# Factors influencing e-learning adoption intention: Examining the determinant structure of the decomposed theory of planned behaviour constructs

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Abstract: The purpose of this study is to examine the factors that determine intention to adopt elearning in Malaysian education system. The studied system (Blackboard) enables online or webbased learning, which has grown in popularity in the new millennium as an innovative and useful educational tool. Two models of e-learning that are observed among adopting institutions are: Elearning as a supplement to traditional classroom mode, and total electronic learning. The respondents in this research have just been introduced to the first model. The paper takes a social, organisational, and technical approach in its investigation by using a research model based on the Decomposed version of Theory of Planned Behaviour (DTPB) to identify the factors that affect intention to adopt e-learning. The model identifies specific salient beliefs that may influence technology usage, such as users' attitude, subjective norm, perceived behavioural control, perceived usefulness and ease of use of the system, etc. The managerial relevance of this model has been acclaimed by researchers who argue that by focusing on belief specifics DTPB helps in managing these specific factors as well as the adoption behaviour. Purposive nonprobabilistic sampling method was used to select students who have participated in a University's one semester e-learning experimentation exercise. Hierarchical Multiple Regression Analysis was used to assess the relationships in the constructs. The paper presents some findings on e-learning adoption intention determinants. It also discusses some of the implications of the findings on theory and practice. Education policy makers and University administrators will also find the study very useful.

Keywords: Decomposed Theory of Planned Behaviour; E-learning; Malaysia.

## Introduction

E-learning has been praised by many as a very useful tool for distance learning, an innovative way to minimize commuting and its associated problems, an ability to let organisations with tight travel and training budgets train their people inexpensively, and many other capabilities such as asynchronous and complementary classroom training that is system supported. In Malaysia, the wave of e-learning is blowing across the entire education system, from public to private institutions. The Malaysian university where this study was conducted, in the year 2002 introduced its e-learning program as a supplement to the traditional classroom mode. This Malaysian university is basically a "brick and mortar" style university from inception with

genuine commitment to consummate e-learning diffusion within the community. The content creator software used by this Malaysian university is the Blackboard 5.0. Understanding the factors that influence intention to adopt electronic learning in general will help to create a more favourable environment for greater adoption, as well as help to design strategies to promote acceptance.

## Literature review

A number of models have been developed to investigate and understand the factors affecting the acceptance of computer technology in organisations. The theoretical models employed to study user acceptance, adoption, and usage behaviour include the Theory of Reasoned Action - TRA (e.g., Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), the Technology Acceptance Model – TAM (e.g., Davis, 1989; Davis et al., 1989), the Theory of Planned Behaviour – TPB (e.g., Ajzen, 1991; Mathieson, 1991), the Model of PC Utilisation (Thompson, Higgins, & Howell, 1991), the Decomposed Theory of Planned Behaviour (Taylor & Todd, 1995), Innovation Diffusion Theory (e.g., Agarwal & Prasad, 1997; Rogers, 1995), Integrated Technology Adoption and Diffusion Model (Sherry, 1998), and recently the Moguls Model of Computing (Ndubisi et al., 2004).

The current effort focuses on the Decomposed Theory of Planned Behaviour (Taylor & Todd, 1995). The DTPB model has advantages over other models in that it identifies specific salient beliefs that may influence information technology usage. Specifically, the model was found to have better predictive power compared to the traditional theory of planned behaviour model and the technology acceptance model. Taylor and Todd comparing their model with TPB remark, "In comparing the two versions of TPB, we believe that there is value added as a result of the decomposition, in terms of increased explanatory power and a better, more precise, understanding of the antecedents of behaviour." "Thus in our view, the decomposed TPB is preferable to the pure form of the model" (p. 169). Comparing with TAM, they commented that, "if the sole goal is the prediction of usage, then TAM might be preferable." "However, the decomposed TPB provides fuller understanding of usage behaviour and intention and may provide more effective guidance to IT managers and researchers interested in the study of system implementation" (p. 170).

