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A study on the factors influencing learners' acceptance of E-learning system

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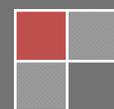
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ABSTRACT

Compared with traditional classroom education, E-learning is unconstrained by time or geographical limits. A better understanding of the factors influencing learners' acceptance of E-learning can promote E-learning's wider application. Based on the analysis of four classical Technology Acceptance Models, this paper proposes an improved Technology Acceptance Model that tackles the shortcoming of previous models that they focus more on user characteristic rather than on information and technology characteristic, by introducing independent variables related to information and technology characteristic such as interface friendliness, user training, environmental support, etc. After applying the model to explore the factors influencing learners' use of E-learning system, the empirical result shows that the improved model can better explain the reasons for learners' acceptance of E-learning system.

KEYWORDS

Technology acceptance; Improved TAM; E-learning system; Influencing factors.



INTRODUCTION

With the fast development of information technology, especially the emergence and wide application of internet technology, E-learning, an educational technology available to students for learning opportunities at any time and any place, is widely applied in modern education. Using E-learning to educate and train people, in accordance with the reality that knowledge is upgrading at an accelerating speed in the knowledge-economy era, is beneficial for educational resource integration, use efficiency and the population quality improvement.

As E-learning is developing rapidly, the number of registered students in American universities and colleges who take at least one e-course is growing at an annual rate of 10% to 20% from 2002 to 2010, reaching 6.14 million in 2010, taking up 31.3% of the total registered students^[1]. According to statistics from China's Ministry of Education, by 2011, the number of students at online universities and colleges was 4.53 million^[2].

Technology Acceptance Model (TAM)^[3], a classical theory about users' acceptance of information technology, has been proved effective by large amounts of empirical studies due to its simple structure^[4] and been applied in many studies on the acceptance of information technology. TAM and its other upgraded models start more from the user's angle, studying various factors influencing user mentality and behavior, rather than on the internal characteristics of information technology. Targeting this shortcoming of TAM, this paper proposed an upgraded TAM integrating the internal characteristics of information technology, and then applied it in the research on acceptance of E-learning.

THEORETICAL BASIS

TAM is a model based on psychology and ethology to explore users' acceptance of information technology that stems from the Theory of Reasoned Action (TRA)^[5]. During the 20 years after TAM's appearance, researchers improved the original model by proposing models and theories like TAM2^[6] and UTAUT (Unified Theory of Acceptance and Use of Technology)^[7], enhancing TAM's power of explanation.

By the 1980s, information technology has been widely applied in various fields, but there was not an effective model about user's acceptance of information technology. In 1989, based on TRA, Davis proposed TAM, a classical model for the analysis of users' acceptance of information technology, absorbing related theories of Expectancy Theory and Self-efficacy Theory^[6]. TAM shows that two specific believes of users—perceived usefulness (PU) and perceived ease of use (PEOU) are two key factors influencing users' acceptance of information technology (Figure 1).

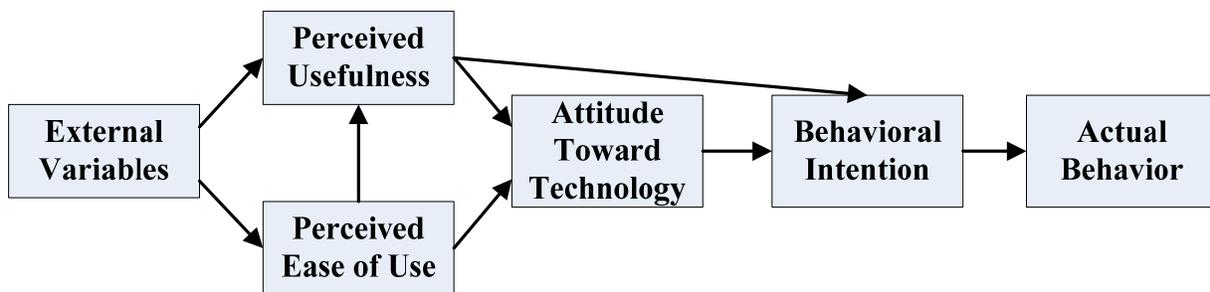


Figure 1 : Technology acceptance model (TAM)

PU measures the user's improvement of working performance after using certain information technology; PEOU measures the easiness the user feels when using certain information technology. PU and PEOU are influenced by training, interference of user at design stage and other factors, which are defined as external variables in TAM. PU has a positive influence on PEOU, PEOU directly influences BI, and user's use behavior is decided by BI.

Although TAM can predict users' acceptance behavior toward information technology (e.g. E-learning) in an effective way^[7], the definition of external variables is too vague. External variables have an influence on both PU and PEOU, but TAM does not clearly points out the specific external variables that have an influence on PU and PEOU respectively^[8].

