Empirical Investigation of E-learning Adoption of University Teachers: A PLS-SEM Approach

Xuelin Xian(✉)

Department of Management, Shenzhen Institute of Information Technology, Long Xiang Street, No. 2188, Long Gang District, Shenzhen, China
xianxl@sziit.edu.cn

Abstract. Nowadays, information technology has a revolutionary impact on virtually all aspects of education. New horizons for learning, teaching and educational administration have been opened up by its transformation. Teachers must effectively master the available technology to excel in education. The aim of this research is to examine the acceptance of information technology of university teachers and identify their influencing factors. Valid data was collected over 500 university teachers and analyzed using the UTAUT 2 model. The result of PLS-SEM analysis indicates that the Performance Expectancy, Facilitating Conditions, Hedonic Motivation, and Habit significantly influence the university teachers' Behavioral Intention of E-learning. Content of the courses has moderating effect of Performance Expectancy and Facilitating Conditions on the university teachers' Behavioral Intention when pursuing further education. This study recommends the continuing education providers focus more on the core value of the contents to gain a competitive edge in the continuing education market sector and teachers should identify ways of optimizing technology.

Keywords: E-learning · University teachers · UTAUT 2 model

1 Introduction

In the new era, one of the breakthroughs in the higher education reform is to put information-based innovative education in an important position and give priority to its consideration. University teachers need to integrate modern information technology to lead the education innovation. The number of university teachers using E-learning to pursue further education such as professional skills or certificate acquisition has been increased. To promote the participation in E-learning, this study investigates the factors that have significant influences toward E-learning. Eight constructs in the Unified Theory of Acceptance and Use of Technology 2 model will be examined, including Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit and Behavioral Intention. Furthermore, it also tests the moderating effect of Contents of E-learning.

S. K. S. Cheung et al. (Eds.): ICTE 2019, CCIS 1048, pp. 169–178, 2019.
https://doi.org/10.1007/978-981-13-9895-7_15

2 The UTAUT 2 Theory

The continuance use of a new technology is subject to different reasons. Technology Acceptance Model by Davis (1989), Diffusion of Innovation by Rogers (1995) and The Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003) all explored to explain the user adoption of a technology. In the UTAUT theory, Venkatesh et al., integrated eight different theories and suggested four determinants accounted for the use of a new technology. These factors are: Performance Expectancy, Effort Expectancy, Social Influences and Facilitating Conditions. The description is listed as followed. PE is how much the user believes a technology would enhance his job performance. EE is the effort the user thinks he needs to take when using a technology. SI is the degree the user perceives that relevant people prefer he uses the technology. FC is the support of an organizational and technical infrastructure. Meanwhile, four key moderators such as age, gender, experience, and voluntariness of use are also investigated. The UTAUT describes the adoption of a technology in an organization. Lately, Venkatesh et al. (2012) expanded UTAUT to UTAUT2 by adding three more variables: Hedonic Motivation, Price Value, and Habit. HM means the enjoyment of using a technology. PV refers to the price value of this technology. HB is defined as the habit having direct or indirect effect. The UTAUT2 model explains the determinants of the individual acceptance of a new technology. Regarding to this study, the UTAUT2 model will be applied to explain the influencing factors that significantly affects the adoption of E-learning of university teachers.

3 Research Hypothesis

Under UTAUT2 model, PE, EE, SI, FC, HM, PV, and HB possibly have significant effects on BI toward E-learning of university teachers; and differences in the contents of E-learning (CT) may have moderating effects of PE, EE, SI, FC, MH, PV, and HB on BI. The hypotheses below were developed. Figure 1 presents the research model.

An online survey was conducted. Invitation letters were sent to individual university teachers to answer the questionnaire through E-mails, WeChat forums and QQ groups. There are 591 respondents submitted their questionnaires in January 2019, 72 sets of invalid data were deleted and the sample size was ultimately 519.

H1: Performance expectancy (PE) has a direct effect on Behavioral Intention (BI)
H2: Effort expectancy (EE) has a direct effect on Behavioral Intention (BI)
H3: Social Influence (SI) has a direct effect on Behavioral Intention (BI)
H4: Facilitating Conditions (FC) has a direct effect on Behavioral Intention (BI)
H5: Hedonic Motivation (HM) has a direct effect on Behavioral Intention (BI)
H6: Price Value (PV) has a direct effect on Behavioral Intention (BI)
H7: Habit(HB) has a direct effect on Behavioral Intention (BI)
H8: Contents (CT) has moderating effects of PE, EE, SI, FC, HM, PV, HB.

