Antecedents of Continuance Intention of Technology Acceptance Model (TAM) Associated with the Learning Management System (LMS) in Online-Merge-Offline (OMO) Learning

Shasha Yu[1,2(✉)], Xuejun Zhang[3], Liang Wu[4], and Bo Wang[1]

[1] Xihua University, Chengdu, China
yushasha@mail.xhu.edu.cn
[2] Assumption University, Bangkok, Thailand
[3] Beihang University, Beijing, China
zhxj@buaa.edu.cn
[4] Tianfu Research Institute, Beihang University, Chengdu, China

Abstract. The development of technology has promoted the progress of knowledge acquisition. This study aims to explore the primary predictors of motivation of Chinese students to continue using learning management system (LMS) in online-merge-offline (OMO) learning. Investigate the effects of the major predictors of system quality, instructor quality, and information quality on perceived usefulness and perceived satisfaction of the technology acceptance model (TAM), examine whether the main determinants of actual use predict the continuance usage intention of LMS, in response to the needs of university students to continue to use LMS for learning and development during the COVID-19 pandemic. Based on a quantitative approach using survey questionnaires as a data-gathering instrument. Cross-sectional data were obtained through an online survey of 624 students from Xihua University in China. Structural equation modeling (SEM) and Confirmatory factor analysis (CFA) are employed in this research. The results reveal that System quality and Instructor quality are the antecedents for improving learners' perceived usefulness and satisfaction are the crucial factors to promote learners to continuance intention of LMS to participate in OMO learning.

Keywords: learning Management system (LMS) · Technology acceptance model (TAM) · Information system success model (ISSM) · Continuance intention (CI) · online merge offline (OMO) learning

1 Introduction

With the normalization of the global COVID-19 pandemic, the rapid development of information and communications technology has caused profound changes in traditional education methods (Chadda & Kaur, 2021). As an innovative practice of the integration

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of information technology and teaching, the online-merge-offline (OMO) learning is widely concerned (Rokhim et al., 2022). OMO learning is not a simple "online teaching" add "offline teaching", nor does it just add some information technology means to traditional teaching (Rughoobur-Seetah & Hosanoo, 2021). It is to configure knowledge into different teaching forms through knowledge classification of different cognitive objectives, to give full play to the maximum efficiency of online and offline teaching (Xiao et al., 2019).

Thus, the use of various learning Management system (LMS) became a necessity for OMO learning (Rokhim et al., 2022). Combined with the powerful technical support, formed a set of professional, efficient learning function, and created a digital learning environment for managing all aspects of the learning process (Kant et al., 2021). (Cheng, 2021) considered that LMS provides content and guidance online, enabling streamlined communication between teachers and learners. Further, (Zwain, 2019) agreed with LMS allows learners' progress to be recorded and tracked within the platform, helping to reduce costs for training institutions, universities, or businesses. In the field of education are several well-known LMS abroad, such as Moodle, Canvas, Blackboard, etc. (Rokhim et al., 2022), and domestic LMS in china, such as Rain Classroom, MOOCs, Treenity, WeChat, Tencent Conference, etc.

However, the development of OMO learning in universities is still infancy, the acceptance and preference of LMS by learners remains uncertain. For this reason, education scholars have done extensive research on this issue, (Mohamed Riyath & Muhammed Rijah, 2022) employed evidence from Sri Lanka, it was confirmed that LMS providing wider access also meant inadequate regulation and potential technical problems. LMS has been designed to be as user-friendly as possible; however, some learners still find it difficult to use (Rokhim et al., 2022). It is proposed that the application of ICT reaches the level of integration, and students can switch between different learning software's, platforms, and systems quickly and smoothly (Kant et al., 2021). If students have a deep understanding of the application of LMS and extensive practical knowledge, so they can gradually expand and innovate the acceptance and use of technological software (Zwain, 2019). How to improve students' intention to continue and explore the antecedents that affect students' acceptance of LMS are worthy of study (Kant et al., 2021; Mohamed Riyath & Muhammed Rijah, 2022; Rokhim et al., 2022).

