Research on the Improvement Path of University Teachers' Information Teaching Ability Based on C-TAM-TPB Framework

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Abstract. With the rise and promotion of information teaching application platforms such as MOOC, micro course and cloud platform, information teaching has promoted the reform and development of higher education and become the direction of modern education reform. This study integrates Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB). Based on Model of Combining TAM and TPB (C-TAM-TPB), this paper has empirically studied the ways to improve university teachers' information teaching ability. Empirical research shows that perceived ease of use (PEOU) and perceived behavioral control (PBC) of university teachers can effectively promote information teaching intention (ITI). Then promote the content teaching ability (ITA), among which information teaching intention (ITI) and self-efficacy (SE) play a chain mediating role. Perceived usefulness (PU) does not have a significant impact on ITA. This study enriches the research model of university teachers' information teaching behavior, and puts forward the model and suggestions for improving university teachers' information ability.

Keywords: university teachers · information teaching ability · Technology Acceptance Model · Theory of Planned Behavior · Model of Combing TAM and TPB

1 Introduction

In recent years, with the continuous development of information technology and the reform of innovative personnel training mode, information technology has been deeply integrated with the field of education. With the rise and promotion of information teaching application platforms such as MOOC, micro course and cloud platform, information teaching has become the general trend of current education reform. At the same time, in the face of the impact of COVID-19 on the education field, the online teaching model has been launched, and most university teachers have gradually realized the urgency of information-based teaching reform. Therefore, this study has conducted empirical studies on university teachers' information teaching ability based on Model of Combining TAM and TPB (C-TAM-TPB) framework, and proposed suggestions to promote the improvement of university teachers' information teaching ability.

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2 Literature Review and Research Hypotheses

2.1 Model of Combining TAM and TPB (C-TAM-TPB)

The Theory of Planned Behavior (TPB) was first proposed by Ajzen (1985) [1]. As an important theory in the field of applied psychology, TPB is mainly used to predict and explain individual behaviors and behavioral intentions [2, 3]. Subsequently, Davis (1989) proposed Technology Acceptance Model (TAM) [4]. TAM was first used in the field of information Technology to explain the key factors affecting users' Acceptance of computer [5]. Later, Taylor and Todd integrated TPB and TAM in 1995 and proposed the Combined TAM and TPB theoretical framework [6]. According to C-TAM-TPB, the factors affecting individual behavioral intention mainly include subjective norm, perceived behavioral control, behavioral attitude, perceived technology usefulness, and perceived technology ease of use. The factors affecting behavioral attitude mainly include perceived technology usefulness and ease of use. Compared with the single TPB framework and TAM framework, this theoretical framework provides a more comprehensive analysis framework, which has been widely used in the study of individual technology adoption behavior [7]. Hossain et al. (2019) used partial least squares (PLS) to investigate 145 consumers from different occupations who used electronic ticketing systems [8]. The study argues that cognitive ability has a significant impact on saving time and trust when buying tickets over the Internet. Perceived ease of use has a positive effect on consumers' use of e-ticketing systems, while cognitive ability has little effect on perceived usefulness. Putra et al. (2022) analyzed whether consumers' perception of COVID-19 risk affects their intention to use digital payment QRIS based on C-TAM-TPB model [9]. Studies show that perceived risk has a significant impact on willingness to pay, and self-efficacy has a significant impact on perceived behavioral control. Therefore, when teachers perceive that the easier it is to use information and the higher the value of information teaching, the stronger their recognition and acceptance of information will be [10, 11]. In addition, the trend of information use and the influence of the organization will also affect teachers' self-efficacy, and then affect their behavior decisions [12, 13]. Therefore, this study concluded that ITI and SE have a mediating effect between teacher informationization perception and ITA. Therefore, the following hypothesis is proposed.