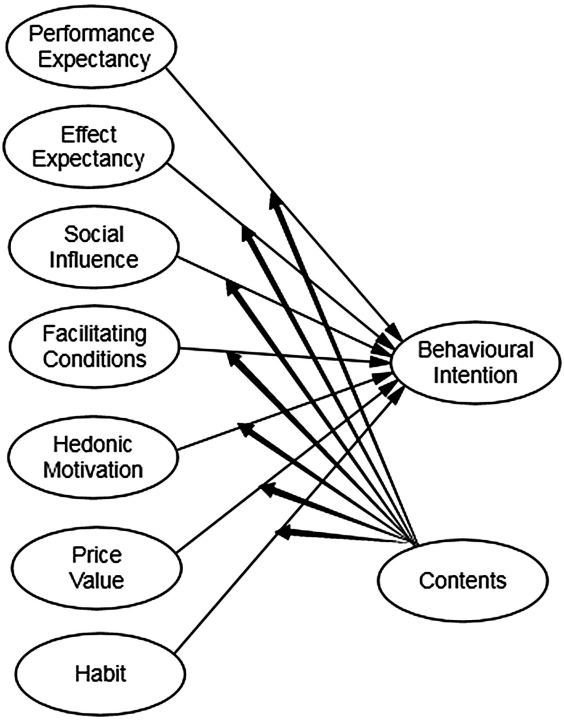

Fig. 1. Research model

4 Findings

4.1 Sample Characteristics

From the online surveys in January 2019, 519 sets of valid data were collected from university teachers. The measurable items for eight constructs were adopted from UTAUT2 (Venkatesh et al. 2012). The sample characteristics are listed in Table 1. The percentages of male and female respondents are 48.17% and 51.83% respectively. Most of the respondents were belonged to young generation aged between the range of 35–39 (26.59%), 30–34 (18.3%) and 25–29 (12.91%). Nearly half of university teachers held a Master degree (48.17%). And teachers came from public universities took up to 92.49%.

4.2 Reliability and Construct Validity

Means, standard deviations, excess kurtosis and skewness of each measurement item were demonstrated in Table 2. The values of PLS loadings of each construct exceed 0.7, meaning the data reached the recommended level.

Table 1. Demographic information (n = 519)

		Frequency	Percentage
Gender	Male	250	48.17
	Female	269	51.83
Identity	University leaders	3	0.58
	Middle-level cadres	66	12.72
	Teaching management personnel	35	6.74
	Ordinary teacher	344	66.28
	Assistant	21	4.05
	Others	50	9.63
Age	25–29	67	12.91
	30–34	95	18.3
	35–39	138	26.59
	40–44	109	21
	45–49	50	9.63
	50–54	40	7.71
	55–59	15	2.89
	60–65	3	0.58
	Over 65	2	0.39
Education degree	Bachelor	124	23.89
	Master	250	48.17
	PhD	132	25.43
	Post-Doctoral	13	2.5
University level	Vocational colleges	278	53.56
	Universities	241	46.44
University category	Public	480	92.49
	Private	39	7.51

The values of Cronbachs' alpha, construct reliability (CR), and average variance extracted (AVE) were presented in Table 3. The Cronbachs' alpha and CR values of eight factors exceed 0.8, and all AVE values exceed 0.6. The reliability and validity of data are confirmed.