Consequently, the objectives of this study are to:

(1) Investigate the main predictors of the actual use of LMS in OMO learning.
(2) Examine whether the main determinants of actual use can predict the continuance intention of using LMS.

2 Theoretical Background

2.1 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is proposed by (Davis, 1989), utilizes rational action theory to investigate user acceptance of the information system, aiming to explain

the decisive factors widely accepted by computer. Davis (1989) emphasized the requirement for understand the motivations behind user acceptance and rejection of apprenticeship systems, with the broader intention of being able to forecast, interpret, and modernize them. According to TAM, when a new technology is market-oriented, intention determines their acceptance of the proposed technology (Davis, 1989), perceived usefulness, perceived ease of use and perceived Satisfaction are factors that measure intention. Through the years, TAM became an advanced science theory for explore the uptake of learning technologies by educational participants ((Nikou & Maslov, 2021)). Studies have evaluated the applicability of TAM to learning management systems (LMS) (Mohamed Riyath & Muhammed Rijah, 2022; Rokhim et al., 2022).

2.2 Information System Success Model (ISSM)

The Information System Success Model (ISSM), originally brought forward byDeLone (1992), include exogenous factors of system quality and information quality. ISSM confirms that information quality, system quality, instructor quality, and satisfaction are factors that influence intention (Hussein et al., 2020; Rui-Hsin & Lin, 2018). The ISSM model has been extensively utilized for exploring and investigating user intentions in several research fields, such electronic commerce, social networking services and knowledge management systems. In addition, ISSM has also been used by many scholars to illustrate the intention of teachers to use LMS in distance-learning environments (Hussein et al., 2020). There is compelling evidence that ISSM is anticipate and explain the intention of users to reuse various LMS (Jaiyeoba & Iloanya, 2019; Nikou & Maslov, 2021).

3 Literature Review and Hypotheses Development

Information quality (InfQ).InfQ refers to the value and usefulness of the output of an LMS to users and the ability of a system to provide accurate and extensive information (DeLone, 1992). (Zwain, 2019)proposed that if an LMS provides diversified and effective courses, users will believe that the LMS is capable of providing exact information, the LMS will therefore be considered appropriate. High-quality information can motivate learners to maintain their use of LMS and improve their appreciation of the system. Seddon (1997) demonstrated an important link between InfQ and perceived usefulness and satisfaction. In the educational sector, scholars have found such positive effects in online learning (Cheng, 2014; Rui-Hsin & Lin, 2018).

Therefore, this study makes the following recommendations:

H1: InfQ has a significant impact on PU.
H2: InfQ has a significant impact on PS.

System quality (SQ). SQ reflects the functional performance of the LMS. Including system query capability, speed of file transfer, response time, and speed of access to software and equipment (DeLone, 1992). If the user's perception of the system's quality is prominent and secure, the system is perceived to be of usefulness and satisfaction

(DeLone, 1992). In the teaching process, the design of system functions can meet the expectations of learners or exceed the expectations, and learners' satisfactory immersion experience will enhance the perceived usefulness and positive confirmation of users' re-use (Abeygunasekera, 2021).

Therefore, this study hypothesized that:

H3: SQ has a significant impact on PU.
H4: SQ has a significant impact on PS.

*Instructor quality (InsQ).*InsQ is defined as the extent to which learners perceive the attitude and responsiveness of the practitioner, and the style of instruction and the extension of quality and support learners through LMS (Rughoobur-Seetah & Hosanoo, 2021). Given that the quality of instructors may be viewed as a dimension of the quality of services in the OMO learning environment. Instructor quality impact the enthusiasm, participation and attitude of learners in OMO learning (Xiao et al., 2019). When learners sense that their feedback is timely and helpful from instructor through LMS, it leads to enhanced acceptance from learners. It is equally understandable that high-quality instructor can improve learners' satisfaction and perceived usefulness with LMS (Cheng, 2014).

