
Applying the Directed Acyclic Graph to Examine the Factors Related to the Adoption of E-Learning

Authors: **Quang Linh Huynh**, Faculty of Economics, Laws and Foreign Languages, Tra Vinh University, Vietnam, huynhquanglinh@yahoo.com, **Thuy Lan Le Thi**, Faculty of Engineering and Technology, Tra Vinh University, Vietnam, aitt Huy Lan@gmail.com

This research explores the causal relationships among the attitude toward using e-learning, the perception on the usefulness of e-learning and the adoption of e-learning as well as the mediating role of the attitude toward using e-learning and the moderating role of the perceived usefulness of e-learning. We use an advanced method known as the directed acyclic graph to investigate the causal associations. Then we use Sobel's technique and hierarchical regressions to examine the mediating and moderating relationships.

The research offers the robust evidence on the causal linkages. Furthermore, it reveals the attitude toward using e-learning mediates the association between the perceived usefulness of e-learning and the adoption of e-learning. The perception on the usefulness of e-learning statistically moderates the relationship between the attitude toward using e-learning and the adoption of e-learning.

This research will be significant to education institutions in their decision to adopt e-learning for their education program.

Keywords: *Perceived usefulness of e-learning; Adoption of e-learning; Attitude toward using e-learning*

Introduction

The increasing developments in information and multimedia technology as well as the popularization in internet has changed the traditional teaching and learning method (Wang et al. 2007 and Tao et al. 2006). Electronic tools have improved the traditional way of learning and teaching to a new method known as electronic learning or e-learning, which benefits students as well as teachers. E-Learning initiates a method to facilitate learning process by using equipments based on information technology. These equipments include laptops, computers, Compact Disc Read Only Memory- CDROM and digital devices. Internet, electronic mail, chat forums and other software are used to share information among students or teachers. E-learning not only supports teachers to construct their pedagogical perception, but it also helps students to get knowledge by debating, and thereby improves their thinking and working skills. Numerous education institutions adopt e-learning to offer the distance education to their students. The distance education is referred to as the process of extending learning, or delivering instructional resource to sites away from a classroom by using videos, audio, computers, multimedia communications or some combination of these with other traditional delivery methods.

Furthermore, Davis (1989) introduces two important factors in the technology acceptance model- TAM, which are the perceived usefulness and the attitude toward using. These two factors are suggested to be antecedents to acceptance behavior; while the perceived usefulness is deemed as a cause of the attitude toward using. Likewise, within the e-learning context, the usefulness of e-learning perceived by learners may affect both their attitude toward using e-learning for their study and their acceptance behavior of e-learning. The attitude toward using e-learning may be also a driver of the acceptance behavior. Further, grounded on the research on the mediation by Baron and Kenny (1986), we can suggest that the attitude toward using e-learning can put a mediating effect on the association between the perceived usefulness of e-learning and learners' acceptance behavior. However, to the best of our knowledge, no research on e-learning has discussed and investigated the mediating role of the attitude toward using e-learning for study in the influence of the perceived usefulness of e-learning on the adoption of e-learning for study. In addition, Ngai et al. (2007) argue that there is still a limitation in the number of empirical studies on the factors

associated with students' adoption of e-learning for study. This research seeks to explore the relationships among the perceived usefulness of e-learning, the attitude toward using e-learning and the adoption of e-learning for study in students. Especially, it employs the directed acyclic graph model, which is an advanced statistical technique, to examine the causal relationships in the research model. More importantly, it tries to discuss and examine the mediating role of the attitude toward using e-learning in the relationship between the perceived usefulness of e-learning and the adoption of e-learning for study. This research also attempts to justify the moderating role of the perception toward the usefulness of e-learning in the link between students' attitude toward using e-learning and their adoption of e-learning, which has not been investigated before. This research will continue as follows. Next, the research framework reviews the related literature and develops the hypotheses being tested, followed by the research design, which guides the data collection and facilitates the data analysis. The empirical findings are provided in a subsequent section- the empirical results. Then, some conclusions are summarized in the final section.

