

AN EMPIRICAL INVESTIGATION OF THE FACTORS INFLUENCING THE ADOPTION OF E-LEARNING BY UNIVERSITY STUDENTS IN SAUDI ARABIA

Khlood Al-Siraihi
University of Leicester, UK
e-mail: ka41@le.ac.uk

Abstract

This study investigates the factors influencing the adoption of e-learning by Saudi university students. It proposes two conceptual models and assesses their explanatory power by comparing them with previous models proposed to explain individuals' behaviours. The study was conducted with Saudi university students (n. 531) and utilised a survey design with self-report questionnaires to collect the data. Multiple regression analysis showed the research proposed models to be superior to earlier models in explaining students' behavioural intention to adopt e-learning as a supplement tool and for distance education. Peers and instructors' pressure was important in shaping the students' decision to adopt e-learning as a supplementary tool whereas system characteristics including usefulness, ease of use, flexibility and interactivity were key determinants of the decision to adopt e-learning for distance education.

Keywords: E-learning, university level, Saudi Arabia, students, adoption of ICT

Introduction

E-learning is a relatively recent innovation, yet, it attracted substantial attention and research not only in education but in other fields such as information systems management, health, business and marketing (Zhang et al., 2006). Research on e-learning has mainly revolved around two areas: research on the impact of e-learning on the educational process or its effectiveness and research on factors influencing e-learning related variables such as usage, satisfaction, acceptance and continuance of use (Lee, 2006). Furthermore, there is no paucity in research relating to the impact of e-learning on education (Zhang et al., 2006). However, despite the importance of understanding the factors contributing to university students' adoption of e-learning, the research literature in this area is scarce (Hara & Kling, 2001). The available literature offers merely rudimentary information about the students' experiences (Harbeck, 2001) and their personalities (Diaz & Carnal, 1999). Moreover, studies concerning Saudi students are even more difficult to locate.

Research indicates that the most important factor in determining success or failure of information systems and technologies is user acceptance and adoption (Davis, 1989). In addition, within an educational setting, acceptance and adoption of e-learning is an important prerequisite of learning (Keller et al., 2007). Therefore, there is a need to investigate the factors that influence e-learning adoption. However, Pituch and Lee (2006) note that although e-learning systems are increasingly being used; only little theory-driven research examining the antecedents of e-learning use is available. The aim of this study, thus, was to investigate factors affecting students' adoption of e-learning based on some prominent theories and informed by empirical research. Understanding why individuals adopt or reject e-learning will help to create a more favourable environment for greater adoption, as well as help to design strategies to promote acceptance (Ndubisi, 2004). Particularly, when a new system is introduced, greater understanding of the factors affecting its adoption will lead to an improvement of training, education, implementation and acceptance. Likewise, careful consideration of the critical adoption factors is important to ensure user satisfaction is obtained and investments warranted (Vitartas et al., 2007). Thus, the aim of this study is to empirically investigate the factors that influence the adoption of e-learning as a supplementary tool and for distance education by university students. Two research questions are posited to fulfill the research aim: *What are the key factors influencing students' behavioural intentions to adopt e-learning as a supplementary tool and for distance education in the university context? How do the research models perform in explaining students' adoption of e-learning as compared to other prominent models, TRA, TBP and TAM?*

Theoretical framework

This research is based on three models emerged from social psychology and information systems management. The theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) and its newer version, the theory of planned behaviour (TPB) (Ajzen, 1985) aim to explain why individuals decide to perform particular behaviours. They focus on the conscious decision of individuals to undertake specific behaviours. In essence, an individual's intention to perform a particular behaviour is determined by his attitude towards performing the behaviour and subjective norm (social pressure) regarding performing the behaviour. TPB adds a control

dimension to the basic TRA to explain actions that are not volitional entirely. Figures 1 and 2 illustrate the research models for the explanation of e-learning adoption as a supplementary tool and for distance education.

