E-learning acceptance: Technological key factors for successful students’ engagement in E-learning system

Abdulhameed Rakan Alenezi¹

Instructional Technology Department , Aljouf University , Saudi Arabia ¹

Abstract - The benefits derived from the E-learning system will not be achieved if the students do not accept and participate effectively in their university’s E-learning systems. The technological factors appear to have a significant influence in making the system usage perceived as useful, functional, interactive and easy to use (Palloff & Pratt, 1999; Selim, 2003; Pituch & Lee, 2006). Thus, the technological factors that are related to E-learning system need further investigation regarding its significant influence on the students’ acceptance of E-learning in higher education environment particularly in Saudi Arabian universities. By reason of a broad global attention given to E-learning and its related challenges, various studies had been conducted by academe, different organizations as well as the government of various nations (Rosenberg, 2001). Saudi Arabian universities are among those universities that implement and promote using E-learning systems. However, recent research indicated that majority of students in Saudi Arabian universities are still unwilling to use online system (Al-Jarf, 2007, Alenezi, et.al.,2011). Therefore, many factors need to be investigated in order to enhance the students' acceptance and usage to use E-learning tools and participate effectively in their courses using the specific Learning Management systems (LMS) in each university. The current study has extended Technology Acceptance Model (TAM) to investigate the effects of System Performance (SP), System Functionality (SF), System Response (SR) and System Interactivity (SI) on students’ acceptance of E-learning. The mediating effects of Attitude in the relationship between perceived usefulness, perceived ease of use and the students’ acceptance was significantly confirmed.

Keywords: E-learning acceptance, Technology Acceptance Model (TAM), System Performance, System Functionality, System Response, System Interactivity.

1 Introduction

E-learning has been used in education as early as the 1950’s. At that time E-learning was referred to as distance learning (Clark, 2000). The term E-learning refers to the learning methods which use electronic channels to deliver the instructional content. Moreover, E-learning is also referred to as web-based learning; technology based learning; online learning; networked learning and so on (Gotschall, 2000; Trombley & Lee, 2002). This way of learning gained its popularity just a decade ago according to Rosenberg (2001). Due to a broad global attention given to e-Learning, various reports and studies have been conducted by educational institutions, different organizations as well as the governments of various nations (Rosenberg, 2001). The Saudi Ministry of Higher Education is among those educational organizations that proposed the use of E-learning in Saudi Arabia. The Saudi Ministry of Higher Education recognised the need of integrating Information and Communication Technology (ICT) in various universities in Saudi Arabia. The Saudi Gazette (2008) by Madar Research reported that “the Saudi Arabian E-learning industry is projected to reach USD 125 million in 2008 and is set to grow at a compound annual rate of 33 per cent over the next five years”. The increased projection shows vital focus on the advantages of E-learning in Saudi Arabia’s modern education. However, many factors still influence negatively on the students’ participation in the online courses. Al-Jarf (2007) pointed out that using the online system for her English course was a total failure. The author has also observed that the interaction between the participants was lacking and that the students had a negative attitude towards online courses. Nevertheless, the factors that have affected the acceptance of the system have still not been investigated yet. Al-Jarf (2007) found that in two Saudi universities, the students were still apprehensive, shy and hesitant to participate in this project. Moreover, the author pointed out that the online project in the two universities proved to be a total failure. Therefore, the researcher is interested in empirically extending the Technology Acceptance Model (TAM) to investigate the effects of System Performance (SP), System Functionality (SF), System Response (SR), and System Interactivity (SI) on students’ acceptance of E-learning. It also aims to examine the Attitude mediating effects on the relationships between the main TAM model predictors and E-learning acceptance.

2 Literature review

2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is one of the most widely applied models to studies on individual acceptance and the usage of technologies. The TAM was adapted from the more general human behaviour which is the theory of reasoned action (TRA). The model was initially developed
and validated by Davis (1986, 1989). Davis et al. (1989) developed TAM as a theoretical basis, to provide an explanation of the determinants of human computer usage behaviour that is general, directly from generic TRA (Fishbein & Ajzen, 1975). Moreover, according to Davis, Bagozzi, and Warshaw (1989, p. 985), the TAM is the proficient of explaining users’ behavior crossways of a broad range of end-user computing technologies, alongside both parsimonious and hypothetically justified. The TAM model has been extensively validated across an array of settings and contexts (Davis et al., 1989; Venkatesh & Morris, 2000; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003).

