

# *Research on Chinese College Students' Using Behavior towards E-learning Services Based on Improved TAM Model*

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**Abstract**—E-learning is becoming more and more popular in many developed and developing countries. The number of E-learning users grows fast, especially in the community of college students. Taking China as an example, this paper investigates factors that influencing the college students' using behavior towards E-learning services by applying an improved TAM (Technology Acceptance Model). The results show that “Perceived Ease of Use” is the variable which has the highest total effect on the users' “Behavioral Intention” in E-learning application, followed by “Perceived Usefulness”. Besides, “Social Influence” and “Cost Tolerance” also have significant indirect effects on users' “Behavioral Intention”. Based on this, we propose some suggestions for the E-learning platforms/companies to raise the use of the college students towards their services.

**Keywords**—*E-learning services; Technology Acceptance Model (TAM); Chinese college students; using behavior*

## I. INTRODUCTION

With the rapid development of internet technology in China, more and more internet-based products and services go into people's life. E-learning, an internet-based education pattern, is one of the products in this wave. This new mode develops very fast in both developed and developing countries, and extensively welcomed by young people especially the college students [1]. In China, more and more college students start to use E-learning in daily courses studying and preparations for professional examinations. Moreover, most of the E-learning systems are public systems that everyone can visit through internet, such as Tencent Class (ke.qq.com), Huijiang Class (class.hujiang.com), New Oriental Online (www.koolearn.com), etc. This paper aims at exploring the key factors that affect college students' using behavior towards E-learning services. We hope that the related findings may help the E-learning systems/platforms improve their services more scientifically.

This paper explores the proposed problem by an improved TAM (Technology Acceptance Model). Normally, TAM is applied to study users' behavior toward new technology applications. Many researchers have applied TAM to study the influencing factors of students' using behavior towards E-learning services. It is found that Perceived Usefulness,

Perceived Ease of Use, Attitudes, Subject Norm and Quality of Work Life are core factors strongly influencing users' behavioral intention towards E-learning applications [2], [3], [4]. Reference [5] further points out that students' using behavior towards e-portfolios is significantly influenced by Perceived Usefulness, Perceived Ease of Use and Attitudes towards Usage. Besides that, by an extended Technology Acceptance Model (TAM2), Van Raaij [6] found that individual differences such as Subjective Norm and Personal Innovativeness in the domain of information technology and computer anxiety should be taken into consideration in this kind of program. In addition, gender, age, income and other demographic factors also deeply show the differences in the use of high-tech learning tools [7], [8].

This study aims to extend TAM with favorite variables and investigate the factors affect the college students' using behavior towards E-learning services. Allowing independent and dependent variables all contain measurement errors which can balance the model's goodness of fit, we collect data and verify whether the proposed theoretical hypotheses established or not, by which we can evaluate the reliability and validity of the proposed theoretical model and further conclude the findings by the modified model. All the findings help clarify the intrinsic and extrinsic factors that influence the users' application behavior towards E-learning.

## II. THEORETICAL FRAMEWORK AND HYPOTHESES

The classical Technology Acceptance Model (TAM) claims that users' technology acceptance behavior is influenced by Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) [9], which has been widely verified by researchers in various situations such as E-business application, information system adoption, and so on. Besides, many other studies propose that “Social Factors” [10] and “Socio-economic Issues (e.g., job status, occupation and income)” also act as the determining factors towards people's adoption of technology-based products and services [11], [12]. In this research, we improve the classical TAM with introducing Social Influence (SI) and Cost Tolerance (CT) into the classical TAM model. These two newly introduced latent variables can be viewed as the proxy

variables of “Social Factors” and “Socio-economic Issues” respectively.

#### A. Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)

Perceived Usefulness (PU) is defined as “the degree to which a person believes that using a particular technology would enhance his or her job performance” [9]. Technology with a high usefulness may act on users’ ability improvements or opportunity extensions in their works. Perceived Ease of Use (PEOU) is defined as “the degree to which a person believes that using a particular technology would be free of physical and mental efforts”. It suggests that an application perceived to be easier to use than another is more likely to be accepted by users [9].