H1: PU can positively affect ITI.
H2: PEOU can positively affect ITI.
H3: PBC can positively affect ITI.
H4: ITI can positively affect SE.
H5: ITI can positively affect ITA.
H6: SE can positively affect ITA.
H7: ITI plays an intermediary role in the relationship between PU and ITA.
H8: ITI mediates the relationship between PEOU and ITA.
H9: ITI plays a mediating role in the relationship between PBC and ITA.
H10: ITI and SE played a mediating role in the relationship between PU and ITA.
H11: ITI and SE played a mediating role in the relationship between PEOU and ITA.
H12: ITI and SE played a mediating role in the relationship between PBC and ITA.

2.2 Definition of Research Model and Operational Definition

Based on the C-TAM-TPB framework, this study constructed a research model with ITI and SE as mediating variables, which included 6 research variables including PEOU, PU, PBC, ITI, SE and ITA (see Fig. 1). In order to maintain the consistency of the measured variables, the operational definition of the study variables is defined as follows:

① PU refers to the degree to which teachers believe that information-based teaching is helpful to improve teaching quality;
② PEOU refers to the degree that teachers think it is easy to carry out information-based teaching;
③ PBC refers to the degree to which teachers think it is difficult to feel self-sustained information behavior in the process of implementing information teaching;
④ ITI refers to the tendency of teachers to plan the continuous information teaching behavior in the future;
⑤ SE refers to the degree of self-effort of teachers to the continuous practice of information teaching;
⑥ ITA refers to the degree to which teachers carry out information-based teaching successfully.

3 Research Methodology

3.1 Measurement Tools

The questionnaire was divided into two parts. The first part was about demographic information. The second part is Liken five-point scale with 24 items. PU, PEOU, PBC ITI, SE, ITA respectively including 4 items. Each item of the scale is referred to Ajzen's

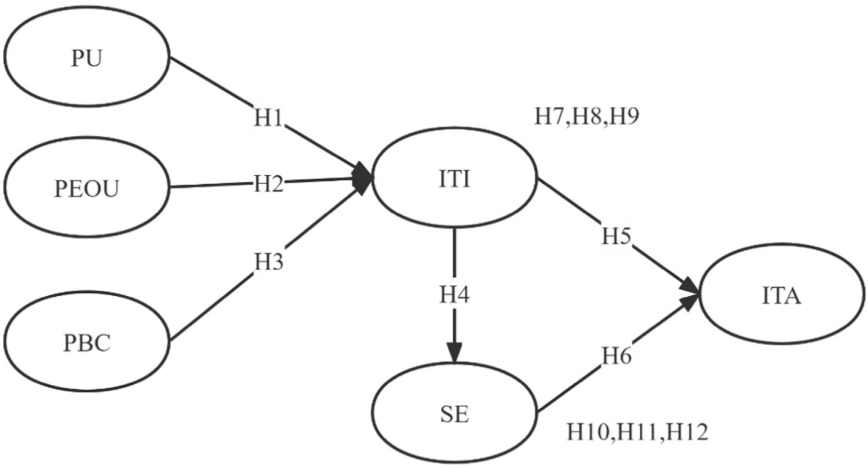

Fig. 1. Conceptual framework model (Drawn by the author)

TPB scale [2], David's TAM scale [1] and scale of Putra et al. [9]. The scale is assigned on a scale of 1–5 (1 = strongly disagree, 5 = strongly agree). As shown in Table 3, Cronbach's Alpha = 0.925, indicating high reliability of the scale.

3.2 Sample Selection and Data Collection

In this study, 678 teachers from 12 universities in Guangdong Province were selected as the research objects, and the sampling areas were distributed in five cities: Guangzhou, Foshan, Dongguan, Zhongshan and Zhuhai. The convenience sampling method was used for sampling, and the questionnaires were distributed and collected mainly through the questionnaire star. In order to ensure the objectivity and validity of the data, all questionnaires collected in this study were screened, and questionnaires with incomplete or identical answers were considered invalid [14]. A total of 800 questionnaires were distributed in this study, and 678 valid questionnaires were recovered, with an effective recovery rate of 84.75%.

