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What Influences User Satisfaction in Virtual Learning Communities? The China Experience

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***Abstract*—Virtual Learning Communities(VLCs) are increasingly being used in lifelong learning, however, little is known about what factors affect user satisfaction in VLCs in China. This study analyzes user satisfaction of the VLCs, represented by ZhiHu, Wiki, Guokr and MOOC etc, by analyzing the data of 1140 valid questionnaires collected from universities and colleges. The aims of this study are twofold: (1) to investigate what a cohesive set of factors influence the satisfaction of VLCs, and (2) to discuss the implications for theory and practice, as well as suggestions for future research. The results show that learning outcome expectation, flow of experience, sense of belong, perceived usefulness, perceived interaction and perceived openness all have significant positive impacts on user satisfaction.**

Keywords—Virtual Learning Communities, Entropy method, OLS regression, Perceived openness, Satisfaction

I. INTRODUCTION

With the rapid development of information technology and the continuous expansion of cyberspace, it is more common to use Virtual Learning Communities (VLCs) in lifelong learning. VLCs have become an important platform for online self-learning because of its convenience, equality, interaction and sharing. It is not only an important channel for people to disseminate knowledge, exchange knowledge and adopt knowledge, but also an important platform for promoting knowledge exchange and innovation in the whole society. More and more people are using VLCs to enhance knowledge capability and widen circles of acquaintance. Matzat [1] uses survey data from 26 online communities for secondary education teachers in The Netherlands and find that VLCs enhance teachers' professional development through improving their teaching skills, improving their knowledge about their school subject, and receiving information about vacancies. Strunga[2] founds that VLCs can consolidate students' professional identity, opening possibilities for entrepreneurship and innovation.

There has been a growing interest in examining the factors that promote use satisfaction in VLCs. Some scholars do research from perspective of technology. They expand the model of information, such as the expectation–confirmation model (ECM), the technology acceptance model (TAM), the theory of planned behavior (TPB), the continuous use model of information system (ECM-ISC), Unified theory of acceptance and use of technology (UTACU) to hypothesize a theoretical model to explain and predict the user satisfaction in VLCs. Some scholars adopted psychological factors such as flow of experience, sense of belong to explain user satisfaction. However, still few studies examined them from both psychological and environmental perspectives. This study focuses on what factors affect user satisfaction in VLCs in China.

II. DATA, VARIABLES AND METHODOLOGIES

A. Data

Questionnaire survey is the main method of data collection in this study. There are two stages: the first stage is to form the initial questionnaire on the basis of relevant literature. Considering that most of the scales are in English, the "back translation" method is adopted to ensure the validity of translation and generate the final Chinese scale. Questionnaire items were measured by Likert scale 5, in which 5 indicated "complete agreement", 3 indicated "general" and 1 indicated "total disagreement". After the initial questionnaire was formed, relevant experts were consulted, and experienced personnel were invited to test the questionnaire. Then the content and format of the questionnaire were revised and improved according to expert opinions and test results. Finally, 85 questionnaires were issued, and the data were imported into SPSS with a reliability of 0.957, which met the quality standard of the formal questionnaire.

The second stage is the formal questionnaire survey. Taking the students of China University of Geosciences (Wuhan), Huazhong University of Science and Technology, Central South University of Finance, Economics, Law, Henan University, China University of Science and Technology, Hebei University of Geosciences, Wuhan Vocational and Technical College, Wuhan Vocational and Technical College of Information Communication and other universities and colleges as the main research objects, we collect and study by sending the address of "questionnaire stars" and issuing paper questionnaires through Wechat Group. User Satisfaction Data of Students and Teachers on Virtual Learning Community. A total of 1216 questionnaires were collected, 76 of which were invalid, excluding missing questions and inconsistencies. A total of 1140 valid questionnaires were collected, with a recovery efficiency of 93.75%. The demographic characteristics of the valid samples are shown in the table Ⅰ.

TABLE I. POPULATION STATISTICS OF QUESTIONNAIRE DATA

users' characteristics		Frequency	Relative frequency
Gender	Male	629	55.2%
	Female	511	44.8%
Age	17 years old and below	14	1.2%
	18-25 years old	888	77.9%
	26-35 years old	154	13.5%
	36-45 years old	59	5.2%
	46-55 years old	19	1.7%
	56 years old and above	6	0.5%
Education	High school and below	11	1%
	Junior College	146	12.8%
	Undergraduate	622	54.6%
	Master	309	27.1%
	Doctor	52	4.6%

[a.] Date Source: based on the sample data collected from questionnaire survey.