TAM suggests that these two variables are directly or indirectly related to “Attitude of Use (AU)”. At the same time, PU, PEOU and AU may positively affect “Behavioral Intention (BI)”. Based on above analyses, hypotheses related to PU, PEOU and AU in E-learning services acceptance model are proposed as follows.

**H1.1-H1.2** PU has positive and significant influences on AU and BI.

**H2.1-H2.3** PEOU has positive and significant influences on AU, BI and PU.

**H3** AU directly influences BI.

#### B. Social Influence (SI)

Social Influence (SI) characterizes “the degree to which an individual perceives important that others believe he or she should use the new technology” [13]. It also represents the degree to which peers influence the use of a new technology [10].

In general, the individual's willingness to use a new technology is likely to be influenced by peers' attitudes. More specifically, peers' attitudes or recommendations towards the technology may have some influences on one's Perceived Usefulness (PU) about the technology. Therefore, this paper measures how SI impacts on PU, AU and BI.

**H4.1-H4.3** SI is directly and significantly associated with PU, AU and BI.

#### C. Cost Tolerance (CT)

Economic issues, including economic sources and personal income, may influence people's adoption of new technology-related products or services [11], [12], [7]. In China, most of the college students have no income and their expenditures (e.g., tuition fees, living expenses, and other costs) come from their parents during the college years. They may concern more about the cost of using the new technological products, thus their final decisions on using or not usually depend on the cost/performance ratio of the services. In this study, Cost Tolerance (CT) will be tested whether relate to AU and BI in the E-learning acceptance issue. The corresponding hypotheses are listed as below.

**H5.1-H5.2** CT has directly positive effects on AU and BI.

### III. METHODS AND RESULTS

This paper employs the method of questionnaire survey, similar with the majority of previous studies on E-learning services adoptions [13], [5], [2]. With appropriate improvements, we design a questionnaire which selecting 16 questions to characterize the E-learning acceptance model, and the questionnaire is released by a professional survey website in China named “So Jump”. There are three main parts in this questionnaire: a) investigation purposes and the concept of E-learning; b) contents about exploring E-learning acceptance constructs (PU, PEOU, SI, AU, BI, CT); c) demographic characteristics of respondents.

Every construct item in the questionnaire is measured by a 5-point Likert scale where ‘1’ to ‘5’ indicates ‘strongly disagree’, ‘disagree’, ‘neutral’, ‘agree’ and ‘strongly agree’, respectively.

#### A. Participants

This article recruits target participants to nationwide as much as possible in order to ensure the comprehensiveness of the data. Since it aims to explore key factors that influence E-learning services using behaviors of Chinese college students, volunteers are all college or university students who have at least one-month-experience of using E-learning services. Finally, we receive 168 questionnaires but only 156 are available due to the problem of data reliability.

#### B. Structural Equation Model (SEM)

Structural Equation Model (SEM) is a practical model that is able to analyze multiple relationships of variables. In common, the modeling process includes theoretical model building, data collection, factor/path analysis, model fit testing, and so on. In this research, all these procedures are operated by SPSS 19 and AMOS 19. Before establishing the model, the collected data should be tested for reliability and validity, the results is shown in Table I.

TABLE I. TESTS OF RELIABILITY AND VALIDITY OF OVERALL DATA

	indices	number	reference range
reliability	Cronbach's Alpha	0.881	0.5 to 0.9
	Standardized Cronbach's Alpha	0.900	0.5 to 0.9
validity	Kaiser-Meyer-Olkin metric (KMO) of Sampling Adequacy	0.877	0.6 to 0.9
	Bartlett Sig.	0.000	Lower than 0.001

The total testing results show that the Cronbach's Alpha is 0.881, reflecting the excellent internal consistency of the data, of course the high data reliability. In addition, KMO is 0.877 and Bartlett significance is 0.000, illustrating the total data is good for doing factor analysis, which benefits the verification of the validities of each latent variable.

We further test the reliability of each latent variable in our model, the results are listed in Table II. It shows that the reliability of each latent variable is satisfying. We also apply

the Principal Component Analysis (PCA) combined orthogonal method for factor rotation, to test the validity of the collected data. By extracting 6 factors from 16 variables, it shows that the eigenvalues of the 6 factors explains the total variance of 76.581% and every factor load is greater than 0.65 (see Table III), indicating the high validity of the data.