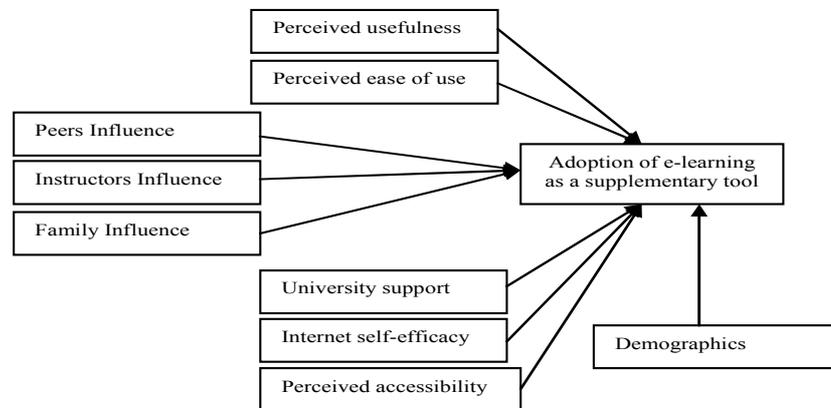


Figure 1. The adoption of e-learning as a supplement tool model

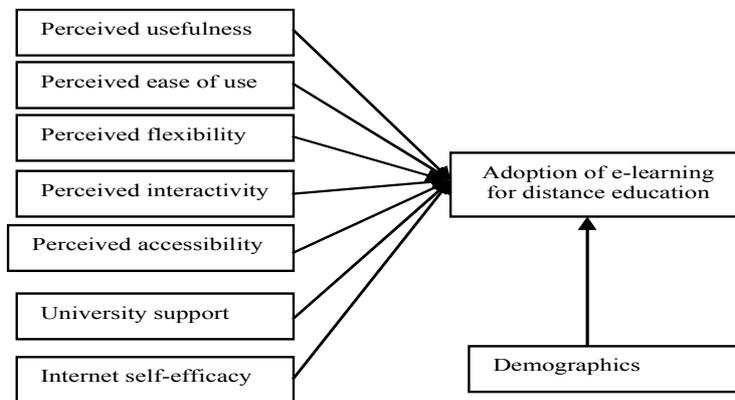


Figure 2. The adoption of e-learning for distance education

Methodology

The instrument used was a self-report questionnaire consisting of three sections. The first section collects information about the students' Internet experience and self-efficacy. The second section elicits information on their perceptions and attitude toward e-learning. The third section gathers some demographic information. The items of the questionnaire are adopted from previously validated instruments (Ajzen, 1985; Moore & Benbasat, 1991). Respondents were asked to rate their perceptions and attitude using a 7-point Likert scales with diverse anchoring points (strongly agree - strongly disagree; disapprove – approve; control – no control). Experience was captured using two items measuring duration and frequency of using the Internet.

Results

To confirm the validity of the models' key dimensions, principle components analysis (PCA) was carried out. Prior to performing PCA, the suitability of data for factor analysis was examined. The Kaiser-Meyer-Olkin value was .932; exceeding the minimum recommended value of .6. The Bartlett test of Sphericity reached statistical significance, supporting the factorability of the data (Tabachnick & Fidell, 2007) Guided by conceptual and practical considerations, the study accepted factor loadings of .40 and above which Hair et al. (2006) consider important. The oblique rotation was used as it represents the clustering of variables more accurately (Tabachnick & Fidell 2007). Eleven distinct factors emerged explaining 73.3% of the variance observed in the underlying items. All items loaded on their factors. Key dimensions, items loadings, eigenvalues and variances are presented in table 1.

Table 1 PCA results

<i>Item</i>	<i>Loading</i>	<i>Eigenvalue and Variance extracted</i>
<i>pu2</i>	<i>.879</i>	<i>Perceived usefulness</i>