4 Research Results

4.1 Basic Information About the Sample

The total sample size of this study was 678. In terms of sex ratio, males accounted for 48.2% and females accounted for 51.8%. In terms of age distribution, 24.3% were over 35 years old, 35.7% were 36–45 years old, 18.8% were 46–55 years old, and 21.2% were over 56 years old. From the analysis of working years, the proportion of less than 3 years is 18%, 4–8 years accounts for 37%, 9–15 years accounts for 23%, more than 16 years accounts for 22%; In terms of educational background, 4.8% of the students have university degree or below, 32.2% have bachelor degree, 33% have master degree, and 30% have doctor degree. Based on the proportion distribution of the basic conditions of the samples above, the sample distribution is reasonable.

4.2 Empirical Analysis

4.2.1 Descriptive Statistical Analysis

SPSS21.0 was used for descriptive statistical analysis in this study, as shown in Table 1. The path model proposed in this study included 6 latent variables including PEOU, PU, PBC, ITI, SE, and ITA. The Liket 5-point scale was used for all the scales, with a minimum value of 1 and a maximum value of 5. From the mean distribution of each item, the minimum value was 3.3405 and the maximum value was 3.7656, indicating that the score of each item was reasonable and the data was objective and true. According to the analysis of skewness and kurtosis, both skewness and kurtosis were distributed within the interval of $(-1.96, +1.96)$, indicating that the samples basically obey the normal distribution.

4.2.2 Reliability and Validity Analysis

4.2.2.1 Reliability Analysis

This paper used SPSS.21 to calculate the reliability coefficient of each dimension, CITC value and the reliability coefficient after deleting items, so as to determine whether the empirical data of each latent variable met the requirements of internal consistency. As shown in Table 2, the Cronbach's Alpha values of each latent variable were all greater than 0.8, and the CITC values were evenly distributed between 0.6 and 0.8. The reliability index of Cronbach's Alpha did not improve after deleting items, indicating that the scale had good reliability.

4.2.2.2 Validity Analysis

According to the data analysis in Table 3, KMO = 0.977, Bartlett's test value of sphericity was 12601.576, $P < 0.05$, AVE values were all greater than 0.5, CR values were all greater than 0.8, and the square root of AVE of each latent variable was all greater than other values, indicating that the validity of the scale was good and suitable for factor analysis.

Table 1. Descriptive statistical analysis (Drawn by the author)

Variables	N	Min-value	Max-Value	Mean	Sta. deviation	Skewness	kurtosis
PEOU	678	1.00	5.00	3.5643	.80392	−.156	.117
PU	678	1.00	5.00	3.6483	.85254	−.232	.198
PBC	678	1.00	5.00	3.6754	.75580	−.124	.142
ITI	678	1.00	5.00	3.3405	.81047	−.234	.190
SE	678	1.00	5.00	3.5444	.82503	−.288	.335
ITA	678	1.00	5.00	3.7656	.79326	−.027	.032

Table 2. Reliability analysis (Drawn by the author)

Variables	Average value after deleting item	Variance after deleting item	CITC	Cronbach'α after deleting the item	Total of Cronbach'α
PEOU	11.03	6.011	.844	.909	0.925
PU	10.89	6.260	.815	.918	
PBC	11.00	6.030	.858	.904	
ITI	10.91	6.315	.840	.911	
SE	11.03	6.011	.844	.909	
ITA	10.89	6.260	.815	.918	

4.2.3 Structural Equation Model Analysis

In this study, AMOS 24 was used to construct SEM. The results of data running are shown in Fig. 2.

