Surveying instructor and learner attitudes toward e-learning

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Abstract

The trend of using e-learning as a learning and/or teaching tool is now rapidly expanding into education. Although e-learning environments are popular, there is minimal research on instructors’ and learners’ attitudes toward these kinds of learning environments. The purpose of this study is to explore instructors’ and learners’ attitudes toward e-learning usage. Accordingly, 30 instructors and 168 college students are asked to answer two different questionnaires for investigating their perceptions. After statistical analysis, the results demonstrate that instructors have very positive perceptions toward using e-learning as a teaching assisted tool. Furthermore, behavioral intention to use e-learning is influenced by perceived usefulness and self-efficacy. Regarding to learners’ attitudes, self-paced, teacher-led, and multimedia instruction are major factors to affect learners’ attitudes toward e-learning as an effective learning tool. Based on the findings, this research proposes guidelines for developing e-learning environments.

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Keywords: E-learning; Attitude; 3-TUM; Behavioral intention
1. Introduction

The use of information and Internet technologies as teaching and learning tools is now rapidly expanding into education. Electronic learning (e-learning) is one of the most popular learning environments in the information age. Thus, e-learning efforts and experiments currently receive enormous attention across the globe. Essentially, e-learning, unlike traditional learning, is another way of teaching and learning. Khan (2000) defines that e-learning encompasses Web-based learning (WBL), Internet-based training (IBT), advanced distributing learning (ADL), and online learning (OL). Moreover, by another definition, e-learning includes instruction delivered via all electronic media such as the Internet, intranets, extranets, and hypertext/hypermedia documents (Govindasamy, 2002). Thus, from e-learning definitions, it acknowledges challenges posed by diverse of learners and instructors. Indeed, e-learning extends traditional learning paradigms into new dynamic learning models through computer and Web technologies. However, only a small amount of e-learning literature assesses both instructors’ and learners’ attitudes toward using e-learning as teaching and learning tools.

Personal attitudes are a major factor to affect individual usage of information technology. In other words, understanding users’ attitudes toward e-learning facilitates the creation of appropriate e-learning environments for teaching and learning. Essentially, methods of assessing e-learning cannot be evaluated using a single linear methodology. In other words, there is a need to build a multidisciplinary approach to survey individual attitudes toward e-learning (Liaw, 2002; Liaw, in press; Wang, 2003). The measurement of e-learning must incorporate different aspects of user perceptions to form a useful diagnostic instrument (Wang, 2003). Additionally, based on Liaw’s (2002) point of view, constructing user attitudes toward computer and Internet technologies can be divided into three major measurements: affective, cognitive, and behavioral measurements. The affective measurement (such as perceived enjoyment) and the cognitive measurement (such as perceived self-efficacy and perceived usefulness) have a positive effect on the behavioral measurement (such as behavioral intention to use e-learning as a teaching or learning tool) (Liaw & Huang, 2003).

Given the importance of individual attitudes in predicting and improving e-learning usage, this study raises the need for further research to examine fully the role of instructor and student attitudes in e-learning usage. Thus, the goals of this research are; first, surveying instructor attitudes toward e-learning as a teaching assisted tool; second, investigating learner perceptions toward e-learning as a learning assisted tool; and finally, exploring from the viewpoint of users including instructors and learners guidelines when deploying e-learning.

2. Literature review

2.1. Developing effective e-learning

In this study, e-learning refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. Rosenberg (2001) states that e-learning is based on the following three fundamental criteria: first, e-learning is networked, making it capable of instant updating, storage/retrieval, distribution, and sharing of instruction or information;
second, it is delivered to the end-user via a computer using standard Internet technology; and third, it focuses on the broadest view of learning that exceeds beyond the traditional paradigms of training. Thus, in e-learning, learning activities center around learner autonomy and interactive learning actions; in addition, learning instruction is based on multiple media and ill-structured formats. Furthermore, it also offers cooperative learning opportunities between instructors and learners and/or among learners. Based on Rosenberg’s approach, e-learning offers more opportunities for improving problem solving capabilities, enhancing high order thinking skills, and achieving learning effectiveness (Chen, Lee, & Chen, 2005; Liaw, 2004).