<i>pu3</i>	.846	<i>E=17.96; V=33.2%</i>
<i>pu4</i>	.734	
<i>pu1</i>	.580	
<i>pu5</i>	.480	
<i>se2</i>	.836	
<i>se3</i>	.833	
<i>se5</i>	.777	
<i>se4</i>	.689	<i>Self Efficacy</i>
<i>se7</i>	.652	<i>E= 4.552; V=8.4%</i>
<i>se1</i>	.649	
<i>se6</i>	.534	
<i>us1</i>	.886	
<i>us3</i>	.764	<i>University Support</i>
<i>us4</i>	.646	<i>E=2.924; V=5.4%</i>
<i>us2</i>	.908	
<i>sn1</i>	.879	
<i>sn3</i>	.862	<i>Subjective Norm</i>
<i>sn2</i>	.748	<i>E=2.090; V=3.8%</i>
<i>sn4</i>	.640	
<i>bis3</i>	.948	
<i>bis1</i>	.929	<i>Behavioural Intention</i>
<i>bis2</i>	.543	<i>E=1.809; V=3.3%</i>
<i>pa1</i>	.830	
<i>pa2</i>	.764	<i>Perceived Accessibility</i>
<i>pa3</i>	.747	<i>E=1.725; V=3.2%</i>
<i>pa4</i>	.621	
<i>pf3</i>	.685	
<i>pf4</i>	.659	<i>Perceived Flexibility</i>
<i>pf2</i>	.600	<i>E=1.489; V=2.7%</i>
<i>pf1</i>	.422	
<i>pe3</i>	.809	
<i>pe4</i>	.766	<i>Perceived Ease of Use</i>
<i>pe2</i>	.763	<i>E=1.324; V=2.4%</i>
<i>pe1</i>	.729	
<i>pi2</i>	.788	
<i>pi1</i>	.759	<i>Perceived Interactivity</i>
<i>pi3</i>	.646	<i>E=1.247; V=2.3%</i>
<i>att2</i>	.674	
<i>att3</i>	.580	<i>Attitude</i>
<i>att1</i>	.565	<i>E=1.150; V=2.1%</i>
<i>pbc1</i>	.771	
<i>pbc2</i>	.720	<i>Perceived behavioural control</i> <i>E=1.024; V=1.8%</i>

Note: *bis*: Behavioural intention to adopt e-learning as a supplementary tool; *bid*: Behavioural intention to adopt e-learning for distance learning; *att*: Attitude; *sn*: Subjective norm; *pbc*: Perceived behavioural control; *se*: self-efficacy; *pu*: Perceived usefulness; *peou*: Perceived ease of use; *us*: University support; *pf*: Perceived flexibility; *pi*: Perceived interactivity; *pa*: Perceived accessibility

Coefficients of internal consistency (Cronbach alpha) were used to test the instrument reliability. As clear from table 2, all the reliability scores are around or above 0.80, which is considered an excellent level of reliability (Hinton et al., 2004).

Table 2 Results of reliability

Subscale	α	N of Items
BIS	.765	3
BID	.916	2
ATT	.825	3
SN	.869	4
PBC	.895	2
ISE	.907	7
PU	.900	6
PEOU	.934	4
US	.819	4
PF	.805	4
PI	.880	3
PA	.790	4
Whole scale	.952	46

Note: BIS: Behavioural intention to adopt e-learning as a supplementary tool; BID: Behavioural intention to

adopt e-learning for distance learning; ATT: Attitude; SN: Subjective norm; PBC: Perceived behavioural control; ISE: Internet self-efficacy; PU: Perceived usefulness; PEOU: Perceived ease of use; US: University support; PF: Perceived flexibility; PI: Perceived interactivity; PA: Perceived accessibility

The sample for this study consisted of 531 students. Table 3 shows the summary of respondents' demographics.

Table 3 Demographics of respondents

		Frequency	Percent
<i>Gender</i>	<i>Male</i>	209	39.4
	<i>Female</i>	321	60.5
<i>Mode of study</i>	<i>Regular – full-time</i>	447	84.2
	<i>External – part-time</i>	83	15.6
<i>Place of residence</i>	<i>Inside City</i>	405	76.3
	<i>Outside City</i>	117	22.0
<i>Type of Internet connection</i>	<i>Dial up</i>	187	35.2
	<i>DSL</i>	287	54.0
	<i>Satellite</i>	18	3.4
	<i>Wireless</i>	29	5.5
<i>Internet –experience1: Period of Internet usage</i>	<i>No or very little experience</i>	77	14.5
	<i>Fair experience</i>	126	23.7
	<i>High experience</i>	328	61.8
	<i>Non user</i>	41	7.7
<i>Internet –experience2: Frequency of Internet usage</i>	<i>Average user</i>	97	18.3
	<i>Frequent user</i>	393	74.0
<i>Usage of the Internet for study</i>	<i>User</i>	390	73.4
	<i>Non user</i>	138	26.0