B. Variables

(1) Dependent variable. User satisfaction refers to the user compares the sum of the mental states generated by the virtual learning community before use and the actual experience after use. Bhattacherjee A, Alruwaie M and Oliver RL [3], [4], [5] developed a cognitive model of satisfaction decisions and post-purchase behavior.Zheng, Zhao [6] take the online forum, message board, news group and other information exchange virtual communities as research objects and define user satisfaction, is a user's emotional or psychological state following IT use experience. Zhang Weiwei and Bailu [7]take Weike China and other crowdsourcing communities as empirical research objects, and measure user satisfaction from three aspects: service satisfaction, pleasant experience and smooth process [8] . measures user satisfaction from two aspects: experience satisfaction and experience pleasure of using community taking ZhiHu as an example. Above this, this study defines satisfaction as the cognitive and emotional satisfaction of users after using virtual learning community. Cognitive satisfaction means that users are satisfied with the knowledge content and learning effect provided by the community. Emotional satisfaction means that users are satisfied with the learning process of using the community and are happy with the communication process. User satisfaction is a reflective construct measured by validated items. All control variables are measured by single-item questions. The composition of user satisfaction index is shown in Table Ⅱ.

TABLE II. DEFINITION OF LATENT VARIABLES OF USER SATISFACTION

Measurement dimension	Label	Definition
cognitive satisfaction	SAT1	users are satisfied with the knowledge content
	SAT2	users are satisfied with the learning effect
emotional satisfaction	SAT3	users are satisfied with the learning process
	SAT4	users are happy with the communication process.

(2) Independent variables. VLCs are derived from the concept of virtual communities. It is the product of the new concept of information technology and education in the network application. It not only has the social characteristics of the common virtual community, but also is an online learning system. Through the interaction between members, people with common interests and purposes are connected through virtual media on the Internet to meet user cognitive needs and emotional needs. Based on the information system continuous use model (ECM-ISC), this paper selects the key factors of user satisfaction from the perspective of user psychology and environment. Learning outcome expectations is defined as the extent to which learners believes that using VLC will help him or her to attain gains in their learning knowledge outcome expectancy. Flow of experience is used to describe the emotional or psychological state of a person's overall focus on the activity [9]. Sense of belonging is defined as the experience of personal involvement in VLCs such that persons feel like an integral part of it [10]. Perceived usefulness is a cognitive belief salient. Perceived interaction is defined as the degree of human-computer interaction and interpersonal interaction perceived by users in the process of participating in VLCs[11]. Among them, human-computer interaction refers to the user's interaction with the system and support for user control and other characteristics. Interpersonal interaction includes interpersonal connectivity and interpersonal responsiveness. Perceived openness refers to the degree to which the system is open to the outside world. Perceptual openness can be measured from three aspects: user's universality, multi-terminal adaptability and software compatibility. The descriptive statistics of the above variables are shown in Table Ⅲ.

TABLE III. DESCRIPTIVE ANALYSIS OF INDEPENDENT VARIABLES

Variable Names	Label	Definition	Min	Max	Mean	S.D.
Learning outcome expectation	LOE1	The experience I gained in the virtual learning community was better than I expected.	1	5	3.340	0.7768
	LOE2	The gains I got were bigger than I expected.	1	5	3.377	0.7640
Flow of experience	FOE1	The learning environment allows me to focus on learning	1	5	2.985	0.8449
	FOE2	When I study, I feel that time flies fast.	1	5	3.307	0.8332
	FOE3	I can immerse myself in learning activities when I use VLCs	1	5	3.264	0.7848
Sense of belong	SOB1	I feel like I am part of a virtual learning community.	1	5	3.157	0.8382
	SOB2	Some people in the community are my friends.	1	5	3.033	0.8610
	SOB3	Have a strong sense of belonging to the community	1	5	2.859	0.8023
Perceived usefulness	PU1	Can provide me with useful information or knowledge	1	5	3.827	0.6900
	PU2	Can help me make friends	1	5	3.080	0.8923
	PU3	Can improve my learning efficiency	1	5	3.296	0.7767
Perceived interaction	PI1	I can easily access learning resources in VLCs	1	5	3.386	0.7538
	PI2	I can easily express or share views in VLCs	1	5	3.676	0.7407
	PI3	My questions in VLCs can be answered by others.	1	5	3.592	0.7123
Perceived openness	PO1	There are many people around me who study in VLCs	1	5	3.311	0.8289
	PO2	I can use mobile phones, computers, PAD and other terminals to learn in VLCs	1	5	3.882	0.7655
	PO3	I can use QQ, Weixin, Weibo and other software to share my learning results.	1	5	3.425	0.8956

