is an important distinction because it is certainly possible to enhance regular face-to-face courses with online resources without displacing classroom contact hours. The BELS emphasizes the central role of computer-based technologies (e-learning system) in blended learning focusing on enabling access and flexibility, enhancing traditional teaching and learning practices, and transforming the way individuals learn (Graham 2006). Thus, we defined the BELS as the combination of online and face-to-face instruction and the convergence between traditional face-to-face learning and e-learning environments. As blended e-learning emerges as perhaps the most prominent instructional delivery solution, it is vital to explore what determines learning satisfaction in a blended e-learning environment.

2.2 Theory of reasoned action and technology acceptance mode

The theory of reasoned action (TRA), proposed by Fishbein and Ajzen (1975), is a well-established model that has been used broadly to predict and explain human behavior in various domains. According to the TRA model, attitudes are a function of beliefs, specifically including the behavioral beliefs directly linked to a person’s intention to perform a defined behavior. Davis (1989) proposed a technology acceptance mode (TAM) derived from TRA in modeling user technology acceptance behavior. The original TAM consists of perceived ease of use (PEOU), perceived usefulness (PU), attitude toward using (ATU), behavioral intention to use (BI), and actual system use (AU). PU and PEOU are the two most important determinants for AU. The ATU directly predicts users’ BI which determines AU.

Venkatesh and Davis (2000) further proposed an extended TAM, i.e. TAM2, which includes social influence processes (subjective norm, voluntarism, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and PEOU), whereas it omits ATU due to weak predictors of either BI or AU. The research indicated that both social influence processes and cognitive instrumental processes significantly influenced user acceptance as well as PU and PEOU indirectly influenced AU through BI. User acceptance can be measured by a positive attitude toward the system based on TAM (Taylor and Todd, 1995). Satisfaction is a good surrogate for user acceptance and was often used to measure learners’ attitude in learning-related studies (Chou & Liu 2005, Piccoli et al. 2001). Prior research in education had found that perceived ease of use and perceived value were positively related to student satisfaction and perceived ease of use was positively related to perceived value (Martins & Kellermanns 2004).

In this study, we conceptualize the student attitude toward the system as learning satisfaction with the BELS. Learning satisfaction is the sum of student feelings and attitudes that result from aggregating all the benefits that a student hopes to receive from interaction with the BELS. Perceived value is defined as the degree to which a person believes that using a particular system would enhance his or her job performance and perceived ease of use is defined as the degree to which using the technology will be free of effort. Therefore, the following hypotheses are proposed.

H1a: Perceived ease of use has a positive effect on BELS learning satisfaction.

H1b: Perceived ease of use has a positive effect on BELS perceived value.

H2: Perceived value has a positive effect on BELS learning satisfaction.
2.3  **External variables**

2.3.1  **Individual difference**

Individual difference refers to user factors that include traits such as personality, demographic variables and situational variables that account for differences attributable to circumstances such as experience and training. Several individual variables, e.g., computer self-efficacy and perceived behavioral control, are believed to be the most relevant factors affecting information system (IS) success (Alavi & Joachimsthaler 1992). In virtual environments, individual differences have been suggested related to IT acceptance (Chen et al. 2000) and e-learning systems (Pituch & Lee 2006). In an e-learning environment, learning success has been found to depend on (a) the ability to cope with technical difficulty and (b) the learners’ perception of the availability of skills, resource facilitating conditions, technology facilitating conditions and opportunities. Therefore, in our study, computer self-efficacy and perceived behavioral control are two individual difference factors that are expected to influence BELS use.