Research Framework

The use of e-learning in education institutions has been a concern to researchers and school-managers thanks to its important role in facilitating the learning and teaching process. The adoption of e-learning can be deemed as similar to the acceptance of a new technology, which is discussed by Davis (1989) in the technology acceptance model (TAM). We apply and adapt TAM to explain our research model in this research. Davis (1989) introduces two important variables, which are the perceived usefulness of a new technology and the attitude toward using this new technology, in TAM. The perceived usefulness refers to the degree to which a user believes that adopting a particular system would improve their effectiveness; whereas the attitude toward using a new technology is users' positive perception of using this technology (Cheong and Park 2005). In particular, TAM examines the causal relationships among the perceived usefulness, the attitude toward using and the usage behaviour of a new technology, where users' perceived usefulness of a new technology is a determinant of both the attitude toward using and the usage behaviour of the new technology, while the positive

attitude toward using the new technology will induce the users to choose it. Consequently, it is helpful in the e-learning context for forecasting and evaluating users' acceptance of e-learning for study. Furthermore, based on the argument by Baron and Kenny (1986), the attitude toward using a new technology is suggested to play an important role in mediating the association between the perceived usefulness and the usage behaviour of this technology. The relationships among the perceived usefulness, the attitude toward using and the usage behaviour of e-learning for study as well as the mediating role of the attitude toward using e-learning and the moderating role of the perception toward the usefulness of e-learning for study in students will be discussed and explained in detail below.

The link between the attitude toward using and the adoption behavior of the new technology has been widely investigated in the literature associated with the technology acceptance model. The attitude toward using the technology expresses a person's general feeling of favorableness toward a new particular technology. The adoption behavior of a new technology is referred to as the extent to which a user adopts this new technology for their work or their life. For the e-learning context, Yu et al. (2007) and Yu (2006) provide statistical evidence on the effect of the attitude toward using on the adoption behavior of e-learning. In addition, Jan et al. (2012) when exploring the adoption of e-learning also confirmed that learners' positive attitude toward using e-learning is a driver of adopting e-learning for their study. These findings allow us to hypothesize that the adoption of e-learning for study in students may be affected by their attitude toward using e-learning, and so the following hypothesis can be reached.

H1. Students' positive attitude toward using e-learning for study will lead to their adoption of e-learning

Users' attitude toward using a new technology is proposed by Davis (1989) as a consequence of their perception on the usefulness of this technology. If a user perceives the use of a technology useful to their work or life, they will have a positive attitude toward using that technology. Davis (1989) also refers to the perceived usefulness as the extent to which a user thinks that using a new technology will improve their effectiveness in job or life. Additionally, Bagozzi (1981) in the research on "Attitudes, Intentions, and

Behavior” suggests the relationship between a user’s attitude toward using a technology and their perception on its usefulness. Moreover, within the e-learning context, Chokri (2012) implies that the perceived usefulness of e-learning is a determinant of developing a favorable attitude towards the adoption of e-learning for study. Grounded on the above discussions, we can arrive at the hypothesis below.

H2. Students’ attitude toward using e-learning for study is determined by their perception on the usefulness of e-learning

The perceived usefulness of a new technology is also argued by Davis (1989) as one of the important factors leading to the adoption of this new technology. In addition, Igarria et al. (1997) assert the influence of the perceived usefulness on the adoption of a new technology by users. Similarly, Cheong and Park (2005) emphasize the importance of the perceived usefulness in adopting the new technology. A study on “Factors Affecting Student Adoption of E-Learning Systems” carried out by Abbad et al. (2009) indicates that the students who perceive e-learning as useful will likely adopt it for their study. The above findings lead to the following hypothesis for the relationship between the perceived usefulness and the adoption of e-learning for study in students.

H3. Students’ perception on the usefulness of e-learning is positively related to their adoption of e-learning for study

As above discussed, the attitude towards adopting e-learning for study may intervene in the link between students’ perception on the usefulness of e-learning and their adoption of e-learning for their study. We rely on the suggestion of Baron and Kenny (1986) to establish the mediating role of the attitude towards using e-learning. According to Baron and Kenny (1986), the mediating relationship can occur, if the following three conditions are satisfied. First, the independent variable statistically impacts on a third variable. Second, the dependent variable is statistically affected by the independent variable in the absence of the third variable. Third, the third variable puts a statistically significant unique effect on the dependent variable. In addition, the inclusion of the third variable into the research model should decrease the relationship between the independent variable

and the dependent variable. We have already come to the three hypotheses which state that students' attitude toward using e-learning for their study is determined by their perception on the usefulness of e-learning, which also leads to the adoption of e-learning for study. Moreover, students' positive attitude toward using e-learning for their study will be a driver of their adopting e-learning for study. These three hypotheses satisfy the three conditions stipulated by Baron and Kenny (1986); therefore we can posit the following mediating hypotheses.