The decomposed TPB model uses constructs from the innovation literature. It also explores subjective norms and perceived behavioural control more completely by decomposing them into more specific dimensions. It provides a comprehensive way to understand how an individual's attitude, subjective norms and perceived behavioural control can influence his or her intention to use e-learning.

# Attitude

Attitude is defined as an individual's positive or negative feeling (evaluative effect) about performing the target behaviour (Fishbein & Ajzen, 1975). It is related to behavioural intention because people form intentions to perform behaviours toward which they have positive feeling. The attitude-behavioural relationship is fundamental to TRA, TAM and related models presented by other researchers such as, Triandis (1977) and Bagozzi (1981). With regards to e-learning, attitude towards this learning model will be positively influenced by its perceived system's usefulness, ease of use, and security.

Perceived usefulness and ease of use are important technology adoption determinants in the technology acceptance model (Davis et al., 1989). Perceived usefulness is defined as the extent to which a person believes that using a particular technology will enhance her/his job performance, while Perceived ease of use is the degree to which using IT is free of effort for the user (Davis et al., 1989). A significant body of studies has shown that perceived usefulness and perceived ease of use are determinants of usage (e.g., Igbaria et al., 1997; Szajna, 1994).

Security is an important issue in e-learning implementation. Sparta (2002), Olsen (2002), and Brown (1999) have recognized the importance of security in their list of features to be incorporated in the e-learning infrastructure. Security against intrusion and unauthorized access, editing, alteration, removal or deletion of files or documents is an important issue that all e-learning systems must address.

#### Subjective norms

Subjective norms refer to "the person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975, p. 302). Subjective norms have been found to be more important prior to, or in the early stages of innovation implementation when users have limited direct experience from which to develop attitudes (Hartwick & Barki, 1994; Taylor & Todd, 1995). Chua (1980) suggests that the adopter's friends, family, and colleagues are groups that will potentially influence adoption.

## Perceived behavioural control

Perceived Behavioural Control (PBC) refers to the constraints to technology usage (Taylor & Todd, 1995). Following from the definition of perceived behavioural control presented earlier, TPB research (e.g., Sparks et al., 1997) has provided evidence indicating that perceived difficulty-especially as it is related to internal constraints is the most important factor. The dimensions of PBC in this study include: (1) Easy access to technological resources and infrastructure (Lau et al., 2001); (2) Self efficacy - defined as an individual's self confidence in his or her ability to perform a behaviour (Hill et al., 1986); (3) Computer anxiety - an individual's apprehension or even fear, when she/he is faced with the possibility of using computers (Simonson et al., 1987). A significant body of research in information systems and psychology has highlighted the importance of computer anxiety by demonstrating its influence on key dependent variables for example, intention (Elasmar & Cartar, 1996), behaviour (Compeau & Higgins, 1995), learning (Martochio, 1994), and performance (Anderson, 1996); (4) Computer Training - Igbaria et al., (1997) and Raymond and Bergeron (1992) found that personal computing training has a positive impact on perceived usefulness and technology acceptance; (5) Prior experience - this has been found to be an important determinant of behaviour (Bagozzi, 1981). Eagley and Chaiken (1993) suggested that knowledge gained from past behaviour would help to shape intention.



Figure 1: Research framework (refer to Table 2 for a definition of hypotheses H1 to H12).

# **Research design**

The population of study consists of students of one of the public Universities in Malaysia who have recently been introduced to e-learning. The purposive non-probabilistic sampling method was used in sample selection to ensure that only students who have participated in the one semester experimentation with online learning were included. Secondly, a deliberate effort was made not to include freshmen that have no experience with the University's traditional classroom system. In other words only students who have spent at least a semester before the introduction of e-learning were included as they are in the best position to relate both experiences in their judgement. A total of 301 qualified business students from the University's two campuses responded to the survey, of which 300 were usable. Several aspects of e-learning are explored including behavioural intention, attitude, subjective norms, perceived behavioural control, perceived usefulness, perceived ease of use, system's security, course leaders influence, computer-self efficacy, computing experience, training, access to technological facilities, and computer anxiety.