Table 2. Mean, Standard deviation, excess kurtosis and skewness

	Mean	Std. dev	Excess kurtosis	Skewness	PLS loadings
PE1	5.547	1.614	0.456	−1.063	0.901
PE2	5.53	1.555	0.668	−1.078	0.918
PE3	5.385	1.644	0.306	−1.002	0.93
PE4	5.013	1.726	−0.306	−0.677	0.868
EE1	5.476	1.441	0.466	−0.866	0.848
EE2	5.522	1.392	0.452	−0.863	0.881
EE3	5.491	1.454	0.511	−0.929	0.856
EE4	5.008	1.558	−0.062	−0.62	0.748
SI1	5.071	1.78	−0.284	−0.753	0.87
SI2	4.792	1.768	−0.485	−0.574	0.945
SI3	4.705	1.781	−0.593	−0.49	0.929
FC1	5.283	1.621	0.236	−0.897	0.854
FC2	5.461	1.506	0.645	−1.007	0.851
FC3	5.364	1.627	0.272	−0.947	0.727
FC4	5.106	1.636	−0.182	−0.722	0.758
HM1	4.825	1.657	−0.248	−0.588	0.943
HM2	4.788	1.672	−0.389	−0.506	0.941
HM3	4.366	1.692	−0.6	−0.344	0.864
PV1	4.322	1.666	−0.596	−0.243	0.882
PV2	4.617	1.589	−0.354	−0.402	0.9
PV3	4.593	1.61	−0.381	−0.411	0.908
HB1	4.337	1.793	−0.784	−0.295	0.866
HB2	3.449	1.834	−1.013	0.156	0.841
HB3	3.649	1.89	−1.044	0.109	0.789
HB4	4.611	1.704	−0.58	−0.368	0.784
BI1	5.158	1.63	−0.204	−0.687	0.944
BI2	5.143	1.604	0.032	−0.75	0.957
BI3	5.056	1.642	−0.185	−0.669	0.945

In Table 4, the correlation analysis of eight constructs was conducted. It shows that the square root of each AVE is larger than its construct correlations, indicating the data's relatively independence of one another.

The f^2 of HB and PE are 0.070 and 0.066 respectively, which are both more than 0.02. These results re-examined the validity of the data.

The heterotrait-monotrait ratio of correlations (HTMT) was presented in Table 5. Each value of eight constructs is less than 0.85, indicating the reliability.

Table 3. Cronbachs' alpha, CR, and AVE

	Cronbachs' alpha	CR	AVE
BI	0.944	0.964	0.9
EE	0.855	0.902	0.697
FC	0.812	0.876	0.639
HM	0.905	0.94	0.84
HB	0.838	0.892	0.674
PE	0.926	0.948	0.819
PV	0.878	0.925	0.804
SI	0.903	0.939	0.838

Table 4. Square roots of AVEs

	BI	EE	FC	HB	HM	PE	PV	SI
BI	0.949							
EE	0.424	0.835						
FC	0.578	0.554	0.8					
HB	0.627	0.457	0.542	0.821				
HM	0.627	0.389	0.641	0.613	0.917			
PE	0.63	0.429	0.592	0.523	0.679	0.905		
PV	0.523	0.369	0.525	0.618	0.621	0.442	0.897	
SI	0.521	0.329	0.547	0.533	0.576	0.547	0.467	0.915

Table 5. HTMT

	BI	EE	FC	HB	HM	PE	PV	SI
BI								
EE	0.46							
FC	0.65	0.652						
HB	0.698	0.518	0.65					
HM	0.676	0.425	0.746	0.7				
PE	0.673	0.462	0.669	0.585	0.739			
PV	0.573	0.409	0.622	0.717	0.698	0.486		
SI	0.564	0.355	0.631	0.606	0.636	0.596	0.523	

4.3 Results of PLS-SEM Analysis

Figure 2 shows the results of PLS-SEM analysis. Bootstrapping was performed using 519 responses to 5000 samples to evaluate the significance of the path coefficients.