Furthermore, many studies have examined the TAM’s applicability and validity to investigate students’ acceptance in using the E-learning technology in higher education institutions (Landry, Rodger & Hartman, 2006; Masrom, 2007; Ngai et al., 2007; Roca et al., 2006; Saadé & Galloway, 2005; Saadé & Bahil, 2005; Selim, 2003). The TAM suggests that perceived ease of use and perceived usefulness of Information Technology (IT) are the main determinant factors of IT usage. Davis (1993, p. 447) defines perceived ease of use (PEOU) as, “the degree to which an individual believes that using a particular system would be free of physical and mental effort”. Moreover, Davis (1989) defined perceived usefulness (PU) as “the degree to which a person believes that using a particular system would enhance his or her job performance”. The two major key constructs of the TAM: PU and PEOU, have the capability to predict an individual’s attitude towards using a particular system. Both constructs, PU and PEOU, will influence an individual’s attitude (A). Davis et al., (1989) defined attitude as an individual’s positive or negative assessment of the behavior and is a function of Perceived Usefulness and Perceived Ease of Use. Attitude (A) will influence the Behavioral Intention (BI) of using a particular system, and in turn, influence the Actual use of the system (AU). Actual use (AU) will be predicted by the individual’s Behavioral Intention (BI). Behavioral Intention (BI) refers to an individual’s intention to perform a behavior and is a function of Attitude and Perceived Usefulness (Davis et al., 1989). According to Davis et al. (1998), Actual Use of a particular system is defined as a behavioral response, measured by the individual’s action. The relationships between the mentioned constructs are presented in Figure 1, as shown below.

**Figure 1. Technology Acceptance Model (TAM)**

![Technology Acceptance Model (TAM)](image)

2.2 System Performance (SP)

System Performance (SP) refers to the degree to which a person believes that a system is reliable and responsive during a normal course of operations (Liu & Ma, 2006). This concept has its intention in different domains such as the wireless system (Shankaranarayanan, 2001), website software purchase (Mahinda & Whitworth, 2005) and medical records (Liu & Ma, 2006). Thus, this factor seems to be a crucial antecedent of both TAM beliefs constructs: perceived usefulness and perceived ease of use.

Liu and Ma (2006) extended the technology acceptance model with the construct perceived system performance. System performance consisted of two sub-constructs: reliability and responsiveness. Perceived system performance has explained around 46% of the variance in perceived ease of use and 56% of the variance in behavior intention. Thus, the perceived system performance seems to be vital in terms of its applicability to predict the users’ perception towards a specific system. Furthermore, when the perceived system is nonexistent, the relations between the TAM constructs are still supporting. However, the association between perceived ease of use and intention of using the system is weak.

Mahinda and Whitworth (2005) have come up with a new model called The Web of System Performance. They extended the TAM to include system related factors such as security, connectivity, flexibility, extendibility and privacy. The study aimed to investigate the proposed factors on the users’ online software purchase. The findings indicated that security, privacy, usability, functionality, reliability and connectivity play a significant role that users would consider when they purchase software via online.

2.3 System Functionality (SF)

System functionality (SF) refers to the perceived ability of an E-learning system to provide flexible access to instructional and assessment media (Pituch & Lee, 2006). System functionality is a very important factor which is related to a system’s characteristics. Many studies have investigated the relationship between system characteristics and users’ acceptance (Davis, 1993; Venkatesh & Davis, 1996, Igbaria et al., 1995; Pituch & Lee, 2006; Ruth, 2000). Several researches study the system impacts on the E-learning environment (Palkoff & Pratt, 1999; Pituch & Lee, 2006; Selim, 2003). In this research, system functionality will be studied with other associated system characteristics as technological factors.

Seels and Glasgow (1998) conducted a research investigating the affecting factors on the instructional design decisions. The research indicated that the system function is related to its capabilities to integrate different types of media such as Video and Audio. The researchers indicated that the high level of the system functionality can be derived from making a clear and interactive instructional design in order to gain the students intention to use a specific system. At the same time, Selim (2003) has referred to system functionality for its ability to provide superior system accessibility from remote and different locations around the world.
Pituch and Lee (2006) investigated the influence of system characteristics on E-learning use. They proposed and tested alternative models that can search for an explanation on students’ intention to use an E-learning system when the system is utilised as an additional learning tool. The data were collected from 259 students from a Taiwanese university. The researchers proposed system functionality, system interactivity, system response, self-efficacy and internet experience as external variables of the TAM. The results indicated that the system characteristics influenced both the E-learning usage outcomes and the users’ beliefs. They indicated that the system characteristics must be considered at the development stage of the E-learning design. The researchers also mentioned that the developers of E-learning system should select the specific system characteristics before the implementation stages.

In short, System functionality seems to be a pre-implementation factor that could have its impact on the students’ willingness to use E-learning system tools in the higher educational environment. Thus, system functionality will be assessed as an external construct and its influences will be examined in relation to students’ E-learning acceptance.

2.4 System Interactivity (SIN)

System Interactivity (SIN) refers to the perceived ability of an E-learning system to provide the interactions among students themselves and the interactions between faculty and students (Pituch & Lee, 2006). Palloff and Pratt (1999, p.5) cited in (Pituch & Lee, 2006) stated that for E-learning systems, the “key to the learning process are the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions”.