In 2002, Venkatesh and Davis expanded TAM and further specified the external factors acting on PU, proposing an expanded TAM—TAM2 (Figure 2). TAM2 divides external variables into social influence process and cognitive instrumental process. The former includes subjective norm (SN) and image (I). Experience (E) and voluntariness (V) are introduced as regulated variables. Cognitive instrumental process includes job relevance (JR), output quality (OQ) and result demonstrability (RD). Social influence process and cognitive instrumental process determine PU together. Subjective norm directly acts upon BI regulated by experience and voluntariness. The influence of PU and PEOU on use behavior consists with TAM. TAM2 has been proved more effective than TAM than some latest research on the acceptance of information technology^[9].

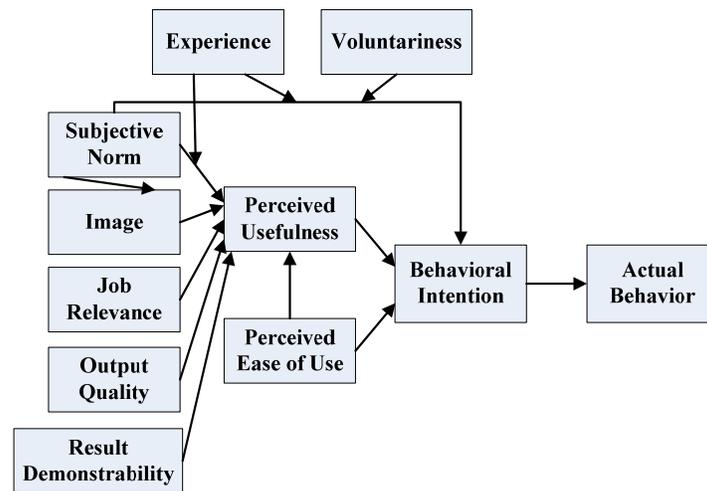


Figure 2 : Technology acceptance model 2 (TAM2)

In 2003, Venkatesh and Davis proposed Unified Theory of Acceptance and Use of Technology (UTAUT) based on eight theories such as Task - Technology Fit (TTF), Innovation Diffusion Theory (IDT) and Theory of Planned Behavior (TPB)^[10]. UTAUT (Figure 3) concludes four factors influencing behavioral intention as: performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). Also, gender (G), age (A), experience (E) and voluntariness (V) are introduced as regulated variables. The empirical study of Venkatesh and Davis shows that this model is 70% effective in predicting users' acceptance behavior of information technologies.

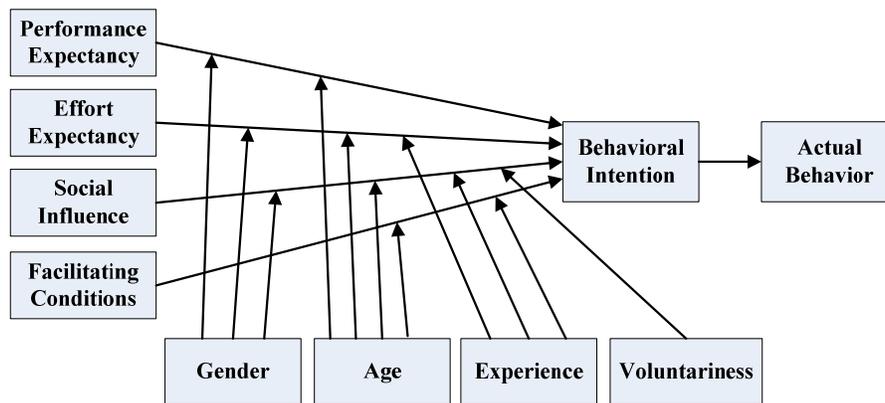


Figure 3 : Unified theory of acceptance and use of technology (UTAUT)

An improved TAM

The above classical theories and models on users' acceptance of IT mainly regard user characteristic and IT characteristic as key variables on the analysis of users' acceptance behavior. We concluded the above classical theories and models in terms of attention focus and type of variables (independent, dependent and moderating variables) (TABLE 1).

TABLE 1 : Summary of variables of classical models

Theory or model	User Characteristic			IT Characteristic		
	Independent Variable	Dependent Variable	Moderating Variable	Independent Variable	Dependent Variable	Moderating variable
TRA	ETR, BTR, NB, MC	ATB, SN, BI, AB				
TAM	EV	PU, PEOU, ATT, AB		EV		
TAM2	SN, I, JR	PU, PEOU, BI, AB	E, V	OQ, RD		
UTAUT	PE, EE, SI, FC	BI	G, A, E, V			

* Abbreviations were mentioned above.