Computer self-efficacy is defined as “the confidence in one’s ability to perform certain learning tasks using a BELS” in this research (Compeau & Higgins 1995). Prior research has indicated that computer self-efficacy influences performance or behavior (Francescato et al. 2006, Piccoli et al. 2001, Johnston et al. 2005), including attitude and behavioral intention (Venkatesh & Davis 2000). Other studies have found that computer self-efficacy and perceived ease of use are related (Davis 1989, Hong et al. 2002, Pituch & Lee 2006). Perceived behavioral control, defined as the learners’ perception of the availability of skills, resource facilitating conditions, technology facilitating conditions and opportunities. Venkatesh et al. (2003) indicated that the related resources support for BELS learners can influence system utilization. Based on the foregoing discussion, the following hypotheses are proposed

H3a: Computer self-efficacy has a positive effect on perceived behavioral control with BELS.
H3b: Computer self-efficacy has a positive effect on perceived ease of use with BELS.
H4: Perceived behavioral control has a positive effect on perceived ease of use with BELS.

2.3.2  **System Characteristics**

Prior research has shown that IS characteristics can significantly affect user beliefs in various contexts (Venkatesh & Davis 2000). For instance, prior researches indicated that system functionality and content features are important external variables that directly affect both perceived ease of use and perceived value of IS (Hong et al. 2002, Pituch & Lee 2006). In our study, system functionality and content feature are two system characteristics factors that are expected to influence BELS use.

System functionality is defined as the perceived ability of a BELS to provide flexible access to instructional and assessment media (Pituch & Lee 2006). For example, allow students to access course content, turn in homework assignments, and complete tests and quizzes online. In addition to system functionality, effective BELS must provide high quality content feature. In our study, content feature is defined as the characteristics and presentation of BELS information (Zhang et al. 2000). Empirical evidences have shown that high quality of content features (Zhang et al. 2000) and system functionality (Pituch & Lee 2006) positively affect both perceived ease of use and perceived value of BELS use. Therefore, we proposed.

H5a: System functionality has a positive effect on perceived ease of use for BELS.
H5b: System functionality has a positive effect on perceived value of BELS.
H6a: Content feature has a positive effect on perceived ease of use for BELS.
H6b: Content feature has a positive effect on perceived value of BELS.
2.3.3 Social factors

There is an increasing focus on facilitating human interaction in the form of online collaboration, virtual communities, and instant messaging in the context of BELS (Graham 2006). From the group interactions perspective, social factors, such as collaborative learning (Francescato et al. 2006), learning climate (Chou & Liu 2005), and social interaction (Johnston et al. 2005), are important antecedents of beliefs about using a learning system. Prior research (Pituch & Lee 2006) showed that social interaction has a direct effect on the usage of an e-learning system. The interactions among students, between faculty and students, and collaboration in learning resulting from these interactions are the keys to the learning process. In addition, the emotional learning climate is an important indicator of learning effectiveness (Chou & Liu 2005). In our study, social interaction is defined as the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning (Chou & Liu 2005). Learning climate is defined as the learning atmosphere in the context of BELS (Prieto & Revilla 2006).

Johnston et al. (2005) proposed that contact and interaction with the instructors and learners is a valid predictor of perceived value for student satisfaction. In addition, a positive learning climate encourages and stimulates the exchange of ideas, opinions, information and knowledge in the organization as it is characterized by trust and collaboration between learners (Prieto & Revilla 2006). That is, when learners believe that BELS provides effective student-student and student-instructor interactions and improves learning climate, they will be more satisfied with the BELS. Therefore, the following hypotheses are proposed:

H7a: Social Interaction has a positive effect on perceived ease of use with BELS.

H7b: Social Interaction has a positive effect on perceived value of BELS.

H7c: Social Interaction has a positive effect on the BELS learning climate.

H8: Learning climate has a positive effect on learning satisfaction with BELS.

Based on the aforementioned discussion, we propose a research model that suggests that perceived ease of use, perceived value and learning climate influence student learning satisfaction, as shown in Figure 1. Table 1 indicates the constructs and their definitions.

![Figure 1. The research model for student learning satisfaction in the BELS context](image-url)
Computer Self-efficacy  CSE
The confidence in one’s ability to perform certain learning tasks using BELS.

Perceived behavioral control  PBC
The learners’ perception of the availability of skills, resource facilitating conditions, technology facilitating conditions and opportunities.