A structured questionnaire was used in this research. Respondents were surveyed using a thirteen-part questionnaire. Parts 1, 2 and 3 measure e-learning adoption intention, perceived usefulness and ease of use perceptions respectively with items adapted from Davis et al. (1989). Part four measures attitude towards e-learning with four items taken from (Davis, 1989). Part five measures the system's security, while external influence and computer anxiety were measured in

parts six and seven with items from Venkatesh (2000). Perceived behavioural control (Davis et al., 1989), training (Igbaria et al., 1997) and computer self-efficacy (Compeau & Higgins, 1995) were measured in parts eight, nine, ten respectively. Part eleven measures technological facilities with items adapted from (Tan & Teo, 2000), while part twelve measures computing experience with item from Ndubisi et al., (2001). Demographic variables were captured in part thirteen with single item measures. Questionnaire items (except for training, computer self-efficacy, and demography) were measured on a seven point Likert-scale anchored at both extremes to 1 *(strongly disagree)* and 7 *(strongly agree)*. The mid-point (4) represents the state of unsure or neutral. Training is anchored to 1 *(never)* and 7 *(always)*. The 10-point Guttman Scale was used for computer self-efficacy from 1 *(not at all confident)* to 10 *(totally confident)*.

Hierarchical Multiple Regression Model (Abrams, 1999) was employed to predict the relationships in the construct. The predictor variables were entered into the model in different stages. The hierarchical regression is employed so that the increase in  $R^2$  corresponding to the inclusion of each category of predictor variables and the unique variance in IT usage explained by the predictor categories could be examined. The  $R^2$  for all sets can be analysed into increments in the proportion of intention to adopt (Y) variance due to addition of each new sets of predictor variables to those higher in the hierarchy. These increments in  $R^2$  are squared multiple semi-partial correlation coefficients.

The mediator effects of attitude, subjective norms, and perceived behavioural control were measured based on Baron and Kenney (1986). According to Baron and Kenney (p. 1176), a variable functions as a mediator when it meets the following conditions: (a) variations in levels of the independent variable significantly account for variations in the presumed mediator, (b) variations in the mediator significantly account for variations in the dependent variable, and (c) when a and b are controlled, a previously significant relation between the independent and dependent variables is no longer significant or it is significantly decreased.

## **Results and discussion**

## Reliability analysis and descriptive statistics

The alpha values were calculated to assess the internal consistency reliabilities of the scales. Computing experience was measured on a single item scale namely, number of years of experience in using computers in general. Item-to-total correlations and inter-item correlations exceeded 0.50 and 0.30 respectively (Robinson et al., 1991) by a wide margin. The results in Table 1 shows that mean scores for all dimensions are high. Alpha coefficients are also high. Except for external influence items and technological facilities, which score .43 and .50 respectively, alpha values for all dimensions exceed the .60 lower limit of acceptability (Hair et al., 1998). This means that items measuring the construct dimensions are reliable. Nevertheless, it is important to bear in mind, the low values of the items measuring course leader's influence and access to technological facilities when applying the findings of the research.

Variables	No. of Items	Mean	SD	Coefficient a
Usage Intention	2	7.68	1.65	0.80
Attitude	4	17.27	2.28	0.72
Subjective Norm	2	6.60	1.86	0.90
Perceived Behavioural Control	5	20.11	5.21	0.70
Usefulness Perception	4	16.45	3.49	0.92
Ease of Use Perception	4	15.08	1.39	0.80
System's Security	3	17.27	3.64	0.78
Course Leader's Influence	2	8.52	2.14	0.43
Computer Anxiety	7	29.49	5.36	0.71
Training	3	9.65	2.39	0.60
Computer-self Efficacy	10	54.00	13.54	0.82
Technological Facilities	2	5.34	1.57	0.50
Prior Computing Experience	1	6.07	3.15	N/A*

#### Table 1: Descriptive and reliability analysis results

\* N/A – not applicable. Prior computer experience is a single item measuring the number of years of prior general computer experience.