From the above TABLE, four classical theories and models mainly start from user characteristic to predict users' acceptance of IT. IT characteristics involved are only TAM and TAM2, and TAM only includes IT related characteristics in external variables (EV), while TAM2 introduces two variables related to system characteristic—output quality (OQ) and result demonstrability (RD), but these two variables are only limited to acting upon PU. Most studies on users' acceptance of IT have neglected IT characteristic, but in fact, the effects, context and capabilities of IT itself are also crucial^[11].

Integrating information technology characteristic into the model and analyzing users' acceptance of IT from two aspects—the subject (user) and object (information technology) of the behavior—is a more comprehensive method. Considering that TAM2 is a more effective model, and the model has introduced two independent variables related to IT characteristic acting upon PU, on the basis of TAM2 we introduced new independent variables acting on PEOU related to information technology, so as to achieve the aim of to improving the original model.

Comparing the Graphical User Interface (GUI) and the performance of the Command Line Interface (CLI), Treweek found that users were more willing to use systems with a more friendly interface, because the user feels such systems are easier to use^[12]. Legris and other scholars considered that user training was beneficial to improve the usability of information technology^[13]. The use of a kind of information technology often requires other related technology as a support, and we consider the environment formed by supporting technologies influences the usability of information technology. We define such factors as environmental support. The influence of friendly interface, user training and environmental support on PEOU has a certain theoretical basis. Based on the above analysis, this paper proposes a modified technology acceptance model (Figure 4).

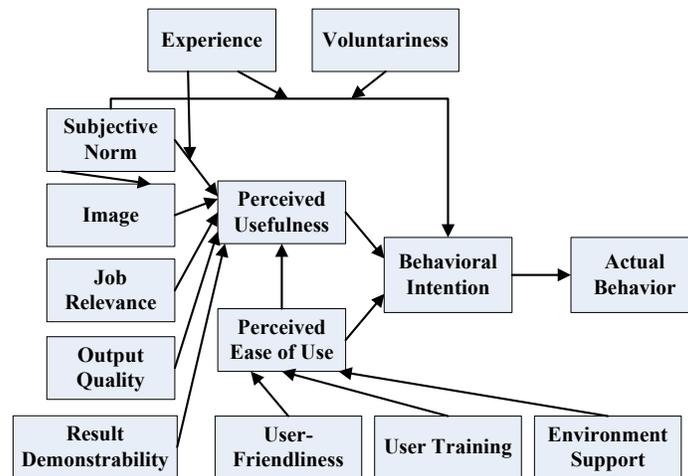


Figure 4 : A modified TAM

An empirical study on learners' acceptance of E-learning system

In order to explore learners' acceptance behavior of E-learning systems, we have left out some independent variables with a low relevance to acceptance and the moderating variables based on the modified model we proposed. A simplified model for acceptance of E-learning systems is then obtained (Figure 5).

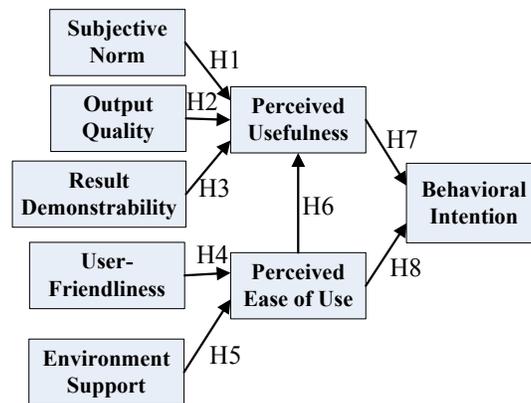


Figure 5 : Presumptive model of learners' acceptance of E-learning systems

Based on the acceptance model of E-learning systems, we proposed the following hypotheses:

H1: learners' subjective norm has a positive influence on their perceived usefulness of E-learning systems.

H2: the output quality of E-learning systems has a positive influence on learners' perceived usefulness.

H3: the result demonstrability of E-learning systems has a positive influence on learners' perceived usefulness.

H4: the user-friendliness of E-learning systems has a positive influence on learners' perceived ease of use.

H5: the environment support of E-learning systems has a positive influence on learners' perceived ease of use.

H6: the learners' perceived ease of use of E-learning systems has a positive influence on learners' perceived usefulness.

H7: the learners' perceived usefulness of E-learning systems has a positive influence on learners' behavioral intention to use it.

H8: the learners' perceived ease of use of E-learning systems has a positive influence on learners' behavioral intention to use it.

The empirical research adopt the method of questionnaire survey, includes the eight kinds of factors the model in the questionnaire, and uses the scale index of five range measurements of Likert scale; scores from 1 to 5 represent "strongly disagree" to "strongly agree".