System Functionality  SF
The perceived ability of a BELS to provide flexible access to instructional and assessment media.

Content Feature  CF
The characteristics and presentation of BELS information.

Social Interaction  SI
The interactions among students themselves, the interactions between faculty and students, and the collaboration in learning.

Learning Climate  LC
The learning atmosphere in the context of BELS.

Perceived Ease of Use  PEOU
The degree to which using BELS will be free of effort.

Perceived Value  PV
The degree to which a person believes that using BELS would enhance his or her performance.

Learning Satisfaction  LS
The sum of student feelings and attitudes that result from aggregating all the benefits that a student hopes to receive from interaction with BELS.

Table 1. Constructs in the research model

3. RESEARCH METHODOLOGY

3.1 Instrument development

To validly develop the instrument, a number of prior relevant studies were reviewed to ensure that a comprehensive list of measures was included. For instance, the measures for learning satisfaction were derived from Chiu et al. (2005) and Wu and Wang (2006). Measures for perceived ease of use and perceived value were taken from previous research (e.g., Davis 1989, Venkatesh & Davis 2000). The computer self-efficacy construct was captured using four items tailored from Compeau and Higgins (1995). The measures for perceived behavioral control were taken from previous studies (e.g., Taylor & Todd 1995, Venkatesh et al. 2003). The system functionality construct was captured using items, selected from Pituch and Lee (2006). The measures for content feature were adapted from Zhang et al. (2000), and Molla and Licker (2001). The measures for the social interaction were taken from Johnston et al. (2005), Kreijns et al. (2003), and Pituch and Lee, (2006). Finally, the measures for the learning climate were selected from Chou and Liu (2005). The instrument items were shown in the Appendix.

The survey questionnaire consisted of two parts including the respondent’s demographic information and the subject’s perception of each variable in the model. All items in the second part of the questionnaire are measured via a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Once the initial questionnaire was generated, an iterative personal interview process with the domain experts from blended e-learning course related instructors and students (including four instructors and five students in three different schools) was conducted to verify the instrument and to confirm the content validity. At the end of the pre-test, there were 9 constructs with 28 items in total to be used for the survey.