H4. Students' attitude toward using e-learning for study may mediate the relationship between their perception on the usefulness of e-learning and their adoption of e-learning for study

The relationships among the perception on the usefulness of e-learning, the attitude toward using e-learning and the adoption of e-learning for study are more complicated than expected bivariate simple ones. Students' perception on the usefulness of e-learning are deemed as a causality of both their attitude toward using e-learning and their adoption of e-learning for study. Accordingly, we can infer that the moderating role of the perception on the usefulness of e-learning in the relationship between the attitude toward using e-learning and the adoption of e-learning can exist. However, due to the lack of previous evidence on the moderating role of the perception on the usefulness of e-learning, we can only suggest that students' perception on the usefulness of e-learning may moderate the effect of the attitude toward using e-learning on the adoption of e-learning for study in a null form as the following hypothesis.

H5. Students' perception on the usefulness of e-learning for study may not moderate the relationship between their attitude toward using e-learning and their adoption of e-learning for study

Research Design

After explicating the hypotheses derived from the reviewed literature, we would like to discuss the research design that we use to guide the data collection and facilitate the data analyses as follows.

Definitions of Variables

Adoption of E-learning (ADP) is evaluated based on the four items, which are adapted from [Okazaki and Santos \(2012\)](#). The four items are constructed from the four questions: (ADP₁) I intend to use e-learning to assist my study, (ADP₂) I intend to use e-learning as much as possible for my study, (ADP₃) I intend to use online instruction to assist my study and (ADP₄) I intend to recommend the e-learning system to others. A five-point scale ranging from 1.strongly disagree, 2.disagree, 3.neutral, 4.agree, and to 5.strongly agree is applied to assess these four items. Perceived usefulness of E-learning (PUS) is assessed with the three dimensions, which are inferred from the three questions: (PUS₁) Using e-learning improves my performance in my study, (PUS₂) Using e-learning improves my productivity in my study and (PUS₃) I find e-learning to be useful in my study, modified from [Okazaki and Santos \(2012\)](#). To measure these three dimensions, a five-point scale as above discussed is employed. Attitude toward using e-learning (ATT) is evaluated by using a five-point scale similar to those for ADP and PUS. The four items constructed from the four questions are employed for the factor "ATT". The four questions are (ATT₁) Using e-learning is a good idea, (ATT₂) I would feel that using e-learning is pleasant, (ATT₃) In my opinion, it would be desirable to use e-learning and (ATT₄) In my view, using e-learning is a wise idea intention, suggested by [Jan et al. \(2012\)](#).

Gathering of Data

The data was gathered from a sample of students in Vietnam National University of Ho Chi Minh. This university that consists of nine main colleges offers about 120 majors to about 36,000 students. We in person interviewed 1350 students from its main nine colleges (150 students each college) to get the information for our research. However, only 493 of them offer good replies with sufficiently required information for this paper.

Analytic Procedures

Reliability analysis is conducted in order to test the properties of measurement scales and the items that compose the scales. Meantime, an exploratory factor analysis is conducted in order for construct validity. Then multiple regression analyses are employed in order to test the causal relationships. Especially, we would like to test the robustness of the results

obtained from the regression analyses by performing the directed acyclic graph (DAG) model to discover the causal relationships among the attitude toward using e-learning, the perception on the usefulness of e-learning and the adoption of e-learning. The DAG analysis is an advanced statistical method, which is undertaken with the software TETRAD IV that is one of the remarkable programs for assessing causal models. In order to investigate the mediating effect of the attitude toward using e-learning, Sobel's (1982) procedures are utilized. Finally, the hierarchical regression analyses are employed to explore the moderating effect of the perception on the usefulness of e-learning.

Empirical Results

Before investigating our hypotheses, we would like to examine the properties of measurement scales and the items making up the scales by performing the reliability analysis, which is a technique calculating a number of commonly used measures of scale reliability and offering information on the correlations between separate items in the scale. The reliability analysis yields the results as given in Tables 1. The results from Table 1 reveal that the eleven items in our research all obtain their item-total correlations of over 0.5, the lowest preferable level suggested by Nunnally (1978). The Cronbach's alphas for the three factors (PUS, ATT and ADP) are all larger than 0.7, the lowest limit suggested by Nunnally (1978). These results indicate that our scales achieve sufficient internal reliability. Accordingly, these eleven items are reasonably retained for next analyses.