4.2.3.1 Model Fit Analysis

According to Table 4, $\chi^2/df = 2.458$, GFI = 0.901, AGFI = 0.878, NFI = 0.950, CFI = 0.964, RMSEA = 0.060. According to the standard of model fitting index, the fitting index of the model all met the requirements, indicating that the fitting degree of the

Table 3. Validity analysis (Drawn by the author)

Variables	PEOU	PU	PBC	ITI	SE	ITA
PEOU	0.691					
PU	0.662**	0.735				
PBC	0.558**	0.504**	0.676			
ITI	0.673**	0.690**	0.560**	0.654		
SE	0.582**	0.634**	0.629**	0.558**	0.707	
ITA	0.617**	0.724**	0.508**	0.634**	0.680**	0.712
KMO				0.977		
Bartlett's sphericity test value	Appro-chi-square			12601.576		
	Sig.			<0.01		

Note: * P < 0.05; * * P < 0.01; * * * P < 0.001

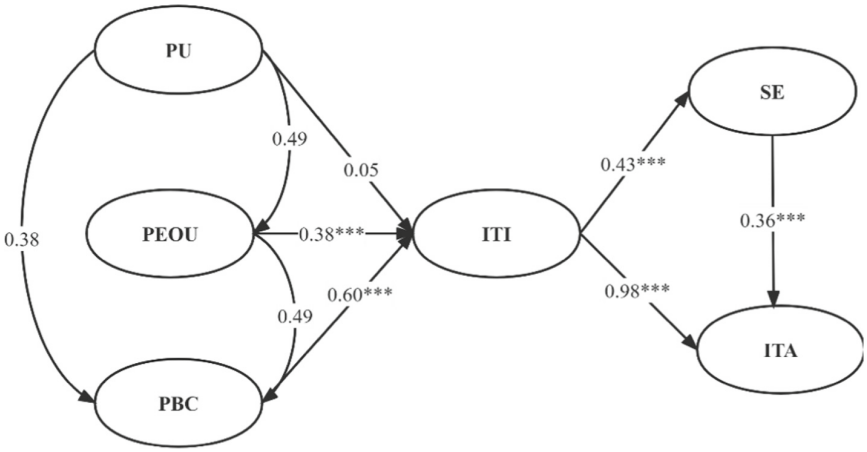

Fig. 2. Structural equation model (Drawn by the author)

Table 4. Goodness-of-fit index of the model (Drawn by the author)

Indicators	X^2/df	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Statistics	2.458	.901	.878	.950	.964	.959	.964	.060
Reference	<3	>0.8	>0.8	>0.9	>0.9	>0.9	>0.9	<0.08
Fitness	Fit	Fit	Fit	Fit	Fit	Fit	Fit	Fit

Table 5. Verification results of direct path (Drawn by the author)

Hypothesis	Path	Estimate	S.E.	C.R.	P	Conclusion
H1	PU > ITI	.049	.042	1.178	.239	No supported
H2	PEOU > ITI	.383	.045	8.516	***	supported
H3	PBC > ITI	.595	.040	14.794	***	supported
H4	ITI > SE	.984	.031	31.262	***	supported
H5	ITI > ITA	.426	.102	4.170	***	supported
H6	SE > ITA	.355	.099	3.571	***	supported

Note: $*P < 0.05; **P < 0.01; ***P < 0.001$

Table 6. Mediating effect analysis (Drawn by the author)

Hypothesis	Mediation Path	Est.	Low.	Upp.	P-val	Conclusion
H7	PU-ITI-ITA	.008	−.025	.062	.705	No supported
H8	PEOU-ITI-ITA	.148	.041	1.061	.024	supported
H9	PBC-ITI-ITA	.233	.031	1.214	.018	supported
H10	PU-ITI-SE-ITA	.121	−.035	0.181	.224	No supported
H11	PEOU-ITI-SE-ITA	.331	.068	1.153	.007	supported
H12	PBC-ITI-SE-ITA	.202	.053	1.221	.032	supported

model was good and the model was acceptable. Therefore, the path of the model was analyzed.

4.2.3.2 Path Analysis

As shown in Table 5, six direct path hypotheses were tested in this study, of which five hypotheses were supported and one hypothesis was not supported.