3.2 Sample characteristics

The empirical data were collected using a questionnaire survey administered over a span of two semesters from May to December, 2006. Subjects for this study were students that had the opportunity to take courses via BELS. We distributed 518 questionnaires (paper-based and online questionnaires) to the targeted universities that actually implemented BELS in Taiwan. Sample data were collected via snowball and convenient sampling. Three hundred seven-six questionnaires were returned. Sixty-four responses were incomplete and had to be discarded. This left 212 valid responses for the statistical analysis, and a valid response rate of 40.93% of the initial sample. Among the valid responses, 84 responses are received from physical classrooms and 128 responses are gathered from online learning environment.
The potential non-response bias was assessed by comparing the early versus late respondents that were weighed on several demographic characteristics. The results indicated that there are no statistically significant differences among demographics between the early and late respondents. The profile of respondents and the results of non-response bias analysis are shown as in Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Classification</th>
<th>Total (%)</th>
<th>Early respondents (%)</th>
<th>Late respondents (%)</th>
<th>$\chi^2$ (Sig.)</th>
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<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>106 0.500</td>
<td>73 0.344</td>
<td>33 0.156</td>
<td>0.022 (0.50)</td>
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<tr>
<td>Female</td>
<td>106 0.500</td>
<td>72 0.340</td>
<td>34 0.160</td>
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<td></td>
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<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>101 0.476</td>
<td>48 0.453</td>
<td>53 0.500</td>
<td>1.344 (0.855)</td>
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<td>31-40</td>
<td>82 0.387</td>
<td>41 0.387</td>
<td>41 0.387</td>
<td></td>
<td></td>
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<tr>
<td>41-50</td>
<td>23 0.108</td>
<td>14 0.132</td>
<td>9 0.085</td>
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<td></td>
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<tr>
<td>51-60</td>
<td>4 0.019</td>
<td>2 0.019</td>
<td>2 0.019</td>
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<tr>
<td>&gt;61</td>
<td>2 0.009</td>
<td>1 0.009</td>
<td>1 0.009</td>
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<td></td>
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<td><strong>Types of Jobs</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>8 0.038</td>
<td>3 0.014</td>
<td>5 0.024</td>
<td>4.806 (0.440)</td>
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</tr>
<tr>
<td>Industry</td>
<td>30 0.142</td>
<td>12 0.057</td>
<td>18 0.085</td>
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<tr>
<td>Manufacturing</td>
<td>57 0.269</td>
<td>27 0.127</td>
<td>30 0.142</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>10 0.047</td>
<td>5 0.024</td>
<td>5 0.024</td>
<td></td>
<td></td>
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<tr>
<td>Finance</td>
<td>59 0.278</td>
<td>36 0.170</td>
<td>23 0.108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>48 0.226</td>
<td>23 0.108</td>
<td>25 0.118</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education level</strong></td>
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<tr>
<td>Senior high school</td>
<td>0 0.000</td>
<td>0 0.000</td>
<td>0 0.000</td>
<td>8.824 (0.32)</td>
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<tr>
<td>College (2 years)</td>
<td>10 0.047</td>
<td>1 0.005</td>
<td>9 0.042</td>
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<td>University (4 years)</td>
<td>116 0.547</td>
<td>60 0.283</td>
<td>56 0.264</td>
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<tr>
<td>Graduate school</td>
<td>86 0.406</td>
<td>45 0.212</td>
<td>41 0.193</td>
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<tr>
<td><strong>BELS experience</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pure physical classroom experience</td>
<td>15 0.071</td>
<td>7 0.033</td>
<td>8 0.038</td>
<td>0.371 (0.946)</td>
<td></td>
</tr>
<tr>
<td>Pure virtual classroom experience</td>
<td>42 0.198</td>
<td>20 0.094</td>
<td>22 0.104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical experience more than virtual experience</td>
<td>105 0.495</td>
<td>53 0.250</td>
<td>52 0.245</td>
<td></td>
<td></td>
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<tr>
<td>Virtual experience more than physical experience</td>
<td>50 0.236</td>
<td>26 0.123</td>
<td>24 0.113</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BELS experience: participating in BELS (Years)</strong></td>
<td></td>
<td></td>
<td></td>
<td>2.695 (0.747)</td>
<td></td>
</tr>
<tr>
<td>&lt; 0.5 years</td>
<td>35 0.165</td>
<td>18 0.085</td>
<td>17 0.080</td>
<td></td>
<td></td>
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<tr>
<td>0.5 ~ 1 years</td>
<td>95 0.448</td>
<td>50 0.236</td>
<td>45 0.212</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 years</td>
<td>48 0.226</td>
<td>25 0.118</td>
<td>23 0.108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 years</td>
<td>11 0.052</td>
<td>6 0.028</td>
<td>5 0.024</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 years</td>
<td>4 0.019</td>
<td>2 0.009</td>
<td>2 0.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;4 years</td>
<td>19 0.090</td>
<td>5 0.024</td>
<td>14 0.066</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BELS experience: participating in BELS (Times)</strong></td>
<td></td>
<td></td>
<td></td>
<td>4.710 (0.452)</td>
<td></td>
</tr>
<tr>
<td>1 times</td>
<td>44 0.208</td>
<td>24 0.113</td>
<td>20 0.094</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 times</td>
<td>43 0.203</td>
<td>22 0.104</td>
<td>21 0.099</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 times</td>
<td>30 0.142</td>
<td>15 0.071</td>
<td>15 0.071</td>
<td></td>
<td></td>
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<tr>
<td>4 times</td>
<td>13 0.061</td>
<td>9 0.042</td>
<td>4 0.019</td>
<td></td>
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<tr>
<td>5 times</td>
<td>10 0.047</td>
<td>6 0.028</td>
<td>4 0.019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;= 6 times</td>
<td>72 0.340</td>
<td>30 0.142</td>
<td>42 0.198</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BELS experience: spending time in the BELS (1 week)</strong></td>
<td></td>
<td></td>
<td></td>
<td>4.729 (0.450)</td>
<td></td>
</tr>
<tr>
<td>&lt; 1 hours</td>
<td>62 0.292</td>
<td>33 0.156</td>
<td>29 0.137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ~ 3 hours</td>
<td>75 0.354</td>
<td>33 0.156</td>
<td>42 0.198</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 ~ 5 hours</td>
<td>43 0.203</td>
<td>22 0.104</td>
<td>21 0.099</td>
<td></td>
<td></td>
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<tr>
<td>5 ~ 7 hours</td>
<td>20 0.094</td>
<td>10 0.047</td>
<td>10 0.047</td>
<td></td>
<td></td>
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<tr>
<td>7 ~ 9 hours</td>
<td>6 0.028</td>
<td>4 0.019</td>
<td>2 0.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 9 hours</td>
<td>6 0.028</td>
<td>4 0.019</td>
<td>2 0.009</td>
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</table>
4. RESULTS