For designing effective e-learning environments, Liaw (2004) suggested three considerations: learner characteristics, instructional structure, and interaction. In developing e-learning, it is necessary to understand targeted population. First, learner characteristics, such as attitudes, motivation, belief, and confidence need to be identified (Passerini & Granger, 2000). Essentially, e-learning signifies autonomous learning environments. In other words, users have more opportunities for self-directed learning in e-learning environments. As for instructional structure, multimedia instruction enables learners to develop complex cognitive skills, such as understanding important elements of conceptual complexity, ability to use acquired concepts for reasoning and inference, and competence to apply conceptual knowledge to novel situations with flexibility (Spiro, Feltovich, Jacobson, & Coulson, 1995). Finally, e-learning environments offer group interaction, such as learners to learners, or learners to instructors. Group interaction is a kind of cooperative learning that helps learners to make progress through their zone of proximal development by the activities in which they engage (Vygotsky, 1978). When learners increase their interaction with instructors and learners, they in turn raise their chances of building their own knowledge because much of learning inevitably takes place within a social context, and the process includes the mutual construction of understanding (Bruner, 1971). Thus, based on fundamental e-learning criteria, these are three considerations in designing e-learning environments: autonomous learning, multimedia environments, and teacher-assisted learning. Fig. 1 presents considerations when facilitating e-learning.

2.2. Attitudes toward e-learning

Many institutions of higher education are resorting to e-learning for authentic learning and enhancing learning performance, while other schools are hopping onto the bandwagon simply
because they do not want to be left behind (Govindasamy, 2002). When instructors exhibit more positive attitudes toward e-learning, then they have more behavioral intentions to use it (Liaw, in press). Indeed, no matter how advanced or capable the technology is, its effective implementation depends upon users having a positive attitude toward it. Thus, as individuals’ attitudes on e-learning become more positive, they will have greater behavioral intention to use it.

Although the concept of attitude towards computers has gained recognition as a critical determinant in the use and acceptance of computer technology, there is no single, universally accepted definition of computer attitude construct (Liaw, 2002; Smith, Caputi, & Rawstorne, 2000). Previous research (Triandis, 1971) suggested that attitude consists of affective, cognitive, and behavioral components. The affective component is the emotion or feeling which includes statements of likes or dislikes toward certain objects. The cognitive component refers to statements of beliefs. And the behavioral component is what an individual actually does or intends to do (Liaw, 2002).

3-TUM (three-tier technology use model) is a conceptual approach for investigating user perceptions toward information and Internet technologies (Liaw, in press). The original concept of 3-TUM is derived from TAM (Technology Acceptance Model). TAM is a popular approach for surveying user attitudes of information technologies (Davis, Bagozzi, & Warsaw, 1989). TAM suggests that two specific behavioral beliefs, perceived ease of use (EOU) and perceived usefulness (U), determine an individual’s behavioral intention to use technologies. Based on the 3-TUM (Fig. 2), individual attitudes toward information technology form three different tiers: the tier of individual experience and system quality, the affective and cognitive tier, and the behavioral intention tier. The tier of individual experience and system quality sets out to evaluate how individual experience and system quality influence individual affective and cognitive components. The affective and cognitive tier investigates how affective and cognitive components change individual behavioral intentions. In the behavioral intention tier, the 3-TUM predict individual behavioral intention to use technology for a particular purpose (for instance search engines as a learning assisted tool or computers as a job assisted tool) (Liaw, in press).

3. Research hypotheses

3.1. Hypotheses of instructor attitudes

Based on the conceptual models of 3-TUM, this research integrates these two approaches to understand instructors’ attitudes toward e-learning environments.

From the concepts of 3-TUM models, system quality is a key factor to influence individual affective and cognitive components. The affective and cognitive attitudes investigate how affective and cognitive attitudes change individual behavioral intentions. DeLone and McLean (1992) suggest that system quality measures information quality and system quality, both crucial
constructs related to the success of information systems. Since e-learning environments are multimedia systems, information quality can be viewed as various information formats. Additionally, user attitudes toward e-learning environments, such as perceived satisfaction or ease of use are functions of system quality. Therefore, this study proposes multimedia environments and system satisfaction as variables that express the system quality of e-learning environments.

Based on 3-TUM, this study proposes the following hypotheses.