4.2.3.3 Mediating Effect Analysis

In this study, AMOS 24.0 was used to run Bootstrap method, which was repeated 5000 times. The confidence interval standard was 95%, and the deviation correction method

was used to test. If the upper and lower intervals of the mediation path do not contain 0 and the P-value is less than the significance level 0.05, then the hypothesis holds and the mediation effect holds. If the upper and lower intervals of the mediation path contain 0 and the P-value is greater than the significance level 0.05, then the hypothesis is not valid and the mediation effect does not exist. As can be seen from the results in Table 6, H7 and H10 of the 6 intermediary paths are not valid, and other hypothesis tests are all supported.

5 Conclusion and Suggestion

This study verifies the influence path of university teachers' informatization ability through empirical analysis. The results show that university teachers' informatization ability is affected by their perception of informatization, willingness to informatization and self-efficacy. The perceived ease of use and usefulness of informatization and the degree of difficulty of self-sustaining behavior of university teachers affect their self-efficacy, and finally promote the improvement of informatization ability. At the same time, university teachers' subjective judgment of informatization and the perceived ease and difficulty of using it in the implementation process also directly affect their willingness to use it, and thus affect their ability improvement. The results of this study validate the core views of TAM and TPB. In addition, the study found that university teachers' perceived usefulness of information-based teaching had no significant impact on their ability improvement. The possible reasons are the lack of support for the implementation of information-based teaching in universitys and universities, such as backward equipment and imperfect incentive mechanism, which lead to the status quo of university teachers' attitude but no behavior.

Based on the above research conclusions, this study constructs a model of university teachers' informatization ability improvement, which is divided into four levels from

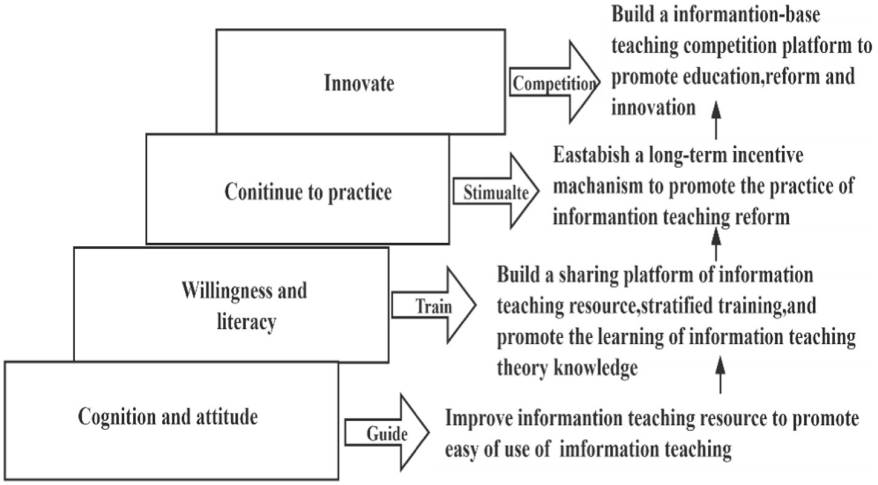

Fig. 3. University teachers' informatization ability improvement model (Drawn by the author)

bottom to top: cognition and attitude, willingness and literacy, continuous practice, and innovation (see Fig. 3).

Based on the following model, this study puts forward four suggestions from the four operation aspects of guidance, training, motivation and competition: 1) The information teaching resources should be improved to guide university teachers' accurate cognition of information teaching. 2) To build a platform for sharing information teaching resources and form an organized and supported information teaching environment. 3) A long-term incentive mechanism should be established to promote the practice of informatization teaching reform. 4) Promote teaching by competition, and promote the innovation of information-based teaching.

Due to the limitation of time and resources, there are still some shortcomings in this study, such as single research method and insufficient sample size. In the future research, this study will use a variety of research methods, increase the sample size and continue the follow-up research from different research perspectives.

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