In the line with this matter, the current E-learning system has been interactive since it provides interactivity tools such as the E-mail and chat room. Therefore, system interactivity will be studied as a critical factor that could determine whether it influences the students’ acceptance of E-learning implementation or not.

2.5 System Response (SR)

System response (SR) is defined as the degree to which a learner perceives the response from the E-learning system as fast, consistent, and reasonable (Pituch & Lee, 2006). Besides the importance of system performance, functionality and its interactivity, the system response is a crucial factor that influences the students’ perception of both usefulness and ease of use of the E-learning system. Kerka (1999) affirmed that the E-learning system has disadvantages upon its wide communication tools and its limitation in bandwidth capacity. Thus, the system response must be the priority of E-learning design and implementation.

Pituch and Lee (2006) investigated the influence of system response on E-learning use. They indicated that the system response has a crucial influence on the students’ acceptance of using the E-learning system. For instance, the students who perceived the E-learning system to be responsive will indicate that the system is easy to use and is useful. Eventually, their intention to use the system will be high and positive.

In brief, system performance, system functionality, system interactivity and system response appear to be significant as antecedents of both the TAM beliefs constructs. It also appears to influence the students’ intention to use E-learning system. Thus, the present research will utilise the proposed constructs to investigate the technological factor that could affect the students’ acceptance of E-learning in Saudi Arabian universities.

3 Research methodology

3.1 Research model and hypotheses

Based on the original TAM model and based on the previous inconclusive findings in the literature review regarding these four variables, null hypotheses are summarized as follows and the Research model is proposed (as depicted in Figure 2).

![Figure 2: Proposed Research Model](image_url)

H₉₁: System Performance (SP) has no influence on the students’ E-learning acceptance.
H₉₂: System Functionality (SF) has no influence on the students’ E-learning acceptance.
H₉₃: System Response (SR) has no influence on the students’ E-learning acceptance.
H₉₄: System Interactivity (SI) has no influence on the students’ E-learning acceptance.
H₉₅: Perceived usefulness has no influence on students’ attitudes toward the using E-learning.
H₉₆: Perceived ease of use has no influence on students’ attitudes toward the using E-learning.
H₉₇: Attitudes toward using of E-learning have no influence on the students’ acceptance.
H₉₈: Attitude towards using E-learning does not mediate the relationship between perceived usefulness and E-learning acceptance.
**H₈9**: Attitude towards using E-learning does not mediate the relationship between perceived ease of use and E-learning acceptance.

**H₈10**: There is no relationship between perceived usefulness and perceived Ease of use.

**H₈11**: E-learning acceptance has no influence on the actual E-learning system use.

### 3.2 Research Design

The questionnaire consisted of 34 Items in order to measure the proposed research model factors. The measurement was adapted from prior research (Liu & Ma, 2006; Ngai, Poon, & Chan, 2007; Pituch, & Lee, 2006; Suh & Lee, 2007). Pilot study was conducted in order to develop the measurements adapted scales. Moreover, the pilot study was performed in order to detect the internal consistency and reliability of utilised questionnaire. The questionnaire was distributed to 50 students from Al-Jouf University in session one 2009/2010. The returned and usable questionnaires were 48 and two questionnaires were excluded from the analysis due to enormous unanswered questions. The analysis of internal consistency was obtained from the interval scale items only. Overall, the pilot study data revealed acceptable high alpha reliability coefficient of all items which were above 0.70. Therefore, all items were retained for the main study. Thus, the questionnaire distribution to the targeted sample can be justified.

### 3.3 Sample and data collection

Based on research population which is 156, 429 bachelor students, it is appropriate to select a minimum sample of 384 students from the entire research population (Krejcie, & Morgan, 1970). The numbers of 480 questionnaires were randomly distributed to the students at five universities in Saudi Arabia. The usable response rate was 85% with 408 undergraduate students from five different government universities. The profile of respondents is portrayed in Table 1.

<table>
<thead>
<tr>
<th>University</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>King Saud University</td>
<td>125</td>
<td>30.6</td>
</tr>
<tr>
<td>King AbdulAziz University</td>
<td>161</td>
<td>39.5</td>
</tr>
<tr>
<td>King Faisl University</td>
<td>38</td>
<td>9.3</td>
</tr>
<tr>
<td>King Khalid University</td>
<td>45</td>
<td>11.0</td>
</tr>
<tr>
<td>Aljouf University</td>
<td>39</td>
<td>9.6</td>
</tr>
</tbody>
</table>