Table 1: Outcomes from Reliability Analysis

Item	Item-total Correlations	Cronbach's Alpha	N of Items
PUS ₁	0.733	0.828	3
PUS ₂	0.659		
PUS ₃	0.673		
ATT ₁	0.800	0.908	4
ATT ₂	0.836		
ATT ₃	0.826		
ATT ₄	0.731		
ADP ₁	0.671	0.836	4
ADP ₂	0.684		
ADP ₃	0.640		
ADP ₄	0.673		

The eleven retained items further go through an exploratory factor analysis for construct validity. We conduct the exploratory factor analysis with the extraction method of principal component analysis and with the rotation method of Varimax- Kaiser Normalization. Table 2 exhibits the results of the exploratory factor analysis which suppresses the coefficients below 0.35. Construct validity is the degree to which a set of observed variables actually reflect their own theoretical latent construct. In order to assess the construct validity, convergent validity and discriminant validity are tested relying on the factor-loading which should be 0.4 or greater, and on the cross-loading which should be greater than 0.3 (Nunnally, 1978). Convergent validity reflects the degree to which the items of a specific factor converge or share a high amount of variation in common, while discriminant validity is known as the extent to which a factor is truly different from other factors (Hair et al. 2009). In addition, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Communalities are suggested to be greater than 0.7 and 0.5 respectively, as the smallest acceptable levels recommended by Hair et al. (2009). The results of Table 2 elicit that the factor loadings are well over 0.4. All the cross-loadings exceed 0.3 with KMO of 0.889. In addition, the communalities all surpass the 0.5 level. Furthermore, Pvalue of the exploratory factor analysis achieves the 0.01 significance level. It is hence reasonably assured that all our eleven items satisfy the construct validity and reliability. This allows us to retain all these eleven items for further analyses.

Table 2: Factor Loadings with EFA

Items	Factor Loadings			Communalities
	1	2	3	
PUS ₁			0.780	0.777
PUS ₂			0.821	0.751
PUS ₃			0.767	0.728
ATT ₁	0.844			0.803
ATT ₂	0.882			0.842
ATT ₃	0.879			0.833
ATT ₄	0.769			0.713
ADP ₁		0.720		0.650
ADP ₂		0.738		0.674
ADP ₃		0.815		0.693

ADP ₄	0.780	0.696
KMO:	0.88900	
P _{value} :	0.000	
Extraction Method:	Principal Component Analysis	
Rotation Method:	Varimax with Kaiser Normalization	

In order to investigate our causal hypotheses H₁, H₂ and H₃, we undertake multiple regression analyses, which produce the results displayed in Tables 3a. The results of Table 3a statistically support our hypotheses H₁, H₂ and H₃ at the 0.01 significance level. The perception on the usefulness of e-learning explains 34.4% of the variation in the adoption of e-learning by itself, but when the attitude toward using e-learning is included into the model, the perception on the usefulness and the attitude toward using e-learning jointly explain 38.3% in the adoption of e-learning. On the other hand, the perception on the usefulness of e-learning only explains 27.2% of the variance in the attitude toward using e-learning. The findings reveal that students, who perceive e-learning as useful, will more likely think e-learning as good and then adopt e-learning for their study.

Further, for the robustness of the results obtained from the regression analyses, we carry out the directed acyclic graph (DAG) model to explore the causal relationships in our research model, which are stated in the hypotheses H₁, H₂ and H₃. The results obtained from the DAG analysis are presented in Table 3b. The attitude toward using e-learning puts a positive effect on the adoption of e-learning with a coefficient of 0.2483 at the 0.01 significance level, which indicates that our hypothesis H₁ is statistically evidenced. In addition, the perception on the usefulness of e-learning is not only positively related to the attitude toward using e-learning at the 0.01 significance level, but it is also positively associated with the adoption of e-learning at the 0.01 significance level with the estimates of 0.4547 and 0.4373 respectively, which statistically supports our hypotheses H₂ and H₃. The results from the DAG analyses are consistent with the above ones from the regression analyses. Overall, our findings for the causal hypotheses are robust across both the methods (the regression analyses and the DAG analyses).