[b.] Source: Calculated by the authors based on data from the questionnaire by using SPSS 22

C. Methodologies

(1) Entropy method. Compared with the subjective empowerment method, entropy method is an objective weighting method which can reflect the practical importance of the evaluation indexes. We used the entropy method to calculate the weight of indicators in user satisfaction index from four dimensions, i.e., using process, the result, communication process and knowledge content. To achieve this, firstly, we used AHP to establish the judgment matrix that was normalized to obtain the standard matrix. Then, we calculated the entropies and the weights of each indicator. Finally, we calculated the weights of each indicator by using the multiplier synthesis method. According to the entropy weight method, the weights of each indicator were multiplied by the standardized value and then we get user satisfaction index.

(2) OLS regression. We used the OLS regression model to analyze the impact of user satisfaction in VLCs. The variables of Learning outcome expectation, flow of experience, sense of belong, perceived usefulness, perceived interaction and perceived openness were included to analyze the influencing factors of user satisfaction in VLCs in China. The empirical model used in this paper was constructed as follows:

$$Si=\alpha+\beta1LOEi+\beta2FOEi+\beta2FOEi+\beta3SOBi+\beta4PUi+\beta5PIi+\beta6POi+\varepsilon \quad (1)$$

where, S refers to user satisfaction; LOE refers to Learning outcome expectation; FOE refers to flow of experience; PU refers to perceived usefulness; PI refers to perceived interaction; PO refers to openness; ε refers to error term.

III. RESULTS

A Use Satisfaction Index and Descriptive Statistical Analysis.

We constructed user satisfaction from the following four dimensions: use process, the result, communication process and knowledge content. The weights of each indicator were calculated by entropy method (see Table Ⅳ.). From the view of indicators, the satisfaction with using process accounts for the smallest weight (23.184%), followed by communication process (23.719%) then the satisfaction with the result accounts for the third weight(25.373%). Results indicate that the satisfaction with knowledge content makes the greatest contribution to the user satisfaction accounts for 27.724%, that is, the higher the user satisfaction in improving knowledge content in the future, the higher user satisfaction. It shows that user satisfaction with knowledge content makes the greatest contribution to the user satisfaction index. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

TABLE IV. INDICATORS WEIGHTS OF USER SATISFACTION INDEX

Dimensions	Indicators	Weight
using process	Satisfaction with the using process (SAT1)	23.184%
the result	Satisfaction with the result of application (SAT2)	25.373%
communication process	Satisfaction with the communication process (SAT3)	23.719%
knowledge content	Satisfaction with knowledge content (SAT4)	27.724%

[c.] Source: calculated by the entropy method.

B Influencing Factors of User Satisfaction in VLCs in China.

This study regards user satisfaction as dependent variable, learning outcome expectation, flow of experience, sense of belong, perceived usefulness, perceived interaction and perceived openness as independent variable, and carries out multiple linear regression. The results of the model estimation are shown in Table 6.

Premise hypothesis of regression analysis: Satisfy normal distribution; sample is random sampling, subjects are independent of each other, thus satisfying sample independence; R^2 =0.567, DW=1. 916, P<0. 05, so the premise assumes that the regression equation is meaningful.

TABLE V. REGRESSION ANALYSIS RESULTS OF USER SATISFACTION

Model	Non-standardized coefficient		standardized coefficient	T	P-value	Collinear statistics	
	B	*Standard error*	*Beta*			*Tolerance*	*VIF*
（constant）	.252	.084		3.014	.003**		
LOE2	.110	.022	.142	5.031	.000***	.488	2.048
PI1	.114	.020	.143	5.715	.000***	.616	1.624
FOE3	.102	.019	.135	5.384	.000***	.614	1.628
PO1	.080	.016	.112	4.975	.000***	.769	1.300
SOB3	.085	.018	.115	4.669	.000***	.633	1.579
PO2	.085	.019	.110	4.448	.000***	.631	1.584
LOE1	.099	.021	.130	4.673	.000***	.500	2.002
PI2	.079	.020	.095	4.001	.000***	.679	1.473
PU3	.065	.019	.086	3.414	.001***	.613	1.632
SOB1	.044	.018	.063	2.491	.013*	.610	1.640
PO3	.035	.015	.053	2.363	.018*	.759	1.318

[d] Note: ***, **, * represent 0.1%, 5% and 10% significant levels, respectively.