Table 1: Profile of respondents

### 4 Data analysis and findings

#### 4.1 Reliability and factor analysis

Construct validity and reliability analysis were examined to ensure that the obtained responses are valid and reliable for further analysis. Exploratory factor analysis (EFA) represented by principal components analysis (PCA) with Varimax rotation were performed. All required criterion to perform the factor analysis were achieved. Kaiser-Guttman criterion was applied regarding to the number of variables to be extracted which only variables with an eigenvalues equal or greater than one can be extracted (Guttman, 1954; Kaiser & Dickman, 1959). The items with only loading 0.300 or greater were consider as acceptable (Hair et al., 1998). The factor analysis has individually been performed on each of the following scales because the ratio of five subjects per item (5:10) suggested by Coakes and Steed (2003) and the ratio of ten subjects per item (1:10) to run a single factor analysis were not achieved (Hair et al., 1998). Therefore, the factor analysis was performed separately for original TAM constructs and the technological factors namely system performance, system response, system interactivity and system functionality. The Cronbach’s alpha coefficient above 0.60 is considered as acceptable and justified (Nunnally & Bernstein, 1994; Sekaran, 2000). Therefore, the suggested acceptable cut-off level of 0.60 was applied in this research. Table 2 represents the obtained results from factor analysis of TAM model. Table 3 represents the obtained results from factor analysis of system performance, system response, system interactivity and system functionality.

**Table 3: Factor loading for Technological Factor (TF)**

<table>
<thead>
<tr>
<th>Items</th>
<th>SF</th>
<th>SR</th>
<th>SP</th>
<th>SI</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>(SF1)</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SF2)</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
</tr>
<tr>
<td>(SF3)</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SF4)</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SF5)</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SR1)</td>
<td></td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SR2)</td>
<td></td>
<td>0.77</td>
<td></td>
<td></td>
<td>0.72</td>
</tr>
<tr>
<td>(SR3)</td>
<td></td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SF6)</td>
<td></td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SP1)</td>
<td></td>
<td></td>
<td>0.88</td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>(SP2)</td>
<td></td>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SP3)</td>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SI1)</td>
<td></td>
<td></td>
<td></td>
<td>0.83</td>
<td>0.70</td>
</tr>
<tr>
<td>(SI2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eigenvalues</th>
<th>4.54</th>
<th>2.17</th>
<th>1.45</th>
<th>1.09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Variance Explained</td>
<td>32.46</td>
<td>15.51</td>
<td>10.36</td>
<td>7.81</td>
</tr>
<tr>
<td>Total Variance explained</td>
<td>21.28</td>
<td>39.25</td>
<td>54.76</td>
<td>66.149</td>
</tr>
<tr>
<td>KMO</td>
<td>0.772</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bartlett’s test</td>
<td>2470.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As shown in Table 3, the KMO value for technological factor items was 0.77. The Bartlett’s test of sphericity was also found to be significant \((p<0.000)\). Thus, factor analysis of these items indicated as appropriate to be conducted. The principle component methods revealed the presence of four components with eigenvalues exceeding one, explaining 66.15\% of the total variance. System Functionality (SF) includes six items accounted for 32.46\% of the total variance explained with an eigenvalue of 4.54. The factor loading of its items was acceptable which ranged form 0.62 to 0.86. One item (SF6) contributed highly to system response with loading of 0.69. Thus, according to Hair et al (1998) items that contributed highly to other variable can take the label name or retain the original variable. Therefore, SF6 retained the related variable. System Response (SR) (eigenvalue = 2.17) contributed 15.51\% of the total variance explained. It has factor loading ranging from 0.69 to 0.78. Thus, the factor items met the current research criteria and three items were retained. System Performance (SP) represented by 3 items and accounted 10.36\% of the total variance explained with an eigenvalue of 1.10. Items factor loading ranged from 0.79 to 0.88. The last factorability of System Interactivity (SI) indicated this factor with an eigenvalue of 1.0 accounting for 7.81\% of the total variance explained. Items factor loading ranged from 0.75 to 0.83. The results of analysing the factorability of Technological factor items has met the proposed criteria and resulted in the elimination of one item. The total items used in the analysis are 14 items.

### 4.2 Hypotheses testing

Three analysis techniques were used in testing the proposed hypotheses. Stepwise regression analysis was performed in order to investigate the factors’ influence on the students’ E-learning acceptance. Moreover, hierarchical regression analysis and Baron and Kenny criteria was carried out in order to test the mediation affect of the students’ attitude towards using E-learning. The final technique used the product-moment correlation analysis in order to test the relationship between perceived usefulness with perceived ease of use and E-learning acceptance. Before testing the proposed hypotheses, several assumptions were met such as normality, linearity, homoscedasticity and independence of errors terms, multicollinearity and multivariate outliers (Hair et al. 1998; 2006; Pallant, 2001; Coakes and steed, 2003).