Therefore, the following hypotheses put forward:

H5: InsQ has a significant impact on PU.
H6: InsQ has a significant impact on PS.

*Perceived Usefulness (PU).*PU explaining learners' beliefs about using the LMS to achieve improved learning outcomes (Hussein et al., 2020). Cheng (2014) recognized that the perceived usefulness of LMS would affect the continuance intention. (Lwoga & Komba, 2015) believed that the utility of LMS is affected by the quality of information, instructor and system. Scholars also found that learners' PU had a positive and meaningful impact on their continuance intention of using LMS in OMO learning during the pandemic (Nikou & Maslov, 2021).

Therefore, H7 was hypothesized that:

H7: PU has a significant impact on CI.

*Perceived Satisfaction (PS).DeLone (*1992*)* proposed that perceived satisfaction is an important measurement to measure the success and effectiveness of information system (Rui-Hsin & Lin, 2018). Perceived satisfaction mainly reflects the cumulative feeling with LMS of users, which is expressed as the gap between the actual performance perceived by users and their expectations (Jaiyeoba & Iloanya, 2019).

Consequently, the following hypothesis put forward:

H8: PS has a significant impact on CI.

*Continuance intention (CI).*CI is the main measurement variable of TAM and ISSM, which refers to the willingness to engage in an activity (Nikou & Maslov, 2021). In this

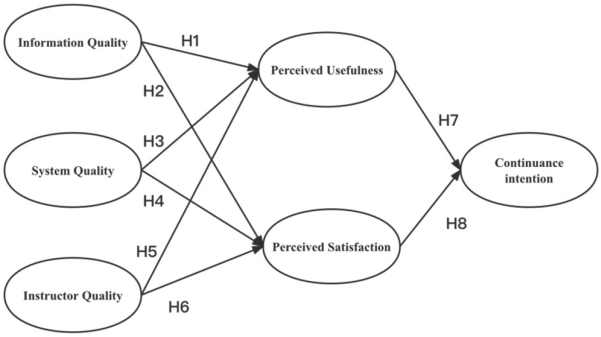

Fig. 1. Conceptual framework of this study

study, it mainly refers to the willingness of learners to continue using LMS in OMO learning (Rughoobur-Seetah & Hosanoo, 2021). Previous studies have proved that PU and PS have significant effects on intention (Jaiyeoba & Iloanya, 2019) Fig. 1 illustrates the research model suggested in this study.

4 Methodology

The methodology used for this study was a positivistic approach, and a quantitative research design was employed. In studies on continuity intent, most researchers have adopted the positivist paradigm with quantitative approaches (Abeygunasekera, 2021).

The target population consists of Chinese students from Xihua University, distributed into School of Management, Economics, Humanities, Energy and Power Engineering, Aeronautics and Astronautics, and Materials Science and Engineering. The data collection instrument is only applied to those who have participated in OMO learning with LMS for more than one semester, ensuring that the respondents have in-depth experience with LMS (Kant et al., 2021; Mohamed Riyath & Muhammed Rijah, 2022).

4.1 Measures and Pre-test

This study is based on a quantitative approach using survey questionnaires as a data-gathering instrument. Responses to InfQ, SQ, InsQ, PU, PS and CI were measured on a 5-point Likert scale ranging from 1 (strongly in disagreement) to 5 (strongly in agreement) (Rughoobur-Seetah & Hosanoo, 2021).After extensive literature review, the authors selected and revised the scale Item adopted by previous studies and compiled a structured questionnaire to measure these structures.

To ensure the validity of the investigate instrument, item-objective consistency (IOC) was applied before data collection (Kulophas et al., 2018). Three professors from economics and management, communication and education were invited to evaluate the scale items. Items that pass the evaluation can enter the large-scale data acquisition phase. Cronbach's Alpha coefficient was used to evaluate the reliability of the instrument, with a value ranging from 0.916 to 0.949 (Table 2), demonstrating a satisfactory level of reliability.

