SHORT PAPER

Examining the Quality of English Online Learning Using the D&M Information System Success Model

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ABSTRACT

This study addresses the quality issues of university English online learning. The Delone and Mclean (D&M) information system success model (ISSM) was used to explore the impact of online platforms on students' engagement in English learning. Empirical results indicate that both information and system quality significantly and positively predict students' intention to use, user satisfaction, and learning engagement. However, although service quality positively influences user satisfaction, it does not reach statistical significance and has a positive impact on usage intention. Both usage intention and user satisfaction serve as mediators in the effects of both information and system quality, while only usage intention acts as a mediator in the effect of service quality on learning engagement. The mediating effect of user satisfaction does not reach significance.

1   INTRODUCTION

Amidst the COVID-19 pandemic, online education in China has undergone significant, high-quality development and profound transformation [1]. In the post-pandemic era, the application of online education has become increasingly widespread, gradually transitioning from emergency to normalized teaching methods [2] [3]. According to a report released by the China Internet Network Information Center in 2022, the number of online teaching users in China has reached 377 million. New characteristics of online education, such as learning forms and management, emerged. Numerous scholars have focused on how to enhance the quality of students' online learning [4] [5] [6] [7] [8]. Process and summative assessments are the current mainstream evaluation modes [9], [10], and [11]. The "General Plan for Educational Assessment Reform" emphasizes the need to "improve outcome assessments, strengthen process assessments, and make full use of information technology,

thereby enhancing the scientific, professional, and objective nature of educational assessments" [12]. Thus, solely relying on outcome-oriented summative assessments does not align with the current educational assessment reform strategy. Process assessments, which emphasize tailored teaching approaches, can promptly reflect students' learning conditions and address the challenges of teachers' inability to perceive student behaviors in online settings. The online English teaching platform at Shandong University serves as a crucial component for non-English majors. The assessment of online learning as part of students' process assessments has garnered considerable attention from students. Enhancing the quality of students' online learning effectively and scientifically has become a topic of common concern among teachers, students, and administrators.

Since the proposal of the original Delone and Mclean (D&M) model, subsequent assessments of information system success have predominantly built upon this model. The improved model suggests that both system and information quality directly impact perceived usefulness and user satisfaction, with perceived usefulness being a determinant of user satisfaction, which in turn fosters user expectations of future system use and the net benefits derived from future use of information systems [13] [14] [15]. This study considers learning engagement (learning quality) [16] [17] as the net benefit and perceived usefulness as the intention to use, thereby constructing a theoretical model for learning quality on the university English online platform.

2 RESEARCH HYPOTHESIS

Figure 1 shows the theoretical model of this study. Information quality, system quality, and service quality are identified as independent variables that are hypothesized to influence the mediating variables, i.e., intention to use and user satisfaction, which in turn are expected to affect the dependent variable, i.e., learning engagement.
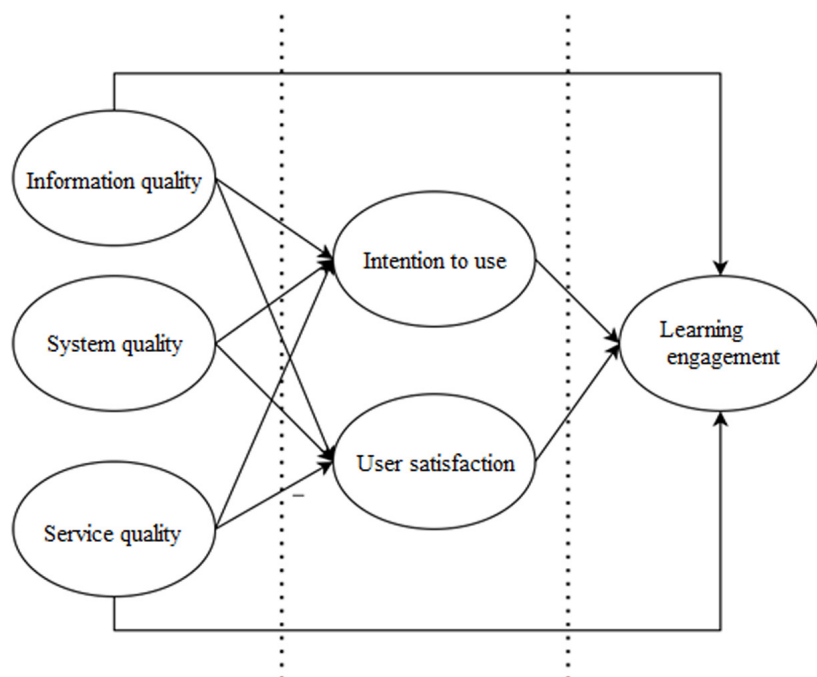