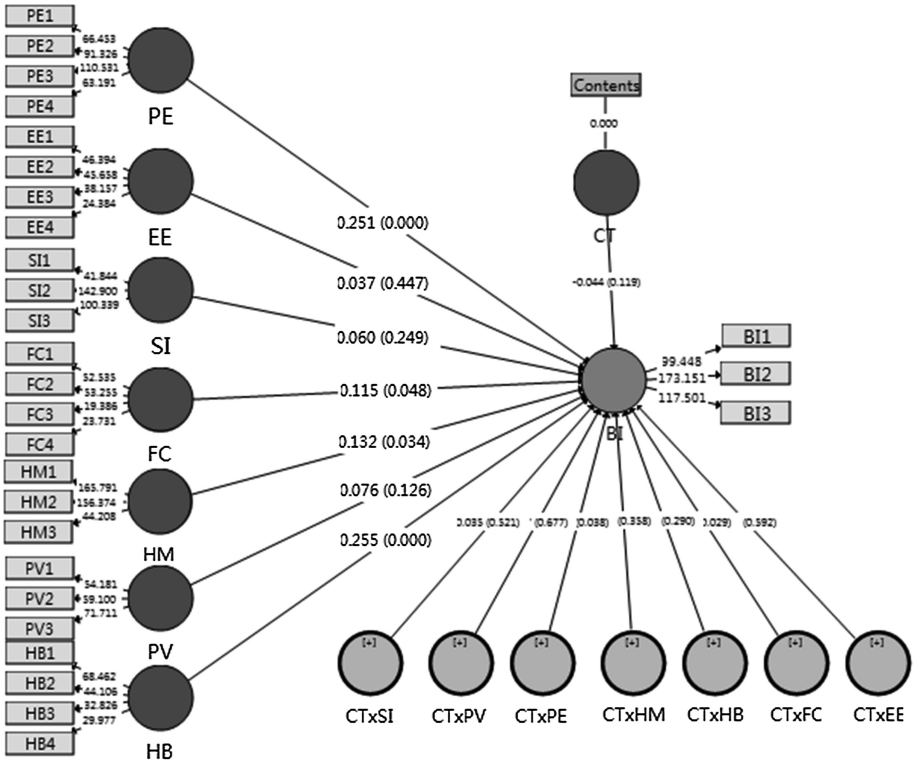

Fig. 2. Results of PLS-SEM analysis

5 Discussion and Conclusion

According to the Partial Least Squares-Structural Equation Modelling (PLS-SEM) results, the value of R^2 in the research model is 0.569, which is more than 0.25. It can be described as 'substantial' (Hair and Sarstedt 2011). The P-values of PE, FC, HM, HB, CTxPE, CTxFC, are less than 0.05. It means PE, FC, HM and HB have significant effect on BI, indicating that Hypotheses 1, 3, 5, 7 are assisted, but Hypotheses 2, 4, 6 are not assisted, Hypothesis 8 is partially accepted where content moderates the effect of PE and FC on BI toward E-learning of university teachers. University teachers like to use E-learning to pursue further education is because of its efficiency. Facilitating conditions and whether the E-learning courses are entertaining are also crucial factors. But the habit of using E-learning affects the user behavioral intention most strongly (β = 0.255). The more time users devoted in E-learning, the more likely they would have continuance use. This conclusion is consistent with Table 7.

Table 6. Results of PLS-SEM

Factor → Behavioral Intention (BI)	Beta value	P-value	
H1: Performance Expectancy (PE) → BI	0.251	0.000	**Accept**
H2: Effort Expectancy (EE) → BI	0.037	0.447	Reject
H3: Facilitating Conditions (FC) → BI	0.115	0.048	**Accept**
H4: Social Influence (SI) → BI	0.060	0.249	Reject
H5: Hedonic Motivation (HM) → BI	0.132	0.034	**Accept**
H6: Price Value (PV) → BI	0.076	0.126	Reject
H7: Habit(HB) → BI	0.255	0.000	**Accept**
H8: CTxPE → BI	−0.097	0.038	**Accept**
CTxFC → BI	0.123	0.029	**Accept**