4.2 Data Collection

This study used cross-sectional data to explore the impact of quality factors on students' willingness to continue using LMS to participate in OMO learning. Collect raw data directly from students to ensure the authenticity of the data. Due to financial and Time Constraints, the sample is stratified sampling, and WENJUANXING is used for online data collection. The instructor was arranged to explain when data collecting for ensuring that the respondents were clear about the definition of each item. After calculating by A-priori Sample Size Calculator for SEM, the result recommended minimum sample size is 425. To avoid the effect of invalid access, 650 questionnaires were distributed, the response rate of a total of 624 usable responses was 96%.

4.3 Data Analysis

Confirmatory factor Analysis (CFA) is frequently tested by modelling structural equations (Hussein et al., 2020). In scientific research per se, the CFA process is the testing process for the measurement model. Reliability analysis was used to evaluate the stability and consistency of each latent construct measurement item (Cheng, 2014). Numerous studies have shown that Structural Equation Modeling (SEM) can effectively establish and estimate the causal relationship between latent variables (Kamal & Illiyan, 2021). Path analysis technique was employed to test the hypothetical relationships between constructs, which is an extension of the linear regression used for studying the structural relations between latent variables (Al Natour & Woo, 2020; Hussein et al., 2020). The maximum likelihood method was used to estimate the model, which is implemented in AMOS 26.0 software. Other analyses have been conducted using SPSS 22.0 and JAMOVI for Mac.

5 Results

5.1 Demographic Information of Respondents

The sample consisted of 624 respondents, most of them were male (66.3 percent), with an average age of 18–25 years, and were full-time students (99.3 percent). All participants took part in course units using LMS during their degree. Overall, 74.7 percent of the respondents majored in engineering, followed by science (15.2 percent) and The Liberal Arts (10.1 percent). For the LMS selection, 51.1 percent of the respondents had experience in using Rain classroom, Treenity with 35.7 percent and GAOXIAOBANG with 13.2 percent.

5.2 Descriptive Statistics

The measurement of variability from central tendency of mean and standard deviation (SD) was described as descriptive analysis as demonstrated in Table 1. The average scores or mean reflected in the standard deviation showed how far of each value in set of scores from the mean per usage of Five-point Likert Scale. The mean score of six constructs was higher than the median of 3. All the standard deviations (SD) are below

Table 1. Descriptive analysis of the scales

Scales	Minimum	Maximum	Mean (SD)	Skewness	Kurtosis	α
InfQ	**1**	5	**3.83(0.584)**	**-0.139**	**1.07**	**0.932**
SQ	**1**	5	**3.89(0.557)**	**-0.108**	**1.1**	**0.929**
InsQ	**1**	5	**3.84(0.596)**	**-0.185**	**1.14**	**0.918**
PU	**1**	5	**3.79(0.648)**	**-0.172**	**0.474**	**0.949**
PS	**1**	5	**3.83(0.664)**	**-0.311**	**0.687**	**0.945**
CI	**1**	5	**3.81(0.637)**	**-0.202**	**0.554**	**0.916**

Source: Elaborated by the authors

1.00, indicating that the difference of learners' opinion is very small. The normality test result reveals the systematic distribution of data and well-shaped despite of the deviation of skewness and kurtosis were between -2 and + 2 as recommended by Browne (1993).

5.3 Convergent Validity and Discriminant Validity

Construct validity is used in CFA as a vital statistical test. The score can verify and confirms the relationship among distinct variables (Nikou & Maslov, 2021). Construct validity resides with the verifications of convergent and discriminant validity to endure the accuracy of data (Rughoobur-Seetah & Hosanoo, 2021). Convergent validity was approved by the acceptable value as results of fit model whereas discriminant validity was confirmed per the value is greater than all inter-construct/factor correlations (Rokhim et al., 2022).