H1A: The quality of e-learning is positively related to instructors’ perceived enjoyment toward it.
H1B: The quality of e-learning is positively related to instructors’ perceived usefulness toward it.
H1C: The quality of e-learning is positively related to instructors’ perceived self-efficacy toward it.

Furthermore, based on 3-TUM approach, perceived enjoyment, and perceived usefulness are positively related to individual behavioral intention to use information systems. Relevant studies (Liaw & Huang, 2003; Moon & Kim, 2001; Vankatesh, 1999) also support these results. Moreover, Liaw (in press) finds that perceived self-efficacy is a major factor to influence individual behavioral intention to use information systems. Therefore, this study leads to three hypotheses:

H1D: The instructors’ perceived enjoyment toward e-learning is positively related to their intentions to use it.
H1E: The instructors’ perceived usefulness toward e-learning is positively related to their intentions to use it.
H1F: The instructors’ perceived self-efficacy toward e-learning is positively related to their intentions to use it.

3.2. Hypotheses of learner attitudes

Liaw (2004) suggested three considerations when developing effective e-learning environments: learner characteristics, instructional structure, and interaction. E-learning provides a user more opportunities to be an active and self-regulatory learner. For example, in an e-learning environment, learners can control the learning time and procedures by themselves. Thus, based on learner perspectives, e-learning is a learner autonomy environment. In addition, e-learning environments provide various assisted functions, such as teacher-made online instruction, online conference, online help and suggestions, online examination, and online monitoring. All these functions offer opportunities for teachers to be assisted tutors. Furthermore, e-learning environments offer both multimedia ill-structured and well-structured instructions. As e-learning environments usually provide collaborative, interactive, network systems, and multimedia contents, they offer a learning environment to improve learners’ problem-solving capabilities and thinking skills. Thus, based on e-learning fundamental criteria, three guidelines should be noted: self-paced, instructor-led, and multimedia for building effective learning environments.

Therefore, this study proposes three hypotheses:
H2A: Self-paced learning is a predictor to learners’ attitudes toward e-learning as an effective learning tool.
H2B: Instructor-led learning is a predictor to learners’ attitudes toward e-learning as an effective learning tool.
H2C: Multimedia instruction is a predictor to learners’ attitudes toward e-learning as an effective learning tool.

4. Research methodology

4.1. Understanding instructor attitudes

4.1.1. Participants
The study was conducted in a university with a sample of 50 instructors. These 50 instructors attended a seminar on “How to Use E-Learning for Teaching Purposes”. All subjects are asked to answer a questionnaire after the 4-h seminar. The questionnaire with a cover letter was distributed to subjects from the researchers. All respondents were asked to complete the survey and their feedback was guaranteed confidentiality. Thirty-five instructors answered the questionnaire. Five missing responses were eliminated and a total of 30 responses were collected.

4.1.2. Instruments
The data for this study was gathered by means of a questionnaire. The questionnaire included three major components: (a) demographic information, (b) computer and Internet experience, and (c) attitudes toward e-learning. The questionnaire is described as below.

Demographic information: The demographic component covered gender, and the field of teaching.

Computer and Internet experience: In this component, participants were asked to indicate whether they had experience using operating systems, the Internet, word processing packages, PowerPoint, computers as a teaching assisted tool, and experience using e-learning. These 6 questions are all 7-point likert scales (from 1 which means “no experience” to 7 which means “well experienced”).

Attitudes toward e-learning: Participants were asked to indicate their attitudes toward e-learning. These 19 questions were all 7-point likert scales (from 1 which means “strongly disagree” to 7 which means “strongly agree”).

4.2. Understanding learner attitudes

4.2.1. Participants
This study conducts another questionnaire survey for understanding learner attitudes. The survey was distributed to 168 college students who took either “Introduction to Computer Science” or “Introduction to Computer Network” courses. After using the e-learning environment for six weeks, all participants were asked to complete a questionnaire that included demographic information and three different components (demographic information, computer and Internet experience, and attitudes toward e-learning). The questionnaires, including a cover letter, were distributed to participants during class. All subjects were asked to respond to the questionnaire and their responses were guaranteed confidentiality.
4.2.2. Instruments

The data for this study was gathered by means of a paper-and-pencil survey. The questionnaire included three major components: (a) demographic information, (b) computer and Internet experience, and (c) attitudes toward e-learning. The following shows the content of the questionnaire.