To understand the factors that influence the adoption of e-learning as a supplementary tool (BIS), multiple linear regression analysis was run to assess how well do the model variables predict BIS. The use of multiple regression requires that several assumptions should be met (Hair et al., 2006). These assumptions include screening the data for presence of outliers, multicollinearity, normality, homoscedasticity. To check the assumption of normality, linearity and homoscedasticity, an assessment of the scatter plot of residuals against predicted DV scores was done. The resulted overall shape of the scatter plot indicated reasonable consistency of spread through the distributions and thus these assumptions were not violated. Moreover, the correlations among all the independent variables were examined to detect multicollinearity which was not a problem in this case as all the correlation coefficients were less than .80. Based on the literature, all the independent variables are hypothesised to influence the dependent variable simultaneously, thus, a direct method of entry was used for the multiple regression analysis. Table 4 displays that the model produced an R^2 of .29 [$F(12,509) = 17.3, p < .001$] for the explanation of behavioural intention to adopt e-learning as a supplementary tool. This means that 29% of the variance in behavioural intention to adopt e-learning as a supplementary tool is explained by this model. The analysis showed that the highest beta weight was for perceived usefulness (95%CI = .128, .379, $\beta = .225, p < .001$). The second highest significant beta weight that was for the variable peer influence (95%CI = .068, .220, $\beta = .176, p < .001$). Instructors influence (95%CI = .067, .216, $\beta = .164, p < .001$) came third. Mode of study (95%CI = -.690, -.041, $\beta = -.097, p < .05$) was the only demographic variable that contributed to the regression. University support (95%CI = .010, .158, $\beta = .092, p < .05$) was also significant. On the other hand, perceived ease of use, family influence, internet self-efficacy, perceived accessibility, experience, gender and place of residence did not contribute significantly to the explanation of the dependent variable.

Table 4 Summary of multiple regression analysis for explaining behavioural intention to adopt e-learning as a supplementary tool

<i>Variable</i>	<i>B</i>	<i>SE</i>	<i>β</i>
<i>(Constant)</i>	2.462	.476	
<i>Perceived Ease of Use</i>	.020	.058	.020
<i>Perceived Usefulness</i>	.254	.064	.225*
<i>Peers Influence</i>	.144	.039	.176*
<i>Family Influence</i>	.051	.044	.050
<i>Instructors Influence</i>	.141	.038	.164*
<i>Internet Self-efficacy</i>	.040	.083	.027
<i>Perceived Accessibility</i>	.022	.045	.023
<i>University Support</i>	.084	.038	.092**
<i>Gender</i>	-.066	.124	-.024
<i>Place of residence</i>	-.255	.134	-.078
<i>Mode of study</i>	-.365	.165	-.097**
<i>Internet Experience</i>	.020	.049	.022

Note: $R^2 = .29$. * $p > .001$. ** $p > .05$

To understand the factors that influence the adoption of e-learning for distance education (BID), multiple regression analysis was run to examine how well do the model variables explain BID. The assumptions of multiple regression were checked. Table 5 shows that a significant model resulted with an R^2 of .52 ($F(11, 510) = 50.8$, $p < .001$) for the explanation of behavioural intention to adopt e-learning for distance education. The significant variables were perceived flexibility (95%CI = .240, .505, $\beta = .245$, $p < .001$), perceived usefulness (95%CI = .139, .443, $\beta = .186$, $p < .001$), perceived interactivity (95%CI = .128, .382, $\beta = .173$, $p < .001$), perceived ease of use (95%CI = .059, .323, $\beta = .135$, $p < .01$) and mode of study (95%CI = .322, 1.060, $\beta = .132$, $p < .001$). The other variables were not found to contribute to the explanation of the model.