The result from CFA analysis illustrates the model displayed all model-fit in acceptable threshold including CMIN/df = 2.886, GFI = 0.921, AGFI = 0.891, CFI = 0.975, NFI = 0.962, TLI = 0.968 and RMSEA = 0.055. Per the result of fit model which expressed all acceptable values, the convergent validity was certified. Subsequently, Table 2 demonstrated the model measurement considering all these results were approved. Factor loading value meet the requirement of higher than 0.50, p value lower than 0.05 Hair (1998). Moreover, all results are well above acceptable standards of CR (pc) higher than 0.7 and AVE (pv) higher than 0.5, it means that all latent variables have good construction validity and convergence validity.

According to Fornell (1981), The square root of AVE is a reliable means of evaluating discriminate validity. The outputs have proven to have convergent and discriminant validity, since that the t-value of each item exceeded the 1.95 value ($p < 0.05$). Table 3 demonstrates that the discriminant validity was accepted in the study.

5.4 Hypotheses Testing

Structural Equation Model (SEM) analysis after modification presented x2/df = 2.280, GFI = 0.938, AGFI = 0.910, CFI = 0.984, TLI = 0.978, NFI = 0.971, and RMSEA = 0.045 (Fornell, 1981). Means that the SEM analysis results meet the goodness of

Table 2. Composite Reliability (CR) and Average Variance Extracted (AVE)

Variable	Factor Loading	S.E.	T-value	CR (pc)	AVE (pv)
Information Quality (InfQ)				0.93	0.690
InfQ1	0.788				
InfQ2	0.842	0.039	26.365***		
InfQ3	0.824	0.043	22.229***		
InfQ4	0.861	0.043	24.531***		
InfQ5	0.869	0.041	24.885***		
InfQ6	0.795	0.043	22.132***		
System Quality (SQ)				0.921	0.701
SQ1	0.821				
SQ2	0.825	0.032	28.971***		
SQ3	0.835	0.037	25.132***		
SQ4	0.834	0.041	25.055***		
SQ5	0.869	0.040	26.728***		
Instructor Quality (InsQ)				0.918	0.736
InsQ1	0.851				
InsQ2	0.856	0.032	30.170***		
InsQ3	0.849	0.033	27.023***		
InsQ4	0.876	0.032	29.255***		
Perceived Usefulness (PU)				0.947	0.816
PU1	0.913				
PU2	0.908	0.026	37.678***		
PU3	0.911	0.026	38.050***		
PU4	0.882	0.028	34.751***		
Perceived Satisfaction (PS)				0.934	0.825
PS1	0.892				
PS2	0.940	0.021	47.147***		
PS3	0.892	0.024	39.126***		
Continuance Intention (CI)				0.909	0.715
CI1	0.916				
CI2	0.871	0.028	33.145***		
CI3	0.799	0.035	26.064***		
CI4	0.790	0.034	27.064***		

Remark: CR = Composite Reliability, AVE = Average Variance Extracted.
*** = Significant at the 0.05 significant levels ($p < 0.05$).

Table 3. Correlation between the constructs

	InfQ	SQ	InsQ	PU	PS	CI
InfQ	**0.831**					
SQ	**0.855*** **	**0.837**				
InsQ	**0.856*** **	**0.861*** **	**0.860**			
PU	**0.820*** **	**0.794*** **	**0.875*** **	**0.903**		
PS	**0.826*** **	**0.794*** **	**0.853*** **	**0.892*** **	**0.908**	
CI	**0.779*** **	**0.785*** **	**0.813*** **	**0.835*** **	**0.859*** **	**0.846**

Note: *** = p-value < 0.01; The diagonally listed value is the AVE square roots of the variables.
Source: Elaborated by the authors