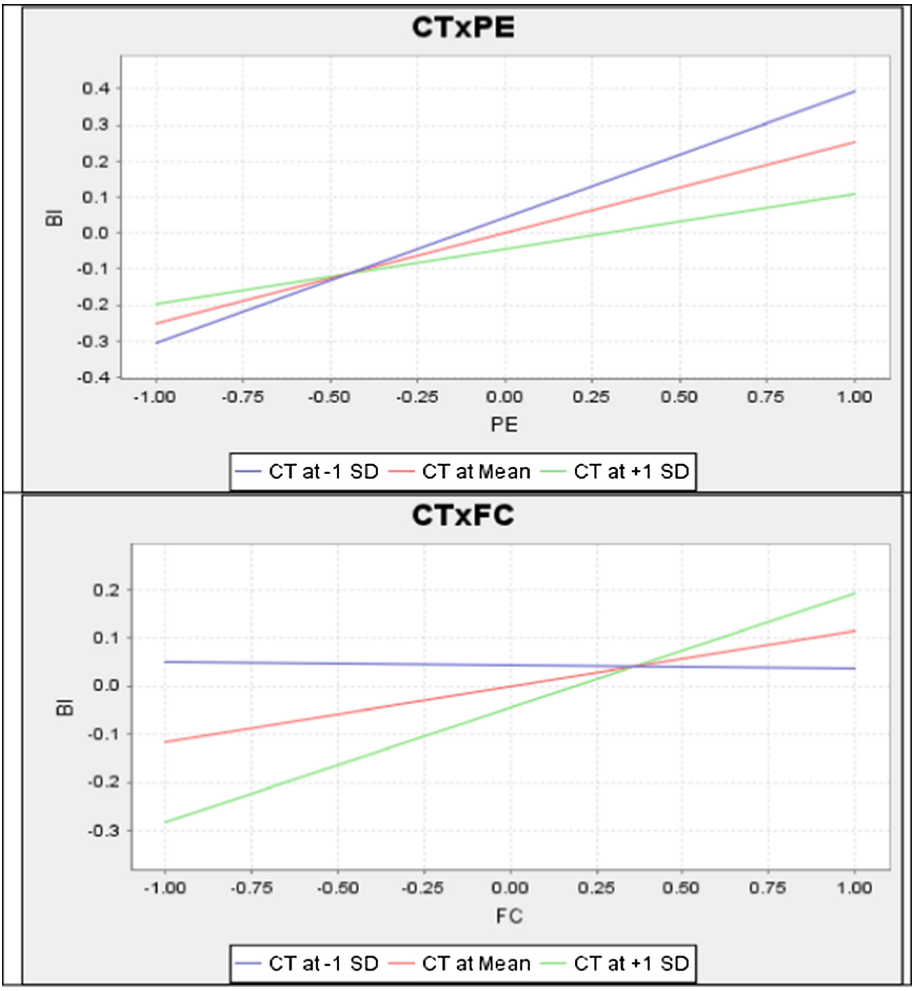

Fig. 3. Simple slope analysis

Table 7. Time of using E-learning (n = 519)

		Frequency	Percentage
Time	0–1 years	140	26.97
	2 years	111	21.39
	3 years	86	16.57
	4 years	56	10.79
	5 years	53	10.21
	6 years	15	2.89
	7 years or above	58	11.18

Figure 3 re-examines CT's moderating effects of PE and FC on BI.

Content of the E-learning (CT) has moderating effects of Performance Expectancy (PE) and Facilitating Conditions (FC) on the university teachers' Behavioral Intention (BI). Most of the university teachers used E-learning to pursue professional skills (45.86%) and professional studies (32.56%). The number of teachers studying for certificate/ Examination took up 11.95%, and others for customized training amounted to 9.63% (Table 8).

Table 8. Contents of E-learning courses (n = 519)

		Frequency	Percentage
Contents	Professional skills	238	45.86
	Professional studies	169	32.56
	Customized training	50	9.63
	Certificate/examination	62	11.95

More than half of the university teachers chose Government-affiliated institutions of E-learning (58.38%). Those from private enterprises and association of industries composed 24.28% and 17.34% respectively (Table 9).

Table 9. Suppliers of E-learning (n = 519)

		Frequency	Percentage
Supplier	Government-affiliated institutions	303	58.38
	Private enterprises	126	24.28
	Association of industries	90	17.34

To achieve target return and gain competitive advantage in the continuing education market sector, the service providers of continuing education should focus more on the core value of the contents to meet with the demand of university teachers, and avoid inaccurate learning positioning for learners, single form of learning resources,

unscientific knowledge structure, inadequate management functions, lack of interactive functions, and useless learning resources in digital curriculum.

Fund Project. Shenzhen Educational Science Planning Project in 2018, Research on the Development Strategy of Shenzhen Higher Education in Greater Bay Area, zdzz18005.

References

Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. **13**(3), 319–339 (1989). https://doi.org/10.2307/249008

Hair, J.F., Ringle, C.M., Sarstedt, M.: PLS-SEM: indeed a silver bullet. J. Mark. Theory Pract. **19** (2), 139–151 (2011). https://doi.org/10.2753/MTP1069-6679190202

Rogers, E.M.: Diffusion of Innovations: Modifications of a Model for Telecommunications (1995). https://doi.org/10.1007/978-3-642-79868-9_2

Venkatesh, V., Thong, J.Y.L., Xu, X.: Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS Q. **36**(1), 17–178 (2012). https://doi.org/10.2307/41410412

Venkatesh, V., Morris, M.G., Davis, G.G., Davis, F.D.: User acceptance of information technology: toward a unified view. MIS Q. **27**(3), 425–478 (2003). https://doi.org/10.2307/30036540