Demographic information: The demographic component covered gender and the field of study.

Computer and Internet experience: In this component, participants were asked to indicate whether they had experience using Web browsers, e-mail, word processing packages, as well as coding Web pages. These 4 questions are all 7-point Likert scales (from 1 which means “no experience” to 7 which means “well experienced”).

Attitudes toward e-learning: Participants were asked to indicate their attitudes toward e-learning. These 15 questions all adopted 7-point Likert scales (from 1 which means “strongly disagree” to 7 which means “strongly agree”).

5. Results

5.1. Results of instructors’ attitudes

Regarding instructors’ experience in using computers or Internet technology for teaching, only one instructor does not have any experience while the other 29 instructors all have experience. Descriptive statistics (means (M) and standard deviations (SD)) of computer use and experience were shown in Table 1. The alpha reliability of instructor attitudes toward e-learning (Table 2) was to be highly accepted (α = 0.95). The high alpha reliability gives a support for questionnaire content reliability.

The Pearson correlation coefficients among the variables are presented in Table 3. The bivariate relationships indicated that many of the variables significantly correlated with each other, but are all less than 0.80.

Concerning analytic strategy for assessing the predictive model, multiple regression analysis is an appropriate multivariate analytical methodology. Essentially, multicollinearity can be controlled in two ways: (1) correlation between independent variables should all be less than 0.8 (Emory & Cooper, 1991); (2) variance inflation factors (VIF) should be less than 10 (Neter & Kutner, 1990). In this study, multicollinearity was ruled out because the correlation between independent variables were all less than 0.8 and the VIFs were all less than 10. Based on multiple regression analysis, the scatter plots of the standardized residuals by the standardized predicted scores were also examined to verify the assumption of linearity.

The results of stepwise multiple regressions for the path associated with the variables were presented in Table 4. For understanding H1A, H1B, and H1C, three regression analyses were performed to check the effects of predicted variables (perceived system satisfaction and multimedia instruction) on perceived self-efficacy, perceived enjoyment, and perceived usefulness toward e-learning environments. The results showed the independent variables of perceived system satisfaction could predict perceived self-efficacy (F(1, 28) = 10.58, p < 0.01, R² = 0.27), and perceived usefulness (F(1, 28) = 68.74, p < 0.01, R² = 0.71). In addition, the independent variables of multimedia instruction could predict perceived enjoyment (F(1, 28) = 13.50, p < 0.01, R² = 0.33). For
examining H1D, H1E, and H1F, a regression analysis was performed to check the effects of predicted variables (perceived self-efficacy, perceived enjoyment, and perceived usefulness) on behavioral intention to use e-learning environments. The results showed the independent variables
of perceived usefulness and perceived self-efficacy could predict instructors’ behavioral intention to use e-learning \( (F(2,27) = 46.22, p < 0.0005, R^2 = 0.77) \), and perceived usefulness was the greatest contributor \( (R^2 = 0.56) \).

5.2. Results of learners’ attitudes

According to learners’ experience in using e-learning environments, 73 students have not taken any e-learning course, 80 students have taken one e-learning course, 9 students two e-learning courses, and 6 students three or more e-learning courses. Descriptive statistics (means \( M \) and standard deviations \( SD \)) of computer use and experience were shown in Table 5. The alpha reliability of learner attitudes toward e-learning (Table 6) was to be highly accepted \( (\alpha = 0.92) \). The high alpha reliability gives a support for questionnaire content reliability.

The Pearson correlation coefficients among the variables are presented in Table 7. The bivariate relationships indicated that many of the variables significantly correlated with each other.