TABLE II. CRONBACH ALPHA RELIABILITY COEFFICIENT FOR EACH LATENT VARIABLE

Factors	number of item	Alpha	Standardized Alpha
PU	3	0.816	0.820
PEOU	5	0.862	0.866
SI	2	0.855	0.857
CT	2	0.649	0.671
AU	2	0.911	0.912
BI	2	0.578	0.579

TABLE III. RESULTS OF CONFIRMATORY FACTOR ANALYSIS FOR TESTING THE VALIDATION OF THE DATA

	Factor loading					
	1	2	3	4	5	6
PU1	.236	<b>.801</b>	.169	.123	.139	.036
PU2	.228	<b>.766</b>	.068	.199	.154	.111
PU3	.307	<b>.684</b>	.342	.263	.112	.079
PEOU1	<b>.659</b>	.320	.295	.167	.105	.043
PEOU2	<b>.758</b>	.256	.299	.182	-.022	-.017
PEOU3	<b>.706</b>	.186	.092	.271	.122	.055
PEOU4	<b>.786</b>	.069	-.007	-.075	.261	.146
PEOU5	<b>.730</b>	.251	.188	.317	.044	.056
SI1	.173	.168	<b>.851</b>	.248	.084	.048
SI2	.231	.190	<b>.873</b>	.072	.050	.077
CT1	.215	.133	-.058	.387	<b>.740</b>	.056
CT2	.114	.186	.172	-.023	<b>.869</b>	-.076
AU1	.299	.361	.293	<b>.740</b>	.137	.123
AU2	.314	.299	.228	<b>.742</b>	.187	.165
BI1	.064	.052	.051	.201	.025	<b>.811</b>
BI2	.074	.082	.049	-.033	-.047	<b>.836</b>

**C. Model Assessment**

In the following, the overall goodness of fit of the model is measured. From the estimated results by AMOS 19, the conceptual model is proved to be with good fitness in general, which is reflected and supported by favorite values of indices such as RMSEA (0.029), CFI (0.990), GFI (0.942), NFI (0.921), IFI (0.990), CMIN/DF (1.132) and Chi-square (106.397). All these indicates a good fitness of the collected data to the theoretical conceptual model, which allows us to conduct a further analysis on the path coefficients to detect whether all paths in our conceptual model is appropriate or not, in other words, whether all hypotheses proposed at the beginning of the paper are established.

**D. Path Analysis**

In this part, through path analysis, we aim to verify the correctness of the proposed hypotheses, as well as clarify the causal relations among the six latent variables, i.e., Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Social Influence (SI), Cost Tolerance (CT), Attitude of Use (AU) and Behavioral Intention (BI). This study applies AMOS 19 to establish Structural Equation Model (SEM) to examine the

path relations among the latent variables with collected data. Overall, only 4 out of 11 hypotheses are not supported while other 7 hypotheses are all supported by the data in this model. From Table IV, it can be observed that the influences of PU, PEOU, SI and CT toward BI are not significant (90% confidence interval), and thus not supported, consistent with previous study of [9]. With the results of hypotheses testing, the E-learning services acceptance model of Chinese university students can be modified as shown in Fig. 1.

TABLE IV. PATH ANALYSIS RESULTS

hypothesis	path	Path coefficients	P-value	Results
H1.1	PU→AU	0.436	***	<i>Supported</i>
H1.2	PU→BI	0.049	0.780	Not supported
H2.1	PEOU→AU	0.261	0.073	<i>Supported</i>
H2.2	PEOU→BI	-0.001	0.995	Not supported
H2.3	PEOU→PU	0.681	***	<i>Supported</i>
H3	AU→BI	0.351	0.019	<i>Supported</i>
H4.1	SI→PU	0.247	0.002	<i>Supported</i>
H4.2	SI→AU	0.167	0.038	<i>Supported</i>
H4.3	SI→BI	-0.021	0.874	Not supported
H5.1	CT→AU	0.243	0.009	<i>Supported</i>
H5.2	CT→BI	-0.108	0.495	Not supported

\*\*\*means P<0.001.