Partial least squares (PLS) method was applied for the data analysis in this study. PLS performs a Confirmatory Factor Analysis (CFA). In a CFA, the pattern of loadings of the measurement items on the latent constructs was explicitly specified in the model. The fit of this pre-specified model is then examined to determine its convergent and discriminant validities. This factorial validity deals with whether the loading patterns of the measurement items corresponds to the theoretically anticipated factors (Gefen & Straub 2005). The evaluation of the model fit was conducted in two stages (Chin 1998, Gefen & Straub 2005). First, the measurement model is assessed, in which construct validity and reliability of the measures are assessed. The structural model with hypotheses is then tested. The statistical analysis strategy involved a two-phase approach in which the psychometric properties of all scales were first assessed through CFA and the structural relationships were then validated using bootstrap analysis.

4.1 Measurement validation

For the first phase, the analysis is performed in relation to the attributes of individual item reliability, construct reliability, average variance extracted (AVE), and discriminant validity of the indicators as measures of latent variables through a CFA. The results indicated that all items of the instrument have significant loadings higher than the recommended value of .707. As shown in Table 3, all constructs in the measurement model exhibit good internal consistency as evidenced by their composite reliability scores. The composite reliability coefficients of all constructs and the AVE in the proposed model (Figure 1) are more than adequate, ranging from 0.836 to 0.957 and from 0.631 to 0.849, respectively.

<table>
<thead>
<tr>
<th>Construct Items</th>
<th>Composite Reliability</th>
<th>AVE</th>
</tr>
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<tbody>
<tr>
<td>Computer Self-efficacy (CSE)</td>
<td>3</td>
<td>0.836</td>
</tr>
<tr>
<td>Perceived behavioral control (PBC)</td>
<td>4</td>
<td>0.921</td>
</tr>
<tr>
<td>System Functionality (SF)</td>
<td>3</td>
<td>0.905</td>
</tr>
<tr>
<td>Content Feature (CF)</td>
<td>2</td>
<td>0.891</td>
</tr>
<tr>
<td>Social Interaction (SI)</td>
<td>3</td>
<td>0.915</td>
</tr>
<tr>
<td>Learning Climate (LC)</td>
<td>3</td>
<td>0.926</td>
</tr>
<tr>
<td>Perceived Ease of Use (PEOU)</td>
<td>3</td>
<td>0.943</td>
</tr>
<tr>
<td>Perceived Value (PV)</td>
<td>3</td>
<td>0.944</td>
</tr>
<tr>
<td>Learning Satisfaction (LS)</td>
<td>4</td>
<td>0.957</td>
</tr>
</tbody>
</table>