Table 5
Summary of multiple regression analysis for explaining behavioural intention to adopt e-learning for distance education

Variable	B	SE	β
(Constant)	-2.391	.544	
Perceived Usefulness	.291	.077	.186*
Perceived Ease of Use	.191	.067	.135**
Perceived Flexibility	.373	.067	.245*
Perceived Interactivity	.255	.064	.173*
Perceived Accessibility	.010	.050	.008
University Support	.059	.041	.047
Internet Self-efficacy	-.034	.094	-.017
Gender	-.207	.139	-.053
Place of residence	.023	.152	.005
Mode of study	.691	.188	.132*
Internet Experience	.087	.056	.068

Note: $R^2 = .52$. * $p > .001$. ** $p > .01$.

The coefficients of determination (R^2) were assessed to answer the second research question and compare between the explanatory power for each model along with the significance of the standardised beta weights (β) for all the constructs of each model. Table 6 illustrates the results of the comparison between the four models.

Table 6 comparisons between the models

	R^2	β
<i>Models for the adoption of e-learning as a supplementary tool</i>		
TRA	.246	Attitude = .174***; Subjective norm = .389***
TAM	.193	Perceived usefulness = .368***; Perceived ease of use = .096
TPB	.249	Attitude = .152**; Subjective norm = .375***; Perceived behavioural control = .066
Research model	.290	
<i>Models for the adoption of e-learning for distance education</i>		
TRA	.362	Attitude = .370***; Subjective norm = .330***
TAM	.413	Perceived usefulness = .390***; Perceived ease of use = .308***
TPB	.378	Attitude = .321***; Subjective norm = .297***; Perceived behavioural control = .146***
Research model	.512	

Note: *** $p > .001$. ** $p > .01$.

Discussion

This study sought to investigate the factors that influence university students' adoption of e-learning. Based on the theory of planned behaviour (Ajzen, 1985), it proposed two different models for the adoption of e-learning as a supplementary tool and for distance education. The results indicated that for the adoption of e-learning as a supplementary tool, perceptions of e-learning usefulness was very important. This gives further support to the robustness of this construct. Moreover, the social context represented by the influence of the student's peers and instructors was also critical in shaping their intent to adopt e-learning as a supplementary tool. This result is in line with the results reported in previous research that found subjective norm to be important in influencing acceptance and usage of an innovation, particularly in the early stages of adoption when prospect adopters have little experience from which to form attitudes (Taylor & Todd 1995). The student mode of study has also emerged as significant factor. This concurs with previous studies (Dorman, 2005; Wagner et al., 2005). Finally, university support was also significant. This result suggests that the students will

adopt and use e-learning more readily if the university supports e-learning initiative. This study further confirms the important role of institutional support reported in previous research (Selim, 2007).

Regarding the adoption of e-learning for distance education, the results indicated that e-learning attributes, specifically, flexibility, usefulness, interactivity and ease of use were critical determinants of the students' behavioural intention to adopt e-learning. This supports other studies that reported this conclusion (Lee, 2004; Pituch & Lee, 2006). Similarly, only mode of study was found as a significant factor in determining the students' intention to adopt e-learning for the distance education mode.

In comparing between the research models and the other baseline models of TRA, TPB and TAM, the two proposed research models for explaining the adoption of e-learning as a supplementary tool and for distance education performed better than the baseline models (table 6). TRA and TPB performed better in explaining adoption of e-learning as a supplementary tool. This could be due to the presence of the social dimension in these theories. In a context where e-learning is not mandated and only used to supplement traditional studies, the adoption and actual use of e-learning may be triggered by opinions and advice from others. This is confirmed with the high beta weights of subjective norm in the two models. Subjective norm constructs were the highest contributors to the explanation of intentions in the three models of TRA, TPB and the study proposed model. On the other hand, in explaining the adoption of e-learning for distance education, system characteristics were more important and thus TAM performed better than TRA and TPB. This is also reported by Lee (2004).

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