To examine the \(H_1- H_4\) hypotheses, Stepwise regression analysis was performed. Table 4 shows the results of stepwise multiple regression analysis.
As depicted in Table 4, the technological factors namely System response, System functionality and System Interactivity were regressed in stepwise technique. The regression model utilised to predict E-learning acceptance resulted in Adjusted R Square = 86.2 % at significant 0.05 levels. Out of four examined technological predictors, three predictors activated prediction equation and were also associated with a significant percentage of variance in E-learning acceptance, F (3, 398) = 834.314, p<0.01. The first significant variable that predict E-learning acceptance is System response with β = .819, t = 35.043, at the significant level of p < .01, two tailed. The second significant variable predicted the E-learning acceptance is System functionality with β = .187, t = 7.923, at the significant level of p < .01. The third significant variable predicted the E-learning acceptance is System Interactivity with β = -.043, t = -2.157, at the significant level of p < .01. However, System performance was excluded from the model due to its insignificant association with E-learning acceptance at the significant level of p < .01. Hence, from technological prospective and based on the findings, students' who perceived E-learning system with satisfied level of response, functionality and Interactivity will have high level of E-learning acceptance. Therefore, three hypotheses were rejected while one hypothesis was accepted.

To examine the H05- H07 hypotheses, simple liner regression was performed to investigate the influence of perceived usefulness and perceived ease of use on the students' attitudes toward the using E-learning as well as investigate the influence of the Attitudes on the students' E-learning acceptance.

### Table 4: Stepwise multiple regression analysis of Technological factors

<table>
<thead>
<tr>
<th>TF</th>
<th>R²</th>
<th>Adjust R²</th>
<th>Uco.B</th>
<th>Sco. Beta</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>0.91</td>
<td>0.841</td>
<td>.818</td>
<td>.819</td>
<td>35.0</td>
<td>.000**</td>
</tr>
<tr>
<td>SF</td>
<td>0.93</td>
<td>0.861</td>
<td>.206</td>
<td>.187</td>
<td>7.92</td>
<td>.000**</td>
</tr>
<tr>
<td>SI</td>
<td>0.92</td>
<td>0.863</td>
<td>0.042</td>
<td>.187</td>
<td>2.16</td>
<td>.032</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01

### Table 5: Simple Liner regression analysis on the influence of perceived usefulness and perceived ease of use on the Attitude, the influence of the attitude on E-learning Acceptance

<table>
<thead>
<tr>
<th>Variable</th>
<th>R²</th>
<th>F</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>B</td>
<td>Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEU</td>
<td>.25</td>
<td>26.758</td>
<td>.323</td>
<td>.062</td>
<td>.250</td>
<td>.000**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.010*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>.11</td>
<td>5.159</td>
<td>.110</td>
<td>.048</td>
<td>.113</td>
<td>.2271</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.024*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Attitude ; b. Dependent Variable: E-learning Acceptance

As shown in Table 5, the results indicated that the perceived usefulness significantly influence students' attitude towards using the E-learning with β = .129, t (401) = 2.592, significant at the level of p < .05. The perceived ease of use has also significantly contributed to the students' attitude towards using the E-learning with β = .250, t (401) = 5.173, significant at the level of p < .01. The results also indicated that the attitude significantly influence students' E-learning Acceptance with β = .113, t (401) = 2.271, significant at the level of p < .05. Therefore, the examined null hypotheses were rejected.

### 4.3 Mediating analysis

Two null hypotheses were formulated to examine the mediating effect of students' attitude on the relationship between the internal independents variables, namely perceived ease of use/ perceived usefulness and students’ E-learning acceptance. In order to investigate the mediating effect the assumed null hypotheses of mediation were examined using hierarchical regression analysis and Baron and Kenny's (1986) approach, as shown in Figure 3.

**Figure 3: Mediation Model: Baron & Kenny (1986)**

**Mediating variable (MV)**

\[ Y \]

\[ (IVs) \]

\[ \text{Perceived Usefulness} \]

\[ \beta_2 \]

\[ \beta_4 \]

\[ \text{Perceived Ease of Use} \]

\[ \beta_1 \]

\[ (DV) \]

\[ \text{E-learning Acceptance} \]

\[ \beta_3 \]
Table 7: Hierarchical regression analysis using Attitude toward E-learning as a mediator in the relationship between perceived ease of use and E-learning acceptance

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>Model 1</td>
<td>(Constant)</td>
<td>2.45</td>
<td>.193</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PERCEIVE D EASE OF USE</td>
<td>.164</td>
<td>.062</td>
</tr>
<tr>
<td>Step 2</td>
<td>Model 2</td>
<td>(Constant)</td>
<td>2.27</td>
<td>.220</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PERCEIVE D EASE OF USE</td>
<td>.137</td>
<td>.064</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATTITUDE</td>
<td>.083</td>
<td>.050</td>
</tr>
</tbody>
</table>

R² = 0.130 in step 1; R² = 0.155 in step 2

The Baron and Kenny's significant criteria were met in the examined (H₅- H₇) hypotheses. Therefore, Hierarchical regression was performed to examine the Attitude total effects on the relationship between the IVs and DV. The results in Table 5 demonstrate the results of hierarchical regression analysis using Attitude as a mediator in the relationship between perceived usefulness, perceived ease of use and E-learning acceptance.