Table 3
Correlation analysis of instructor attitudes

<table>
<thead>
<tr>
<th>Variables</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Perceived self-efficacy</td>
<td>0.64**</td>
<td>0.32</td>
<td>0.68**</td>
<td>0.52**</td>
<td>0.50**</td>
</tr>
<tr>
<td>2. Perceived enjoyment</td>
<td>0.31</td>
<td>0.58**</td>
<td>0.54**</td>
<td>0.57**</td>
<td></td>
</tr>
<tr>
<td>3. Perceived usefulness</td>
<td>0.75**</td>
<td>0.78**</td>
<td>0.73**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Behavioral intention to use e-learning</td>
<td></td>
<td></td>
<td>0.76**</td>
<td>0.79**</td>
<td></td>
</tr>
<tr>
<td>5. Perceived system satisfaction</td>
<td></td>
<td></td>
<td></td>
<td>0.78**</td>
<td></td>
</tr>
<tr>
<td>6. Multimedia instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlations are significant at the \( p < 0.01 \) (2-tailed).

Table 4
Regression results of instructor attitudes

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variables</th>
<th>( \beta )</th>
<th>( R^2 ) change</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived self-efficacy</td>
<td>Perceived system satisfaction</td>
<td>0.68</td>
<td>0.27</td>
<td>0.003</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>Perceived system satisfaction</td>
<td>0.91</td>
<td>0.71</td>
<td>0.000</td>
</tr>
<tr>
<td>Perceived enjoyment</td>
<td>Multimedia instruction</td>
<td>0.63</td>
<td>0.33</td>
<td>0.001</td>
</tr>
<tr>
<td>Behavioral intention to use e-learning</td>
<td>Perceived usefulness</td>
<td>0.60</td>
<td>0.56</td>
<td>0.000</td>
</tr>
<tr>
<td>Behavioral intention to use e-learning</td>
<td>Perceived self-efficacy</td>
<td>0.41</td>
<td>0.21</td>
<td>0.000</td>
</tr>
</tbody>
</table>

of perceived usefulness and perceived self-efficacy could predict instructors’ behavioral intention to use e-learning \( (F(2,27) = 46.22, p < 0.0005, R^2 = 0.77) \), and perceived usefulness was the greatest contributor \( (R^2 = 0.56) \).

5.2. Results of learners’ attitudes

According to learners’ experience in using e-learning environments, 73 students have not taken any e-learning course, 80 students have taken one e-learning course, 9 students two e-learning courses, and 6 students three or more e-learning courses. Descriptive statistics (means \( M \) and standard deviations \( SD \)) of computer use and experience were shown in Table 5. The alpha reliability of learner attitudes toward e-learning (Table 6) was to be highly accepted \( (\alpha = 0.92) \). The high alpha reliability gives a support for questionnaire content reliability.

The Pearson correlation coefficients among the variables are presented in Table 7. The bivariate relationships indicated that many of the variables significantly correlated with each other.

Table 5
Descriptive statistics of learner attitudes (from 1 which means “no experience” to 7 which means “well experienced”)

<table>
<thead>
<tr>
<th>Variables</th>
<th>( M )</th>
<th>( SD )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience using Web browsers</td>
<td>4.92</td>
<td>1.70</td>
</tr>
<tr>
<td>Experience using e-mail</td>
<td>5.46</td>
<td>1.41</td>
</tr>
<tr>
<td>Experience using word processing packages</td>
<td>4.89</td>
<td>1.48</td>
</tr>
<tr>
<td>Experience coding Web pages</td>
<td>3.11</td>
<td>1.50</td>
</tr>
</tbody>
</table>
Concerning analytic strategy for assessing H2A, H2B, H2C, multiple regression analysis is an appropriate multivariate analytical methodology for empirically examining sets of relationships in the form of linear causal models. The results of stepwise multiple regressions for the path associated with the variables were presented in Table 8. The regression analysis was performed to check the effects of predicted variables (e-learning as a self-paced learning environment, e-learning as a multimedia instruction environment, and e-learning as an instructor-led learning environment) on e-learning as an effective learning environment. The results showed all three independent variables are predictors ($F(3,163) = 67.21, \ p < 0.0005, \ R^2 = 0.55$). These three predictors have 55% contribution.