Table 3. Results of confirmatory factor analysis

To assess discriminant validity, (1) indicators should load more strongly on their corresponding construct than on other constructs in the model and (2) the AVE should be larger than the inter-construct correlations (Chin 1998). For each specific construct, AVE shows the ratio of the sum of its measurement item variance as extracted by the construct relative to the measurement error attributed to its items. As a rule of thumb, the square root of the AVE of each construct should be much larger than the correlation of the specific construct with any of the other constructs in the model and should be at least .50 (Chin 1998). As the results show in Table 4, all constructs meet the above mentioned requirements. The values for reliability are all above the suggested minimum of 0.7. Thus, the convergent and discriminant validity of all constructs in the proposed model can be assured.
Table 4. Correlation between constructs

<table>
<thead>
<tr>
<th></th>
<th>PBC</th>
<th>SF</th>
<th>CF</th>
<th>SI</th>
<th>LC</th>
<th>PEOU</th>
<th>PV</th>
<th>LS</th>
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<tbody>
<tr>
<td></td>
<td>0.643</td>
<td>0.502</td>
<td>0.455</td>
<td>0.346</td>
<td>0.365</td>
<td>0.695</td>
<td>0.364</td>
<td>0.403</td>
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<td></td>
<td>0.863</td>
<td>0.650</td>
<td>0.534</td>
<td>0.402</td>
<td>0.407</td>
<td>0.802</td>
<td>0.398</td>
<td>0.519</td>
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<td></td>
<td></td>
<td>0.872</td>
<td>0.603</td>
<td>0.507</td>
<td>0.513</td>
<td>0.580</td>
<td>0.501</td>
<td>0.531</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>0.896</td>
<td>0.609</td>
<td>0.597</td>
<td>0.519</td>
<td>0.580</td>
<td>0.603</td>
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<td></td>
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<td></td>
<td></td>
<td>0.884</td>
<td>0.726</td>
<td>0.462</td>
<td>0.658</td>
<td>0.613</td>
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<td></td>
<td>0.898</td>
<td>0.440</td>
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<td></td>
<td>0.921</td>
<td>0.813</td>
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</tbody>
</table>

*The shaded numbers in the diagonal row are square roots of the average variance extracted.

4.2 Test of the structural model

In the second phase of the statistical analysis, the structural model is assessed to confirm to what extent the causal relationships specified by the proposed model are consistent with the available data. The PLS method does not directly provide significance tests and path coefficient confidence interval estimates in the proposed model. A bootstrapping technique was used to estimate the significance of the path coefficients. Bootstrap analysis was performed with 200 subsamples and the path coefficients were re-estimated using each of these samples. This approach is consistent with recommended practices for estimating significance of path coefficients and indicator loadings (Löhmöller 1984).

Hypotheses and corollaries testing were performed by examining the size, the sign, and the significance of the path coefficients and the weights of the dimensions of the constructs, respectively. Results of the analysis for the structural model are presented in Figure 2. The estimated path coefficient (standardized) and its associated significance level are specified next to each link. The $R^2$ statistic is indicated next to the dependent construct. We found that all specified paths between constructs in the model had significant path coefficients except for the paths drawn from system functionality and content feature to perceived ease of use and perceived ease of use to perceived value. The results provide good support for our model.

Figure 2. Results of PLS analysis

One indicator of the predictive power of path models is to examine the explained variance or $R^2$. The explained variance (R^2) is indicated next to each dependent construct. The R^2 statistic is specified next to the dependent construct. The results provide good support for our model.
values (Barclay et al. 1995). The results indicate that the model explained 71 percent of
the variance in learning satisfaction. Similarly, 71.3 percent of the variance in PEOU (R² = 0.713)
and 49.5 percent of the variance in PU (R² = 0.495) were explained by the related antecedent
constructs. The path coefficient from computer self-efficacy to perceived behavior control was
0.414 and from social interaction to learning climate was 0.526. The magnitude and significance
of these path coefficients provides further evidence in support of the nomological validity of the
research model. For the individual differences, Hypotheses, H3a, H3b, and H4 are supported.
That is, the computer self-efficacy influences the perceived behavioral control and the computer
self-efficacy and perceived behavioral control apparently positively influence the perceived ease
of use too.