Table 6: Hierarchical regression analysis using Attitude toward E-learning as a mediator in the relationship between perceived usefulness and E-learning acceptance

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>Model 1</td>
<td>(Constant)</td>
<td>2.541</td>
<td>.201</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PU</td>
<td>.127</td>
<td>.061</td>
</tr>
<tr>
<td>Step 2</td>
<td>Model 2</td>
<td>(Constant)</td>
<td>2.284</td>
<td>.237</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PU</td>
<td>.111</td>
<td>.061</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATTITUDE</td>
<td>.098</td>
<td>.049</td>
</tr>
</tbody>
</table>

R² = 0.104 in step 1; R² = 0.144 in step 2

As portrayed in Table 6, the results indicate that in the first model, perceived usefulness significantly contributed to E-learning intention, R² = 0.104, F (1, 400) = 4.346, p<0.05. Model one shows that perceived usefulness is positively related to E-learning acceptance, β = .104, t = 2.085, at the significant level of p < .05. In model two, the Attitude was added to the equation, the R² = 0.144 significantly change with F (2, 399) = 4.241, p<0.05. Model two shows that perceived usefulness is insignificantly reduced, β = .091, t = 1.815, at the significant level of p < .05. In testing the mediation effect of Attitude, in model 1 the relationship between perceived usefulness (IV) and E-learning acceptance (DV) was significant. While in Model 2 the relationship between IV and DV becomes insignificantly reduced. Therefore, the attitude towards E-learning fully mediates the relationship between perceived usefulness and E-learning acceptance.

As presented in Table 7, the results indicate that in the first model, perceived ease of use is positively related to E-learning intention, R² = 0.130, F (1, 400) = 4.926, p<0.05. Model one shows that perceived ease of use is positively related to E-learning intention, β = .130, t = 2.632, at the significant level of p < .05. In model two, the Attitude was added to the equation, the R² = 0.156 significantly change with F (2, 399) = 4.880, p<0.05. Model two shows that perceived ease of use was still significant but reduced, β = .109, t = 2.134, at the significant level of p < .05. In testing the mediation effect of Attitude, in model 1 the relationship between perceived usefulness (IV) and E-learning intention (DV) was significant. While in Model 2 the relationship between IV and DV was still significant but the magnitude of the relationship between them is reduced (β = .130 to.109, t = 2.632 to 2.134. Hence based on Baron and Kenny approach, the attitude towards E-learning partially mediates the relationship between perceived ease of use and E-learning intention.

In order to investigate (H10) which examines the relationship between perceived usefulness and perceived Ease of use, Pearson correlation coefficient was used. Table 8 shows the results of correlation test between perceived usefulness and perceived Ease of use.

Table 8: Correlation test between perceived usefulness and perceived Ease of use

<table>
<thead>
<tr>
<th>Perceived Usefulness (1)</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.254(**)</td>
<td>.000</td>
<td>402</td>
</tr>
</tbody>
</table>

As portrayed in Table 8, indicated the positive and weak strength relationship between perceived usefulness and perceived Ease of use with coefficient's value r = 0.254, n = 402, p = 0.01. Therefore, the null hypothesis is rejected.

In order to investigate (H11) which examines the influence of the E-learning acceptance on the actual E-learning system use? Regression analysis was performed. Table 9 shows the results of regression analysis.
Table 9: Simple Linear regression analysis on the influence of E-learning acceptance and actual E-learning system use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL</td>
<td>R² = 0.10</td>
<td>F (1, 400) = 10.333, p&lt;0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>.211</td>
<td>.106</td>
<td>.566</td>
<td>.055</td>
</tr>
</tbody>
</table>

** p <.01, a. Dependent Variable: Actual E-learning system Use

As portrayed in Table 9, the results indicate that the E-learning acceptance significantly contributed to the actual E-learning system use. The results indicated that the system response, system interactivity and system functionality have a positive relationship with the TAM constructs and that it had influenced the E-learning acceptance. However, the obtained findings were confirmed by Pituch and Lee (2006), who investigated the influence of system characteristics on E-learning use. The findings indicated that the system response, system interactivity and system functionality have a positive relationship with the TAM constructs and that it had influenced the E-learning acceptance. However, the obtained findings were inconsistent with that of Shankaranarayanan (2001) in addition to that of Liu and Ma (2006). Liu and Ma (2006) extended the technology acceptance model with the construct of perceived system performance. The results indicated a strong relationship between system performance and users' acceptance which explained 56% of the variance in behaviour intention. However, in this research system performance was insignificant in stepwise regression compared to other related variables in the technological factor. The reason could be the reduced intention paid to system performance problems since the recent enhanced and updated new E-learning systems that are provided by the national centre of E-learning. At the same time, the students' intention might be intended to evaluate the provided new system characteristics such as system functionality, system interactivity and system response.