Table 6
Means, standard deviations and item-total correlations (from 1 which means “strongly disagree” to 7 which means “strongly agree”)

<table>
<thead>
<tr>
<th>Items</th>
<th>M</th>
<th>SD</th>
<th>r*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E-learning as a self-paced learning environment</strong></td>
<td>5.16</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>I can learn actively in the e-learning environment</td>
<td>4.77</td>
<td>1.43</td>
<td>0.57</td>
</tr>
<tr>
<td>I have more opportunities to create my own knowledge in the e-learning environment</td>
<td>5.62</td>
<td>1.24</td>
<td>0.75</td>
</tr>
<tr>
<td>The hypertext online instruction can enhance my learning motivation</td>
<td>4.70</td>
<td>1.39</td>
<td>0.66</td>
</tr>
<tr>
<td>I can discuss actively with others in the e-learning environment</td>
<td>5.35</td>
<td>1.26</td>
<td>0.49</td>
</tr>
<tr>
<td>I can read the online instruction actively</td>
<td>5.15</td>
<td>1.44</td>
<td>0.68</td>
</tr>
<tr>
<td>I can find information actively in the e-learning environment</td>
<td>5.34</td>
<td>1.43</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>E-learning as an effective learning environment</strong></td>
<td>5.31</td>
<td>1.26</td>
<td></td>
</tr>
<tr>
<td>The e-learning environment improves my thinking skills</td>
<td>5.04</td>
<td>1.39</td>
<td>0.69</td>
</tr>
<tr>
<td>The e-learning environment enhances my problem-solving skills</td>
<td>5.42</td>
<td>1.23</td>
<td>0.75</td>
</tr>
<tr>
<td>The e-learning environment provides various aspects to solve problems</td>
<td>5.46</td>
<td>1.16</td>
<td>0.62</td>
</tr>
<tr>
<td><strong>E-learning as a multimedia instruction environment</strong></td>
<td>5.93</td>
<td>1.15</td>
<td></td>
</tr>
<tr>
<td>I like colorful pictures in online instruction</td>
<td>6.04</td>
<td>1.09</td>
<td>0.62</td>
</tr>
<tr>
<td>I like learning videos in online instruction</td>
<td>5.90</td>
<td>1.21</td>
<td>0.66</td>
</tr>
<tr>
<td>I like the animated online instruction</td>
<td>5.86</td>
<td>1.15</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Teachers as an instructor-led learning environment</strong></td>
<td>4.68</td>
<td>1.54</td>
<td></td>
</tr>
<tr>
<td>I like the instructor’s help and suggestions in the e-learning environment</td>
<td>4.89</td>
<td>1.48</td>
<td>0.60</td>
</tr>
<tr>
<td>I like the instructor’s voice and image in the e-learning environment</td>
<td>4.51</td>
<td>1.60</td>
<td>0.60</td>
</tr>
<tr>
<td>I like the instructor’s online multimedia instruction in the e-learning environment</td>
<td>4.65</td>
<td>1.54</td>
<td>0.60</td>
</tr>
</tbody>
</table>

r*: Corrected item-total correlation.

Table 7
Correlation analysis of learner attitudes

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<th>Variables</th>
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<td>0.66**</td>
<td>0.60**</td>
<td>0.54**</td>
</tr>
<tr>
<td>2. E-learning as an effective learning environment</td>
<td></td>
<td>0.62**</td>
<td>0.57**</td>
</tr>
<tr>
<td>3. E-learning as a multimedia instruction environment</td>
<td></td>
<td></td>
<td>0.54**</td>
</tr>
<tr>
<td>4. E-learning as an instructor-led learning environment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlations are significant at the $p < 0.01$ (2-tailed).
6. Discussions

The results of this research confirm that all Hypotheses are true, from H1A through H2C. Based on descriptive statistical data of Table 1, instructors have adequate computer experience (such as operating system and word processing experience). Furthermore, they are also well experienced in using the Internet. According to teaching technology experience (such as experience using PowerPoint, computers as a teaching assisted tool, and experience using e-learning), instructors have high competency in using those tools. These results support that instructors have remarkable computer and e-learning related skills for teaching.

Additionally, from Table 2, instructors have highly positive attitudes toward e-learning that included perceived self-efficacy, enjoyment, usefulness, and behavioral intention of use. As for the quality of e-learning environment, instructors believe both system satisfaction and multimedia instruction are vital factors. Thus, from Table 2, instructors display highly favorable attitudes toward e-learning environments as a useful teaching assisted tool, supporting their intention to use them for teaching in the future. Table 3 presents that these 6 factors have high correlations with each other. These results indicate that these 6 factors could be investigated at the same time when understanding users’ attitudes toward e-learning.