Table 3a: Results from Regression Analyses

Explained Variable	Explanatory Variable	Coefficients	Standard Error	t-statistics	P _{value}	R ²	Supported
ADP	PUS	0.550	0.034	16.057	0.000	0.344	H ₃
ADP	PUS	0.437	0.039	11.211	0.000	0.383	H ₃
	ATT	0.248	0.045	5.547	0.000		H ₁
ATT	PUS	0.455	0.034	13.668	0.000	0.272	H ₂

Table 3b: Results from DAG Analyses

Relationships		Coefficients	Standard Error	t-statistics	P _{value}	Supported
From	To					
ATT	ADP	0.2483	0.0447	5.5548	0.000	H ₁
PUS	ATT	0.4547	0.0335	13.5786	0.000	H ₂
PUS	ADP	0.4373	0.0389	11.2346	0.000	H ₃

As inferring from Table 3a and Table 3b that when included into the model, the attitude toward using e-learning will lessen the effect of the perception on the usefulness of e-learning on the adoption of e-learning. In agreement with Baron and Kenny (1986), we suggest that the attitude toward using e-learning may intervenes in the relationship between the perception on the usefulness of e-learning and the adoption of e-learning. The mediating role of the attitude toward using e-learning in the relationship between the perception on the usefulness of e-learning and the adoption of e-learning are examined with a method produced by Sobel (1982), which utilizes a t-test to investigate the statistical significance for the indirect effect of the mediating variable by testing the null hypothesis that there is no the indirect impact of the mediating variable on the relationship between the independent variable and the dependent variable, in which t-statistics is a ratio of the indirect coefficient to its standard error ($t_{indirect} = \frac{b_{indirect}}{sb_{indirect}}$). Using the information in Table 3a to run Sobel's (1982) procedure, we obtain the results in Table 4. The findings offer statistical evidence on the mediating role of the attitude toward using in the association between the perception on the usefulness of e-learning and the adoption of e-

learning at the 0.01 significance level with the t-statistics of 5.096. As a result, our hypothesis H4 is statistically supported at the 0.01 level. When included in the model, the attitude toward using e-learning will decrease the linkage between the perception toward the usefulness and the adoption of e-learning.

Table 4: Results for Mediating Effect

Intermediary Variable	Relationship	$t_{indirect}$	P_{value}
ATT	PUS and ADP	5.096	0.000

To examine our null hypothesis H5 that the perception on the usefulness of e-learning may not moderate the relationship between the attitude toward using e-learning and the adoption of e-learning, we employ “Hierarchical Multiple Regression” procedure. First we create the interaction variables of PUS and ATT by multiplying PUS with ATT (PUS*ATT). Then we perform the hierarchical procedure with the regression analysis for PUS, ATT and PUS*ATT on ADP. The results are given in Table 5.

The results from the first hierarchy indicate that PUS and ATT both affect ADP at the 0.01 significance level. The inclusion of the interaction variable (PUS*ATT) in the model increases the explanation for the model to 39.9% from 38.3%. In addition, the effect of PUS*ATT on ADP is statistically significant at the 0.05 level. The findings suggest that our null hypothesis H5 is insignificant at the 0.05 level. This implies that the perception on the usefulness of e-learning is statistically evidenced to moderate the relationship between the attitude toward using e-learning and the adoption of e-learning. The findings suggest that an increase in the perception on the usefulness of e-learning by 1 unit will increase the influence between the attitude toward using e-learning and the adoption of e-learning by 0.095 units. This implies that the perception on the usefulness of e-learning augments the effect of the attitude toward using e-learning on the adoption of e-learning.