The research findings were consistent with the majority of previous researches on TAM model particularly the affect of both TAM predictors' namely perceived usefulness and perceived ease of use on the users' behavioral intention (E-learning acceptance) to use new technology (Landry, Rodger, & Hartman 2006; Masrom, 2007; Ngai et al., 2007; Roca, Chiu, & Martinez, 2006; Selim, 2003; Saadé & Bahli, 2005; Saadé & Galloway, 2005). The obtained findings indicated that the attitude towards using E-learning fully mediated the relationship between perceived usefulness and E-learning acceptance. It is also partially mediated the relationship between perceived ease of use and E-learning acceptance. The results contradicted to the Davis et al. (1989) findings, which demonstrated that the power of the TAM in predicting the individual's acceptance is equally good and parsimonious without the attitude mediating effects. Likewise, Venkatesh and Davis (1996) eliminated the attitude variable from their proposed model because the attitude as a mediating construct did not seem to mediate fully the effect of perceived usefulness and perceived ease of use on behavioural intention as confirmed also by Wolfsi and Jackson (1999), who stated that the relationship between Attitude and behavioural intention was not supported. Hence, the present research findings could be dissimilar with above authors' findings by reason of the struggling capability of TAM main constructs in predicting the users' acceptance in different settings particularly with the presence of Attitude as mediator variable. So, the mediating effect of the Attitude could be absence or presence due to the nature of study and the examined culture. Conversely, the present research finding was supported by many studies in the area of technology acceptance which had confirmed the positive relationships of the Attitude with perceived Ease of Use, Perceived Usefulness and Intention to use E-learning in mandatory settings (Brown, 2002; Lee et al., 2005; Ngai et al., 2005; Saadé & Bahli, 2005). The research findings were confirmed by Brown (2002), who conducted a research in South African universities in order to investigate factors affecting perceived ease of use of web-based learning technologies. The proposed factors were directly tested with TAM’s main constructs. In terms of attitude findings, the result indicated that attitude has an important role in enhancing the students’ ease of using the web-based learning. Lee, Cheung and Chen (2005) modelled the students’ acceptance using the TAM extension to include extrinsic factors (perceived usefulness and ease of use) and intrinsic factors (perceived enjoyment). The findings related to the mediating attitude role with perceived usefulness were fully confirmed. However, the relationship between the perceived ease of use and the students’ acceptance to use online activities through attitude were partially supported. Therefore, these research findings could be justified since the literature review provides contradicting findings in the relationship between them. In consistent with this research findings, Ngai et al. (2005) in his research findings confirmed that usefulness and ease of use are the main factors affecting the attitude of students using WebCT, and ultimately affect their intention to use WebCT activities.

As pointed out earlier, the finding indicated that there was a positive relationship between perceived ease of use and perceived usefulness. This can be confirmed by the majority of technology acceptance research findings particularly E-learning acceptance findings (Babenko-Mould, Andrunyszyn, & Goldenberg, 2004; Davis et al., 1992; Gefen & Straub, 2000; Masrom, 2007; Ngai et al., 2007; Ong et al., 2004; Rezaei, Mohammadi, Asadi, and Kalantary, 2008; Selim, 2003; Sun, Tsai, Finger, Chen, & Yeh, 2008; Szajna, 1996; Tung & Chang, 2008; Saadé & Bahli, 2005). In
consistent with this research finding, Sun, Tsai, Finger, Chen, & Yeh (2008) conducted an empirical study to investigate the significant factors affecting online system satisfaction. The research confirmed the positive relationship between perceived ease of use in relation to perceived usefulness. The findings also indicated that perceived usefulness of the online learning system would positively influence the learners’ satisfaction with this system. Furthermore, Tung and Chang (2008) utilised the TAM in order to investigate the students’ intention to use online courses. This study investigated whether the Taiwanese students accepted the online courses or not. The study findings also indicated the original positive relationship between ease of use and usefulness as proposed by Davis et al. (1989). In line with this research finding, Ong and Lai (2004) conducted a research to examine the students’ acceptance of E-learning by extending the TAM with gender as a demographic characteristic. The study showed that the students who had a high level of belief that online courses were easy to use showed an increase in their acceptance of online learning. In addition, they found that the perceived ease of use has a significant relationship with the perceived usefulness of using E-learning system. Therefore, the relationship between perceived ease of use and perceived usefulness possibly justified because of their nature that related to the E-learning system characteristics and their proven influence on the users’ beliefs, attitudes and their behavioural Intentions.