As shown in Table 4, perceived system satisfaction is a crucial factor to influence instructors’ perceived self-efficacy and perceived usefulness toward e-learning. Multimedia instruction is a critical predictor for their perceived enjoyment. Furthermore, when understanding instructors’ behavioral intention to use e-learning environments, perceived usefulness is the greatest contributor (56%) and perceived self-efficacy has a 21% contribution. From instructors’ viewpoints, system satisfaction can positively affect their attitudes toward e-learning as a useful teaching assisted tool. And multimedia instruction can significantly affect their enjoyment toward e-learning.

On the other hand, Table 5 shows that learners have abundant computer related experience. Students have more experience using browsers and e-mail than word processing. This reaffirms that today’s learners have adequate Internet related experience. From Table 6, students feel that e-learning environments can be autonomous and rich in multimedia. Additionally, they expect teachers to help them when they use e-learning environments for assisted learning. Moreover, students believe that e-learning environments are an efficient learning tool. Therefore, they have positive attitudes toward e-learning environments for learning purposes as shown in Table 6. Table 7 presents that 4 factors (self-paced, multimedia instruction, instructor-led, and effective learning) have high correlations with each other. These results indicate that these factors could be investigated at the same time when understanding learner attitudes toward e-learning.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variables</th>
<th>$\beta$</th>
<th>$R^2$ change</th>
<th>$P$</th>
</tr>
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<tbody>
<tr>
<td>E-learning as an effective learning environment</td>
<td>E-learning as a self-paced learning environment</td>
<td>0.38</td>
<td>0.44</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>E-learning as a multimedia instruction environment</td>
<td>0.28</td>
<td>0.08</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>E-learning as an instructor-led learning environment</td>
<td>0.23</td>
<td>0.03</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Table 8 shows learners’ attitudes toward e-learning as an efficient learning tool can be predicted positively by three factors (e-learning as a self-paced learning environment, e-learning as a form of multimedia instruction, and e-learning as an instructor-led learning environment). When building an e-learning environment, these three factors should be taken into consideration in order to create an efficient learning environment.

7. Conclusions

Modern day learning environments are characterized by their place and time independence, their integrated presentation and communication facilities, and their opportunities for re-use of learning technologies in the form of learning objects. Many researchers claim that technology push will enhance the quality of education; In fact, Clark (1994) argues that the question of whether media or technology will ever influence learning remains open to debate. A well-defendable viewpoint lies not in the media or technology used because only positive attitudes toward that media or technology can improve the quality of learning or teaching. Thus, understanding users’ attitudes toward learning technology, including instructors’ and learners’ attitudes, enables us to make learning more effective, efficient, and appealing.

When applying a learning tool or system for learners, it is necessary to investigate both teachers’ and learners’ attitudes toward that tool or system. Essentially, understanding their perceptions toward learning environments is a crucial issue for enhancing teaching performance and learning effects. The results of this study confirm that instructors are willing to use e-learning environments to aid their teaching activities. Learners also respond favorably to e-learning environments for complementing to their learning activities. The present study helps us understand instructor intentions and learner attitudes toward e-learning. Specifically, user perceptions toward e-learning could include affective, cognitive, behavioral, and social components. All in all, e-learning environments could be developed with these guidelines in mind: multimedia instruction, autonomous learning, instructor-led interaction, and improving learning effectiveness.

7.1. Understanding instructors’ intentions to use e-learning

The results of this research provide evidence that instructors have highly behavioral intentions to use e-learning (mean is 5.71). In other words, e-learning could be a teaching assisted tool. From the findings, perceived e-learning satisfaction is a key factor to affect instructors’ cognitive perceptions, such as perceived self-efficacy and perceived usefulness of e-learning. Table 4 also shows that multimedia instruction is a main factor to influence instructors’ affective perception. Regarding instructors’ behavioral intention to use e-learning, perceived usefulness and self-efficacy are two major predictors. Thus, the results support that 3-TUM is an appropriate research model for investigating instructors’ attitudes of e-learning usage.