## Relationship tests

The results of the Regression Analysis used in examining the construct relationships are summarized in the following Tables.

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s Statement	
	coefficients
Perceived usefulness of using e-learning will positively affect	.394***
attitude toward the system	
Security of the system will positively affect attitude toward it.	.188***
Perceived ease of using e-learning will positively affect attitude	.228***
toward the system	
$R^2 = .42$ F = 68.02 Sig. F = .000	
Course leaders influence will positively affect subjective norms	.303***
$R^2 = .10$ F = 30.08 Sig. F = .000	
User's self-efficacy will positively affect perceived behavioural	.102 <sup>m</sup>
control	
Prior computer experience will positively affect perceived	.054
behavioural control	
Training will positively affect perceived behavioural control	.092
Access to technological facilities will positively affect perceived	.071
behavioural control	
Computer anxiety will negatively affect perceived behavioural	341***
control	
$R^2 = .22$ F = 15.21 Sig. F = .000	
Attitude toward the system will positively affect behavioural	.429***
intention	
Subjective norms will positively affect behavioural intention	.020
Perceived behavioural control will positively affect behavioural	
intention	
$R^2 = .24$ F = 30.11 Sig. F = .000	
	StatementPerceived usefulness of using e-learning will positively affect attitude toward the systemSecurity of the system will positively affect attitude toward it.Perceived ease of using e-learning will positively affect attitude toward the system $\mathbf{R}^2 = .42$ $\mathbf{F} = 68.02$ Sig. $\mathbf{F} = .000$ Course leaders influence will positively affect subjective norms $\mathbf{R}^2 = .10$ $\mathbf{F} = 30.08$ Sig. $\mathbf{F} = .000$ User's self-efficacy will positively affect perceived behavioural controlPrior computer experience will positively affect perceived behavioural controlAccess to technological facilities will positively affect perceived behavioural controlAccess to technological facilities will positively affect perceived behavioural controlComputer anxiety will negatively affect perceived behavioural controlSig. $\mathbf{F} = .000$ Attitude toward the system will positively affect behavioural intentionSig. $\mathbf{F} = .000$ Attitude toward the system will positively affect behavioural intentionPrior computer anxiety will negatively affect perceived behavioural controlComputer anxiety will negatively affect perceived behavioural control<

## Table 2: Regression results – Direct relationships

<sup>m</sup> – marginal relationship \*\*\* p < .001

The results in Table 2 show that perceived usefulness, perceived ease of use, and system's security contribute significantly (F = 68.02; p < .001) and predict 42% of variations in user's attitude. Further, the results show that perceived usefulness (t = 7.69; p < .001), perceived ease of use (t = 3.58 p < .01), and security (t = 4.17; p < .001) are key attitude shapers. When e-learning is perceived as useful, easy to use, and secure, attitude is more favourable.

It is also observable from the table that there is a significant association between the influence of the course leader and subjective norm. Course leader's influence contributes significantly (F = 30.08; p < .001) and also predicts 10% of variations in subjective norms.

Furthermore, self-efficacy, prior computer experience, training, technological facilities, and computer anxiety contribute significantly F = 15.21; p < .001) and predict 22% of variation in perceived behavioural control. Furthermore, it is observed that there is an inverse relationship between computer anxiety and perceived behavioural control. Self–efficacy has only a marginal predictive power over perceived behavioural control. Although the five variables contribute significantly to perceived behavioural control, only a few are significantly associated with it. The direction of the beta coefficient for computer anxiety is negative, which shows that the more computer anxiety an individual has, the less his or her perceived behavioural control.