As for the construct of system characteristics, the results also provide support for the
Hypotheses, H5b and H6b. Contrary to our predictions, the paths from system functionality
(H5a) and content feature (H6a) to perceived ease of use are not supported. For the social
factors, Hypotheses, H7a, H7b, and H7c are supported. That is, social interaction apparently
influences the perceived ease of use, perceived value, and learning climate, respectively.
Concerning the learning satisfaction, the analysis results provide support for the Hypotheses,
H1a, H2, and H8. That is, perceived ease of use, perceived value, and learning climate influence
learning satisfaction. Contrary to our prediction, the path from perceived ease of use to
perceived value (H1b) is not supported.

5. DISCUSSION AND CONCLUSIONS

The results provide strong empirical evidence for the nomological validity of each construct
and validate the proposed model, as shown in Figure 2. The estimate of 0.713 for the perceived
ease of use construct (R² = 0.713) for these paths provides good support for the hypothesized
impact of computer self-efficacy, perceived behavioral control and social interaction on the
dependent variable, PEOU. The estimate of 0.495 for the perceive value construct (R² = 0.495)
for these paths provides good support for the hypothesized impact of system functionality,
content feature, and social interaction on the dependent variable, perceived value. The estimate
of 0.526 for the learning climate construct (R² = 0.526) for the path provides good support for
the hypothesized impact of social interaction on the dependent variable, learning climate. In
addition, the estimate of 0.710 for the learning satisfaction construct (R² = 0.710) denotes that
the learning satisfaction as perceived by learners are directly and indirectly mediated by the
perceived ease of use, perceived value, and learning climate constructs. Therefore, as a whole,
the model has strong explanatory power for the learning satisfaction construct.

It is worth noting that the effect of system characteristics on perceived ease of use was not
significant and perceived ease of use did not significantly influence perceived value. This
effect subsides over time. In past years, the user interface for IS was the text mode. Presently,
most software uses a graphic user interface with an intuitive interface design. These features
have significantly improved the functionality of systems and thus enhanced the ease of use.
Scarborough and Zimmer (2000) addressed that the introduction of IT has three stages:
substitution, adaptation, and revolution. When the substitution stage approaches its end, users
are familiar with using the information technology. In our study, about 70% of the subjects had
ten years or more computer experience. Thus, ease of use for them is not an important issue
and perceived value outweighs ease of use. This may provide a good reason that supports these
striking findings. The implications of this study include that:

A BELESHould be easy to use and provide useful information and have positive learning
climate. Our findings indicate that perceived value, perceived ease of use, and positive
learning climate have a direct effect on student’s learning satisfaction; perceived value
provided the greatest contribution (total effect) to learning satisfaction. Therefore, a BELESH
should provide useful information promptly so that useful recommendations are rapidly
disseminated or shared with those that need to know. Instructors and learners should promote
and create the positive learning atmosphere within the context of BELESH. In addition, a BELESH’s
user interface should be user-friendly and include key functions to minimize user’s efforts in learning. If using the BELS is worthwhile, enjoyable and simple, learners will be more likely to use it resulting in greater satisfaction.

**University administrators should provide resources to enhance students’ computer self-efficacy.** The computer self-efficacy has a significant positive influence on perceived behavioral control. In addition, computer self-efficacy and perceived behavioral control had a direct significant positive influence on perceived ease of use. The perceived behavioral control has the most contribution (total effect) to the perceived ease of use. These finding suggest that (1) a BELS should provide customized functions to allow learners control over the system and built-in help to fit various learners’ needs in different learning circumstances; (2) learners should have the computer competency necessary to use the BELS and control over his/her learning activity. Students’ computer self-efficacy could reduce their barrier in using the BELS. If students have the higher computer self-efficacy and can control over the BELS, they will perceive the system is easy to use. Therefore, university administrators should provide resources to enhance students’ computer self-efficacy; insufficient computer self-efficacy may decrease the students’ motivation to use the BELS resulting less satisfaction in learning.