[e] Source: calculated by SPSS 22 software.

As can be seen from Table5, the VIF is less than 2, so there is no multicollinearity. Among the influence factors. The regression equation expression is:

SAT=0.252+0.110*LOE2
+0.114*PI1+0.102*FOE3+0.080*PO1+0.085*SOB3+0.085*PO2+0.099*LOE1+0.079*PI2+0.065*PU3+0.044*SOB1+0,035*PO3 (2)

IV. DISCUSSION

By using the method of stepwise regression in SPSS for independent variables, we find that the independent variables which are FOE1, FOE2, SOB2, PU1, PU2, PI3 have no significant correlation with user satisfaction. According to Table Ⅴ., we find that:

A. LOE1, LOE2, FOE3, SOB1 and SOB3 have Significant Correlation with User Satisfaction

Learning outcome expectation, flow of experience and sense of belong are variables that belong to the user's psychological level. Learning outcome expectation consists of LOE1 and LOE2. Both LOE1 and LOE2 are positively correlated with user satisfaction at the level of 0.001. Their correlation coefficients are 0.099 and 0.110. Flow of experience consists of FOE1, FOE2 and FOE3. Only FOE3 is positively correlated with user satisfaction at the level of 0.001. Its correlation coefficients is 0.102. Sense of belong consists of SOB1, SOB 2 and SOB 3. Among them, SOB1 and SOB3 are positively correlated with user satisfaction. Their correlation coefficients are 0.044 and 0.085. SOB1 is positively correlated with user satisfaction at the level of 0.05. SOB3 is positively correlated with user satisfaction at the level of 0.001.

B. PU3, PI1, PI2, PO1, PO2 and PO3 have Significant Correlation with User Satisfaction

Perceived usefulness, perceived interaction and perceived openness are variables that belong to the system characteristics level. Perceived usefulness consists of PU1, PU2 and PU3, Only PU3 is positively correlated with user satisfaction at the level of 0.001. Its correlation coefficients is 0.065. Perceived interaction consists of PI1, PI2 and PI3. Among them, PI1 and PI2 are positively correlated with user satisfaction. Their correlation coefficients are 0.114 and 0.079. PI1 and PI2 are positively correlated with user satisfaction at the level of 0.001. Perceived openness consists of PO1, PO2 and PO3. Their correlation coefficients are 0.080, 0.085 and0.035. PI1 and PI2 are positively correlated with user satisfaction at the level of 0.001.PI3 is positively correlated with user satisfaction at the level of 0.05.

V. CONCLUSIONS

In this paper, we introduced learning outcome expectation, flow of experience, sense of belong, perceived usefulness, perceived interaction and perceived openness to find what influences users' satisfaction in VLCs in China. The main conclusions are as follows:

A. Learning Outcome Expectation, Flow of Experience and Sense of Belong all have Significant Positive Impacts on User Satisfaction.

Different latent variables have different effects. Our findings indicate that we can improve user learning expectations through enhancing the experience expectation and the result expectation, improve the user's flow experience through design learning activities to motivate user immersed in VLCs, improve user sense of belong through various mechanisms which make users feel that they are part of the community and have a strong sense of belonging to the community. This series of measures related to emotional states such as user psychology can effectively improve user satisfaction.

B. Perceived Usefulness, Perceived Interaction and Perceived Openness all have Significant Positive Impacts on User Satisfaction.

Different latent variables have different effects. Our findings indicate that we can improve perceived usefulness through enhancing user learning efficiency, improve perceived interaction through developing a friendly system environment to facilitate users' access to resources and sharing views, improve perceived openness through attracting the surrounding users, meeting the needs of different user scenarios, facilitating users to share information anytime, anywhere with mainstream social software. This series of measures related to cognition and emotional states by improving system characteristics can effectively improve user satisfaction.

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