Attitude, subjective norms, and perceived behavioural control significantly contribute (F = 30.11; p = .000) as well as predict 24% of variations in e-learning adoption intention. Further, the results show that there is significant relationship between attitude (t = 8.14; p < .001), perceived behavioural control (t = 3.22; p < .01), and intention to adopt E-learning. Subjective norm is not significantly associated with intention (t = .37; p > .05). A plausible explanation for the non-significant impact of subjective norm could be because all the respondents are volunteers. Since they voluntarily opted for the e-learning trial, it is not unexpected that subjective norm is not a likely factor.

#### Mediation effects

The mediation effects of attitude, subjective norms, and perceived behavioural control on the relationship between the independent variables and adoption intention were assessed following the recommendation of Baron and Kenney (1986). By hierarchically regressing the independent variables (in step 1) and the mediators (in step 2) against the dependent variable, mediation effects are established as shown in the following Table. Table 3 shows the mediation effects of attitude subjective norms and perceived behavioural control.

	<b>Beta Coefficients without</b>	<b>Beta Coefficients with</b>
	attitude (model 1)	attitude (model 2)
Perceived Usefulness*	.348	.263
Perceived Ease of Use*	.213	.175
Security*	.135	.099
	$R^2 = .31$	$R^2 = .35$
	Beta Coefficients without	Beta Coefficients with
	Subjective Norm (model 1)	Subjective Norm (model 2)
Course Leader's Influence*	.196	.180
	$R^2 = .038$	$R^2 = .042$
	Beta Coefficients without	Beta Coefficients with PBC
	PBC (model 1)	(model 2)
Self-Efficacy*	.113	.111
Computing Experience*	.113	.104
Training*	.069	.059
Technological Facilities*	.075	.069
Computer Anxiety	-293	263
	$R^2 = .20$	$R^2 = .23$

Model 1  $\beta$  is significantly higher than model 2  $\beta$ 

Attitude mediates the relationship between perceived usefulness, perceived ease of use, and security in one hand and behavioural intention in another for two reasons: (1) the beta coefficients for model 1 are significantly higher than those of model 2 (Baron and Kenney, 1986), and (2) the increase in  $R^2$  of .042 is explained by the mediation effect of attitude. The coefficient of determination  $(R^2)$  for the model 1 regression is .31, indicating that 31 percent of the variation in dependent variable (attitude) is explained by the independent variables included in the regression. The coefficient of determination  $(R^2)$  for the model 2 regression is .35, indicating that 35 percent of the variation in dependent variable is explained by the independent variables and the mediator (attitude) included in the regression. The difference between the two coefficients of determination is accounted for by the mediation effect of attitude.

For the mediation effect of subjective norm, the beta coefficient for model 1 is significantly higher than that of model 2. This, when added to the increase in the coefficient of determination from model 1 to model 2, provide evidence supporting the claim that subjective norm mediates the relationship between course leader's influence and e-learning adoption intention.

Lastly, the mediation effects of perceived behavioural control (PBC) were evaluated and the results are summarized in Table 3. The results suggest that except for computer anxiety, perceived behavioural control mediates the relationship between the independent variables and intention to adopt e-learning. Hence, there is an indirect relationship (via perceived behavioural control) between self-efficacy, computing experience, training, access to technological facilities and e-learning adoption intention.

#### Implications

Attitude has an important direct influence on intention to adopt e-learning. Attitude is anchored to perceived usefulness, ease of use, and system's security. Course leader's influence is positively associated with subjective norm, which also mediates in the relationship between course leader's influence and adoption intention. Perceived behavioural control is another important determinant of intention. It also mediates the relationship between self-efficacy, computing experience, training, access to technological facilities and e-learning adoption intention.

These findings are particularly relevant to systems designers and marketers targeting students with their e-learning applications, as well as university administrators, as it unveils ways to increase students' involvement in e-learning.

#### Conclusion

In other to enhance e-learning adoption intention and in turn acceptance among Malaysian students, interested parties to this learning arrangement must try to build favourable attitude through enhanced usefulness and ease of use perceptions, as well as security. Perceived behavioural control should also be improved, specifically by enhancing computer-self efficacy, general computing experience, access to technological facilities and resources, training, and elimination or reduction in computer anxiety.

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