The findings indicated that there is a positive relationship between perceived usefulness and E-learning acceptance, which indicated through the behavioural intention variable. The previous research findings were confirmed and support this research finding of the relationship between perceived usefulness and students’ acceptance (Davis et al., 1992; Gefen and Straub, 2000; Ong et al., 2004; Masrom, 2007; Ngai et al., 2007; Rezaei, Mohammadi, Asadi, & Kalantary, 2008; Saadé & Bahli, 2005; Selim, 2003; Szajna, 1996; Tsai, Finger, Chen, & Yeh, 2008, Tung and Chang, 2008). For instance, Rezaei, Mohammadi, Asadi, and Kalantary (2008) conducted a research in order to predict the factors affecting the E-learning system in Agriculture schools in higher education. The study showed “a strong direct influence of perceived usefulness on students’ intention to use e-learning” (Rezaei et al., 2008, p.90). It also indicated that there was a positive relationship between students’ intention to use E-learning and perceived usefulness besides the internet experience, computer self-efficacy and affect.

The findings also indicated that the E-learning acceptance significantly contributed to the actual E-learning system use. TAM hypothesizes that the behavioral Intention to use a particular system is determined by the actual use of particular system. The Actual use or system usage has been extensively used in information system (IS) research as key success factor of IS investment projects. It is also considered as an important factor of Information Technology (IT) acceptance (Davis, 1993; Taylor & Todd, 1995). Several studies have tested the perceived ease of use and perceived usefulness directly to Actual system use and they have dropped the behavioral intention (Thompson, Higgins, & Howell, 1991; Al-Ghatani & King, 1999). Al-Ghatani and King (1999) in their study suggested that system usage is an indicator of IT success and superior indicator of information technology acceptance. Similarly, Davis (1993) has stated that the success and failure of Information system projects are determined by the users’ acceptance to use these systems. Moreover, many studies have confirmed the strength of Usefulness – Actual use relationship in comparison with the Ease of Use – Actual use relationship. According to Igbaria et el. (1995), perceived usefulness used to has a strong direct relationship with actual system use. In line with this matter, Davis et al. have reported the same findings reliable with the recent research. In contrast, several studies have affirmed that perceived ease of use is an important factor in determining the actual use of system (Davis, 1989). Rogers (1995) in IDT has claimed that embracing the technology is a function of varieties of variables such as relative advantages and ease of use the innovation. However, it is not always that the researchers have reported positive information about the relationship between perceived ease of use and the actual system use (Adams, Nelson, & Todd, 1992). While other researchers have found that both perceived usefulness and perceived ease of use positively related to the system actual use (Igbaria et al., 1996). Furthermore, this research utilised self reported usage measurement. The majority of TAM model research relied on subjective Self-reported measures of system usage (Saadé, Tan, & Kira, 2008). However, several researches criticized the subjective measurement of the actual use because of the respondents can deduction the researchers’ expectation or follow the social norms (Saadé, Tan, & Kira, 2008; Straub et al., 1995). Therefore, the accuracy of actual E-learning system use influence need to justified.

6 Implications, limitation and recommendations

The applicability and validity of the TAM and its related original constructs were confirmed in the Educational context especially in the area of E-learning in Saudi Arabian institutions of higher education as consistent with the research that examined the TAM’s applicability in the area of E-learning (Lee et al., 2006; Masrom ,2007; Rezaei, Mohammadi, Asadi, & Kalantary ,2008; Saadé, Tan, & Nebebe ,2008). In terms of significant technological variables, the findings are likely to be relevant to learning and content management system designers. System response, interactivity and functionality were significantly influenced the students’ acceptance. In other words, when the students’ perceived the system as interactive, functional and highly responsive, their acceptance level will be increased. Therefore, system designers must take this into consideration in achieving these significant system characteristics. Furthermore, the influence of original TAM’s main constructs, namely perceived usefulness and perceived ease of use also confirmed. Thus, the E-learning system should be perceived as both easy to use and useful to maximize use of the system. Universities’ learning management system should be perceived as both useful and
easy to use in order to maximize the system acceptance and ultimately increase the students' participation.

Even though, there are limitations related to the sample size and number of universities that participated in this study. It would be certainly useful for future research to implement the research examined factors and its related instrumentation with additional universities’ either governmental or private ones, in order to obtain a better representation for entire population and ultimately represent optimum generalization. Furthermore, the research was limited only to university students, it is therefore future research should consider other university members such as research assistants, lecturers and administrators in order identify their trend to accept E-learning and determine the important factors that could affect their acceptance. This study is also limited to subjective measure of the Actual use (Self-reported) which influences the accuracy of measuring the students’ actual system usage and its related relationships. Therefore, future research should examine the actual system usage using objective measures such as computer recorded (actual system access frequency recorded by computerised system). The reported R-square yielded other additional variables that might be needed particularly from the technical perspective since the technological factor was the most contributive factor among the proposed factors. Therefore, future research could investigate and test more additional technological related variables such as system interface design, credibility, privacy, quality and complexity. Based on the findings, it is suggested that, among others, higher educational institutions consider the influence of technological, institutional, social and psychological factors in the process of implementing E-learning. In conclusion, further research is still needed in the area of E-learning readiness, adoption and perception in order to adopt, implement and use successfully future updated E-learning management systems In Saudi Arabia.

References