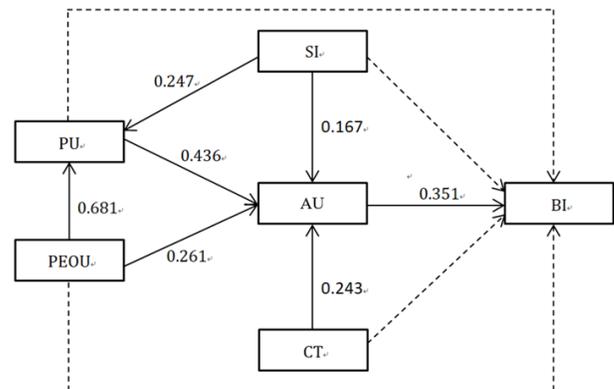


Fig. 1. Modified E-learning acceptance model of Chinese university students

Besides, AMOS 19 helps calculate the direct effect, indirect effect, and total effect between the variables, as shown in Table V. From Table V, PU, PEOU, SI and CT all have no significant direct effects on BI, however, AU alone has strongly direct influence on BI. The rationale may be that PU, PEOU, SI and CT only significantly affect users' willingness of application rather than the actual using behaviour to E-learning services. Whether using or not maybe depends on some other additional factors such as external environment and individual characteristics, except for the AU.

From Table V, it can be also observed that the PEOU has the highest total effects on the users' BI, followed by the PU. And, both of these two variables (PEOU and PU) only have indirect effects on BI. First, PEOU indirectly affects BI through two paths, i.e., PEOU→AU→BI and PEOU→PU→AU→BI, while PU indirectly affects BI only through one single path, i.e., PU→AU→BI. Besides, SI and CT also have significant indirect effects on BI, and all these effects work

through the intermediate variable: AU, showing the importance of AU in the acceptance model of E-learning.

TABLE V. EFFECTS OF EACH VARIABLE ON BI

variables	Total effects	Direct effects	Indirect effects
Perceived Usefulness(PU)	0.153	NA	0.153
Perceived Ease of Use(PEOU)	0.196	NA	0.196
Social Influence(SI)	0.096	NA	0.096
Cost Tolerance(CT)	0.085	NA	0.085
Attitude of Use(AU)	0.351	0.351	NA

### E. Implications

(a) The Perceived Ease of Use (PEOU) has the strongest impact on the users' Behavioral Intention (BI), followed by the Perceived Usefulness (PU). So, in order to increase the users' BI, the E-learning service providers should pay more attentions to improve the users' feeling on PEOU and PU. For example, simplifying the operations and optimizing the services by technical means to achieve higher service accessibility, quicker visiting response, higher watching fluency and timelier obstacle elimination assistance are critical to improved users' PEOU. And, enriching the quantity at the same time improving the quality of the E-learning materials are the important ways to rise users' PU.

(b) Social Influence (SI) and Cost Tolerance (CT) also show significant influences on users' Behavioral Intention (BI), implying that the socio-economic factors may affect the college students' application behavior towards E-learning service. Hence, the service providers can pointedly give some discounts to the college students, especially to those who recommend other students to apply the service. In these ways, the elder one will have more motivation to recommend and more new customer will involve.

(c) An important finding is that all the above four mentioned variables, i.e., PEOU, PU, SI and CT, are indirectly affect BI through an intermediate variable AU (Attitude of Use). So, AU serves as a "unique bridge" between the four mentioned variables and BI, which shows its special and crucial status in the model. Thus, the service providers should insist to improve the users' AU by various means especially those can drive users' "persist in use" and "recommendation".

### IV. CONCLUSIONS

This paper investigates the factors that influence the college students' using behavior towards E-learning services by applying an improved TAM (Technology Acceptance Model). Online questionnaire survey is conducted to collect data and

Structural Equation Model (SEM) is employed to investigate the casual relations of the latent variables in the theoretical model. The model is proved to be with good fitness, and plenty of findings are obtained. Perceived Ease of Use (PEOU) is verified to be the variable has the highest total effect to the users' Behavioral Intention (BI) in the E-learning application, followed by Perceived Usefulness (PU). Besides, Social Influence (SI) and Cost Tolerance (CT) also have significant indirect effects on Behavioral Intention (BI). Based on this, we propose some suggestions for the E-learning platforms/companies to raise the using behavior of the college students towards their services.

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