Table 4. Hypotheses testing results

Hypothesis	Standardized path coefficient (β)	t-value
H1: Information Quality (InfQ) => Perceived Usefulness (PU)	-0.224	-1.244
H2: Information Quality (InfQ) => Perceived Satisfaction (PS)	-0.102	-0.624
H3: System Quality (SQ) => Perceived Usefulness (PU)	-1.047	-4.632***
H4: System Quality (SQ) => Perceived Satisfaction (PS)	-0.904	-4.504***
H5: Instructor Quality (InsQ) => Perceived Usefulness (PU)	2.176	8.064***
H6: Instructor Quality (InsQ) => Perceived Satisfaction (PS)	1.942	8.526***
H7: Perceived Usefulness (PU) => Continuance Intention (CI)	0.464	6.342***
H8: Perceived Satisfaction (PS) => Continuance Intention (CI)	0.466	6.536***

Note: *** = p-value < 0.001.
Source: Elaborated by the authors

fit hreshold. Properties of the causal paths, including standardized path coefficients (β), t-values, and squared multiple correlations (R^2), are visualized in Fig. 2. As for antecedents to learners' beliefs, System Quality (SQ) had significant effects on Perceived Usefulness(PU) (β = -1.047,t = -4.632, p<0.001) and Perceived Satisfaction(PS) (β = -0.904,t = -4.504, p<0.001),hence, H3 and H4 are supported. Instructor Quality (InsQ) had significant effects on Perceived Usefulness (PU) (β = 2.176, t = 8.064, p<0.001) and Perceived Satisfaction (PS) (β = 1.942, t = 8.526, p<0.001), thus, H5

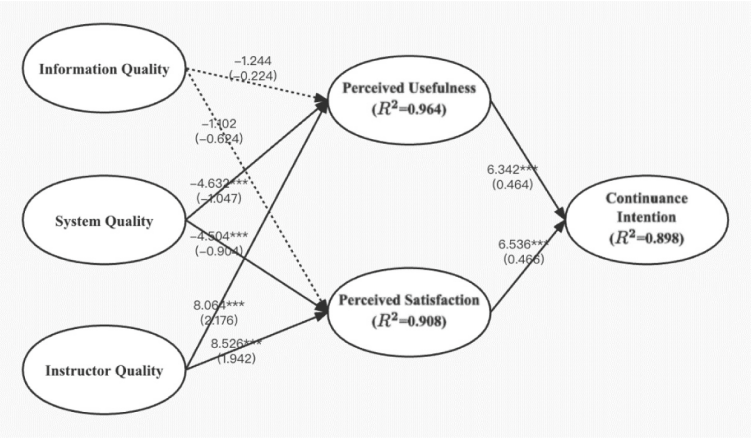

Fig. 2. Structural mode of this study

and H6 are supported. Perceived Usefulness (PU) had significant effects on Continuance Intention (CI) ($\beta = 0.464$, t = 6.342, $p<0.001$), therefore, H7 are supported. Perceived Satisfaction (PS) had significant effects on Continuance Intention (CI) ($\beta = 0.466$, t = 6.536, $p<0.001$)), therefore, H8 are supported. In construct, Information Quality (InfQ) is not found to have a significant impact on Perceived Usefulness (PU) (β = -0.224, t = -1.244, $p>0.1$) and Perceived Satisfaction (PS) (β = -0.102, t = -0.624 $p>0.1$), as a result, H1 and H2 are not supported, per Table 4. In the following, the squared multiple correlations (R^2) of Perceived Usefulness (PU), Perceived Satisfaction (PS), and Continuance Intention (CI), were 0.964, 0.908, 0.898, respectively.

6 Discussion

Obviously, this study provides a better understanding of the impact of PU and PS to CI. Extensive discussions are outlined below.

System quality. SQ had a significant impact on PU and PS. The results explained that the quality of the system is an important criterion for assessing the utility of the system. In the operation process, learners mainly pay attention to the interactive performance and controllable performance of the system. Particularly, communication and loading speed had a significant impact on learners' experience. In addition, easy to operate and interesting system function can improve user satisfaction. Most learners are pleased that LMS can present the teaching material in multimedia and legible form.