Among the various theoretical models developed to examine users’ intentions of using computer and communication technology, perceived usefulness is a key to influence behavioral intentions (Gefen & Straub, 1997; Liaw & Huang, 2003; Moon & Kim, 2001; Szajna, 1996; Taylor & Todd, 1995; Vankatesh & Davis, 1996; Vankatesh, 1999). According to Bandura (1997), self-efficacy is the belief “in one’s capabilities to organize and execute the courses of action
required to produce given attainments” (p. 3). Some researchers emphasize that self-efficacy beliefs should be assessed in such a way that the beliefs correspond to the targeted performance and domain of interest. Compeau and Higgins (1995a) state that when individuals have higher self-efficacy toward information technology, they also feel that information technology is more useful. Additionally, Compeau and Higgins (1995b) and Compeau et al. (1999) indicate that when individuals have higher self-efficacy toward information technology, they also intend to use information technology more. Therefore, the findings of this research support previous studies.

7.2. Realizing learner attitudes toward e-learning

One of the critical factors using e-learning is to improve learning performance. The results of this study offer a view that effective e-learning environments are affected by learner self-paced learning, multimedia instruction, and instructor-led learning. It means that an effective learning environment, including problem-solving capabilities and high order thinking skills, is influenced by learner autonomy, multimedia content, and teacher helps. Although self-paced learning, multimedia instruction, and instructor-led learning are all major predictors, learners have the highest positive attitudes toward multimedia instruction (mean is 5.93) and moderately positive attitudes toward instructor-led learning (mean is 4.68). From the results, it supports that most learners prefer multimedia instruction and many of them believe that interaction with others is necessary. Palloff and Pratt (1999) state that the main features of the learning process include interactions among students, and interactions between students and instructors for collaboration in learning. Therefore, e-learning should provide useful tools and instructors should utilize creative teaching approaches that can facilitate the interactions and collaboration in the learning process, which may finally increase effective learning performance, such as problem-solving and high order thinking.

7.3. Perceptions toward e-learning including affective, cognitive, behavioral, and social components

Much research on using learning technologies in education involves some measure of learners’ attitudes by means of a questionnaire or an interview after they have used a particular piece of technology or software. In such questionnaires, researchers often ask users about their experience. Based on questionnaire investigation, users’ responses serve as critical information to understand more about users’ attitudes toward that technology or software. Liaw (2002) claims that constructs of user attitudes toward computer and Internet technologies should be divided into three major measurements: affective, cognitive, and behavioral measurements. Additionally, Jones and Issroff (2005) argue the importance of considering both affective and social components when trying to understand user attitudes. Thus, user attitudes toward e-learning could be studied from various perspectives, such as affective, cognitive, behavioral, and social components.

This research provides affective, cognitive, behavioral, and social perspectives to understand instructors’ and learners’ attitudes toward e-learning. Attention to these four aspects would serve as an ideal beginning to further our comprehension of the role of attitude factors when using learning technologies. From the results of social perspectives, instructors’ leadership or assistance is a critical factor to affect learners’ attitudes. In other words, interaction between instructors and students is a success factor for enhancing e-learning effects. Based on activity theory, learning activities include individual and social levels at the same time (Kuutti, 1997).
7.4. Guidelines of developing e-learning environments

This research offers four factors that could be considered when developing e-learning environments: multimedia instruction, autonomous learning, instructor-led interaction, and improving learning effectiveness. Based on the results of investigating instructors’ and learners’ attitudes, four guidelines should be considered when facilitating e-learning: vivid multimedia learning instruction, highly autonomous learning environments, enhancing instructors’ and learners’ asynchronous or synchronous communications, as well as improving learning effectiveness (including learners’ problem solving or high order thinking skills presented in Table 6). Fig. 3 shows the guidelines of developing e-learning environments.

In summary, e-learning is the new wave in learning strategy. Through innovative use of modern technology, e-learning not only revolutionizes education and makes it more accessible, it also brings formidable challenges for instructors and learners. Thus, surveying instructors’ and students’ attitudes toward e-learning is a critical issue in learning and training. This research assesses instructors’ attitudes toward e-learning environments as a teaching assisted tool. Moreover, this study explores learners’ perceptions toward e-learning as an effective learning tool. Future research may explore methods to increase learner autonomy, and interactions among instructors and students for improving learning performance. Besides, “how to design vivid multimedia e-learning contents for improving learners’ performance” is also a potential research direction.

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References