The measurement of PU, PEOU and BI was made by reference of Davis (1989) measurement method^[4]. The measuring of subjective norm was by reference of Taylor and Todd (1995) measurement method^[14]; Output quality measurement was made by reference of Davis (1992) measurement method^[15]. Result demonstrability measurement was made by reference of Moore and Benbasat (1991) measuring methods^[16]; User-friendliness measuring was made by reference of Treweek (1996) research methods^[13]. Environment support measurement was made by reference to Goodhue and Thompson (1995)'s definition of education information technology^[17].

Questionnaires were distributed to online study learners who have used E-learning system, and a total of 133 valid questionnaires were retrieved. Questionnaire data was used to analyze the scale reliability and validity. This paper uses Cronbach α as test scale reliability index, and results of the reliability test of the subscales are shown in TABLE 2. The α coefficients of all variables and the total scale TABLE are all above 0.7, so the subscales has a good internal consistency. Test reliability and validity is tested by Kaiser - Meyer - Olkin (KMO) and Bartlett's spherical test χ^2 . The KMO of whole Scale is 0.795, close to the good standard of " > 0.8 ", showing that there are common relations among variables, which is suitable for relation analysis. In addition, Bartlett's spherical test χ^2 value is 2157.003, degree of freedom 231, Sig. 0.000, reaching < 0.05 significant level, showing that the partial correlation matrix is not unit matrix, and the variable data file is suitable for relation analysis.

TABLE 2 : Reliability test of scale

Variable	Question number	Cronbach α
Subjective Norm	2	0.766
Output Quality	3	0.787
Result Demonstrability	2	0.721
User-friendliness	2	0.711
Environment Support	2	0.732
Perceived Usefulness	5	0.771
Perceived Ease of Use	4	0.796
Behavioral Intention	2	0.716
Overall reliability		0.931

A multivariate regression analysis is conducted on the dependent and independent variables involved in this model, and the results are shown in TABLE 3, 4 and 5.

TABLE 3 : Multivariate regression analysis on dependent variables as PU

Model	R ²	ΔR^2	Standardized Coefficients	t	Sig	Significant or not
Subjective Norm	0.450	0.450	0.436	6.704	0.000	Y
Output Quality	0.613	0.163	0.374	6.147	0.000	Y
Perceived Ease of Use	0.639	0.026	0.214	2.770	0.006	Y
Perceived Usefulness	NA	NA	-0.220	-0.295	0.768	N

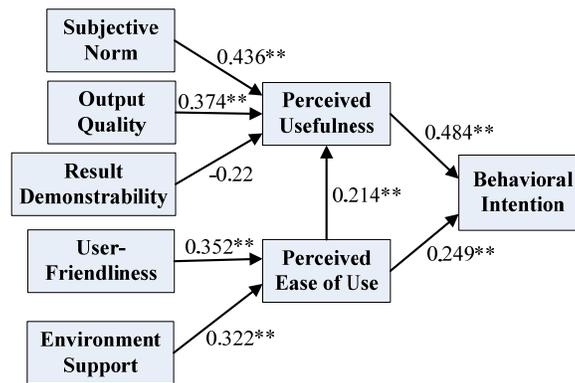
TABLE 4 : Multivariate regression analysis on dependent variables as PEOU

Model	R ²	ΔR^2	Standardized Coefficients	t	Sig	Significant or not
User-friendliness	0.393	0.393	0.352	2.653	0.009	Y
Environment Support	0.415	0.026	0.322	2.427	0.017	Y

TABLE 5 : Multivariate regression analysis on dependent variables as BI

Model	R ²	ΔR ²	Standardized Coefficients	t	Sig	Significant or not
Perceived Usefulness	0.401	0.401	0.484	3.044	0.003	Y
Perceived Ease of Use	0.441	0.040	0.249	5.906	0.000	Y

6. Except for H3, the other 7 hypotheses raised in the model all passed testing, and a path model is obtained in Figure 6.

**Figure 6 : Path model of learners' acceptance of E-learning**

CONCLUSION

As an efficient energy-saving learning style, E-learning has a promising future. Through a summary of the classical TAM theories, this paper proposed a modified TAM focusing on both user and IT characteristics, which is applied in the research on learners' acceptance of E-learning. Through questionnaire survey and data analysis, most hypotheses raised in the model were verified. Research results show that learners' behavioral intention in E-learning system acceptance is influenced by perceived usefulness (PU) and perceived ease of use (PEOU); the output quality of E-learning system and the subjective norm in external environment have influence on PU; whether the interface of an E-learning system is friendly and whether the system is well compatible have a positive influence on PEOU; PEOU has a positive influence on PU.

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