Table 5: Results from Hierarchical Regression Analysis

Explained Variable	Explanatory Variable	Coefficients	Standard Error	t-statistics	Pvalue	R ²
ADP	PUS	0.437	0.039	11.211	0.000	0.383
	ATT	0.248	0.045	5.547	0.000	
ADP	PUS	0.050	0.178	0.283	0.778	0.399
	ATT	-0.114	0.168	-0.676	0.499	
	PUS*ATT	0.095	0.043	2.233	0.026	

Conclusion

While the attitude toward using e-learning plays a mediating role in the connection between the perception on the usefulness of e-learning and the adoption of e-learning, the perception on the usefulness of e-learning plays a moderating role in the relationship between the attitude toward using e-learning and the adoption of e-learning. However, these roles have been not examined in previous research. This research attempts to investigate the mediating role of the attitude toward using e-learning and the moderating role of the perception on the usefulness of e-learning. The findings reveal that when students perceive e-learning as useful, they will think well about it, which induces them to adopt it for their study. The research is first to employ the advanced statistical method- the DAG model to investigate the causal relationships among the attitude toward using e-learning, the perception on the usefulness of e-learning and the adoption of e-learning. It offers the results consistent with those of previous research. This research is also the first to provide statistical evidence on the mediation of the attitude toward using e-learning in the link between the perception on the usefulness of e-learning and the adoption of e-learning as well as on the moderation of the perception on the usefulness of e-learning in the association between the attitude toward using e-learning and the adoption of e-learning. This research offers an insight into the complicated relationships among the attitude toward using e-learning, the perception on the usefulness of e-learning and the adoption of e-learning. Hence, it is helpful to education institutions in designing good education programs using e-learning such as the distance education program.

References

- [1] Abbad M. M., Morris D. and Nahlik C. D. (2009) *Looking under the Bonnet: Factors Affecting Student Adoption of E-Learning Systems in Jordan*, International Review of Research in Open and Distance Learning, 10(2), 1-25
- [2] Bagozzi R. P. (1981) *Attitudes, Intentions, and Behavior: A test of some key hypotheses*, Journal of Personality and Social Psychology, 41(4), 607-627
- [3] Baron R. M. and Kenny D. A. (1986) *The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations*, Journal of Personality and Social Psychology, 51(6), 1173-1182
- [4] Cheong J. H. and Park M. C. (2005) *Mobile internet acceptance in Korea*, Internet Research, 15(2), 125-140
- [5] Chokri B. (2012) *Factors influencing the adoption of the e-learning technology in teaching and learning by students of a university class*, European Scientific Journal, 8(28), 165-190
- [6] Davis F. D. (1989) *Perceived usefulness, perceived ease of use, and user acceptance of information technology*, Management Information System Quarterly, 13(3), 319-40
- [7] Hair J. F., Black W. C., Babin B.J., Anderson R. E. and Tatham R. L. (2009) *Multivariate Data Analysis Ed*, New Jersey: Pearson Prentice Hall, USA
- [8] Igarria M., Zinatli N., Cragg P. and Cavaye A. (1997) *Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model*, Management Information System Quarterly, 21(3), 279-305
- [9] Jan P. T., Lu H. P. and Chou T. C. (2012) *The adoption of e-learning: an institutional theory perspective*, The Turkish Online Journal of Educational Technology, 11(3), 326-343
- [10] Ngai E. W. T., Poon J. K. L. and Chan, Y. H. C. (2007) *Empirical examination of the adoption of WebCT using TAM*, Computers & Education, 48(2), 250-267
- [11] Nunnally J. C. (1978) *Psychometric Theory*, New York: McGraw-Hill, USA
- [12] Okazaki S. and Santos L. M. R. D. (2012) *Understanding E-Learning Adoption in Brazil: Major Determinants and Gender Effects*, The

-
- International Review of Research in Open and Distance Learning,
13(4), 91-106
- [13] Sobel M. E. (1982) *Asymptotic confidence intervals for indirect effects in structural equation models*, Sociological Methodology, 13(1), 290-312
- [14] Tao Y. H., Yeh C. R. and Sun S. I. (2006) *Improving training needs assessment processes via the Internet: system design and qualitative study*, Internet Research, 16(4), 427-49
- [15] Wang Y. S., Wang Y. M., Lin H. H. and Tang T. I. (2003) *Determinants of user acceptance of Internet banking: An empirical study*, International Journal of Service Industry Management, 14(5), 501-519
- [16] Yu S., Chen I. J., Yang K. F., Wang T.F. and Yen L. L. (2007) *A feasibility study on the adoption of e-learning for public health nurse continuing education in Taiwan*, Nurse Education Today, 27(7), 755-761
- [17] Yu T. K. (2006) *An Empirical Study of Web-based Learning Adoption in the Behavioral and Cognitive Styles*, Journal of Education & Psychology, 29(4), 687-717