Instructor quality. InsQ makes an obvious contribution to the certification of PU and PS. Implicating that if the instructor is friendly and cares about the learning situation of the learners, and timely answers the questions of the learners through the LMS can significantly improve the satisfaction of the learners. Although the communication is online, the teaching style of the instructor can still be displayed through LMS. The teacher who represents funny, humorous, and enthusiastic will stimulate the students' desire to study, as a result to increase their continuance intention.

Information quality. Contrary to prior research, no significant effect of information quality on PU and PS was found in this study. This was not beyond the researchers' expectations. Previously, Rughoobur-Seetah and Hosanoo (2021) and Aboelmaged (2018) have found that Information quality have no effect on students' CI to use LMS. This is a valuable discovery. Hypothetical rejection perhaps because it is easy to acquire knowledge, the quality of information will not be reduced in OMO learning but more informative than offline learning.

Perceived Usefulness and Perceived Satisfaction. As expected, the results of this study strongly support the model demonstrated by TAM and ISSM theory. PU and PS contributed significantly to the confirmation of continuance intention. When learners feel that the LMS has promoted the improvement of learning efficiency and academic performance, learners perceived is useful and reluctant to continue. If the respondents deem that the usage of LMS can strengthen their control of learning behavior and effectively helps the completion of learning tasks, satisfaction, and intention to continue will be confirmed.

7 Implication

With the continuous spread of the global epidemic, exploring the effective implementation of LMS in OMO learning is a necessary topic for higher education in the future (Abeygunasekera, 2021). Strategic analysis of improving students' LMS use intention, to ensure the smooth progress of OMO learning in the post-epidemic era. First, according to the research results, it is suggested that LMS should improve the satisfaction level of learners from the aspect of system quality. Focus on optimizing the course quality of the platform, providing convenient links to learning resources and arranging the learning schedule reasonably, for efficiently enhance the users' viscosity of LMS. Learners pay special attention to communication and speed of response. In addition, flexible, convenient operation and interactive interface considerations are also necessary. Second, as an important character within OMO learning, instructors should guide students to learn efficiently, fully demonstrate the advantages of LMS through interesting interactions, make students better perceive the usefulness of OMO learning, and enhance students' learning enthusiasm to continue.

8 Limitation and Further Research Direction

This study provides a comprehensive understanding of quality factors that influence learners' intention to continue using LMS participating in OMO learning. The proposed research model combines TAM and ISSM theory, positioning its important motivation of students' CI of LMS. The conceptual model proposed in this study is supported by empirical evidence. It provides a more complimentary comprehension of students' ongoing OMO learning process than any of the theories considered separately. The major findings of the research are summarized below. System quality and instructor quality have important effects on PU and PS, and these factors together explain the continuing intention of learners to use LMS.

Some limitations should be noted indispensable, in this regard, following recommendation for further research warrant efforts. First, given the limited scope of this study, further research can extend the population to different education levels of respondents in other regions. Second, information quality was not confirmed in this study and is a subject worthy of revalidation. Further studies can use longitudinal data to verify again from the perspective of time dimension accumulation.

9 Conclusion

The epidemic has spurred the reform of university teaching model and further development of digital education. During the epidemic, the practice of large-scale OMO learning has changed from "emergency" to "normal", which requires the integration of new technologies and new perspectives.

At present, collaboration with the learning management system (LMS) in online-merge-offline (OMO) learning is the new trend of future education development. With the continued upgrading of LMS, OMO learning model will enter the stage of deep development. According to the research results, universities should vigorously promote the deep integration and development of LMS and OMO learning model, to provide a guarantee for the sustainable development of digital education in the digital era.

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[3] Ministry of Education of the People's Republic of China Industry-school cooperative education program < The blended teaching practice of "Foundation and Practice of College Students' Innovation and Entrepreneurship Education" based on mobile information technology > Project no. 201702031045.

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