**A BELS should offer good content features with multimedia presentation and flexibility in learning activity.** The results indicated that system functionality and content feature have a significant positive influence on perceived value. These findings suggest that (1) a BELS should offer useful information with appropriate online feature and good content design that satisfy students’ needs; (2) a BELS should provide various types of content presentation functions (e.g., multimedia) and flexible access to fit various learners’ needs. Therefore, it seems reasonable to infer that universities may provide relatively efficient technical support, training, and an awareness program for all staff involved and sufficient resources to implement the BELS.

**A BELS should provide an environment for social interaction and instructor should motivate positive interaction publicly.** The results indicated that social interaction had a significant positive influence on perceived ease of use, perceived value, and learning climate. In addition, social interaction has the most contribution (total effect) to the perceived value. These findings suggest that when implementing the BELS, the instructors should motivate the positive interaction publicly to encourage collaborative learning interaction via the system. If the BELS could offer a good environment to facilitate the interaction among students and instructors, learners will be more likely to perceive better learning climate, greater BELS value, and easier BELS usage.

Although the empirical research develops and validates a model of learning satisfaction in the BELS context, it has several limitations that could be addressed in the future research. First, our results were obtained from one single study that examined some particular e-learning systems and targeted some specific students in Taiwan. Thus, caution needs to be taken when generalizing our findings to other blend e-learning systems or students groups. In addition, the sample size used in this study is another limitation. A cross-cultural validation using a large sample gathered elsewhere is required for greater generalization of the proposed model.

### Appendix

<table>
<thead>
<tr>
<th>Construct</th>
<th>Instrument Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Self-efficacy (CSE)</td>
<td>I could use blended e-learning system (BELS) for learning...</td>
</tr>
<tr>
<td></td>
<td>1. if there was no one around to tell me what to do as I go.</td>
</tr>
<tr>
<td></td>
<td>2. if I had never used a package like it before.</td>
</tr>
<tr>
<td>3 items</td>
<td>3. if I could call someone for help if I got stuck.</td>
</tr>
</tbody>
</table>
| Perceived Behavioral control (PBC) | 1. I have control over using the BELS.  
2. I have the resources necessary to use the BELS.  
3. I have the knowledge necessary to use the BELS.  
4. Guidance and specialized instruction concerning the system was available to me in the selection of the BELS. |
|-------------------------------------|------------------------------------------------------------------------------------------------|
| System Functionality (SF)          | 1. The BELS allows learner control over his or her learning activity  
2. The BELS offers flexibility in learning as to time and place  
3. The BELS offers multimedia (audio, video, and text) types of course content |
| Content Features (CF)              | 1. The content of BELS is personalization.  
2. The content of BELS is ease of understanding.  
3. Key features of good online resources, from a student’s perspective, include: accessibility (fast to download, easy to read, easy to navigate), use of appropriate online features and good content design. |
| Social Interaction (SI)            | 1. The BELS enables interactive communication between instructor and students  
2. The BELS enables interactive communication among students  
3. The BELS environment is an excellent medium for social interaction |
| Learning Climate (LC)              | 1. The course in BELS is interesting.  
2. I felt less pressure in BELS environment.  
3. The climate in BELS could help me to learn.  
4. The interaction feature in BELS could help me to learn. |
| Perceived Ease of Use (PEOU)       | 1. Learning to operate the BELS would be easy for me.  
2. I would find it easy to get the BELS to do what I want it to do.  
3. I would find the BELS easy to use |
| Perceived Value (PV)               | 1. Using the BELS would improve my learning performance.  
2. Using the BELS would enhance my effectiveness for learning.  
3. I would find the BELS useful in my job |
| Learning Satisfaction (LS)         | 1. I am satisfied that BELS meet my learning needs  
2. I am satisfied with BELS efficiency.  
3. I am satisfied with BELS effectiveness.  
4. Overall, I am satisfied with the BELS |

Reference