Fig. 1. Theoretical model of the study

3 RESEARCH METHODOLOGY AND IMPLEMENTATION

3.1 Sample selection and data collection

The online English teaching platform at Shandong University, designed as an integrated online learning space for English, supports not only daily online courses but also comprehensively records the teaching behaviors of instructors and students. Data for this study were sourced from the mandatory undergraduate courses in General English, Academic English, and Basic English offered during the autumn and winter terms of 2022–2023. Online learning behavior data were collected from students, and valid data were fitted and transformed through surveys and interviews, leading to the construction of the model. After a multistage selection process, a total of 3,872 valid samples were obtained.

3.2 Variable measurement

The study employs the enhanced D&M ISSM proposed by Delone et al. in 2003 [18], selecting variables across five dimensions, i.e., information quality, system quality, service quality, intention to use, and user satisfaction. The outcome variable of net profit was adapted to online learning engagement, measured according to the revised online learning engagement scale by Dixson et al. in 2015, which includes dimensions of skill, affect, participation, and performance. This scale is noted for its high reliability and validity.

3.3 Reliability and validity analysis

Analyses were conducted using Statistical Package for the Social Sciences (SPSS) 26.0 and Mplus 8.0. The reliability and convergent validity of the scales were assessed by examining Cronbach's α coefficient, factor loading, composite reliability (CR), and average variance extracted (AVE). As indicated in Table 1, the Cronbach's α coefficients for the variables of information quality, system quality, service quality, intention to use, user satisfaction, and learning engagement predominantly exceeded 0.8, suggesting good reliability of the scales. Factor loadings for all scales were above 0.5. CR for all scales exceeded the recommended threshold of 0.7 [19]; AVE values for all variables were above 0.5 [20], indicating satisfactory convergent validity of the scales. Thus, the scales used in this study demonstrate good internal consistency.

Table 2 presents the mean, standard deviation, inter-variable correlation, and the square root of the AVE for each variable. It was observed that the square root of AVE for each variable exceeded its correlation coefficients with other variables, indicating good discriminant validity (Bagozzi, 1981).

Based on Table 1, moderate correlations were found between information quality and system quality, as well as between intention to use and user satisfaction. Therefore, a collinearity diagnostic was performed for these groups of variables. The diagnostics for information quality revealed a tolerance (TOL) of 0.77 and a variance inflation factor (VIF) of 1.25, with an eigenvalue of 0.06 and a condition index (CI) of 6.68. Similarly, system quality displayed a TOL of 0.76, a VIF of 1.27, an eigenvalue of 0.02, and a CI of 15.32. For the variables intention to use and user satisfaction, the corresponding figures were TOL = 0.73, VIF = 1.30, Eigenvalue = 0.03, CI = 10.21, and TOL = 0.85, VIF = 1.30, Eigenvalue = 0.03, CI = 12.92, respectively. The results

showed that common diagnostics were within normal ranges; hence, the impact of data collinearity on this study is within acceptable limits.

Table 1. Reliability and convergent validity of variables (N = 3872)

Variable	Cronbach's α	Factor Loading	CR	AVE
Information quality	0.81	0.56~0.81	0.82	0.54
System quality	0.85	0.55~0.84	0.81	0.55
Service quality	0.79	0.71~0.82	0.78	0.52
Intention to use	0.89	0.65~0.86	0.84	0.66
User satisfaction	0.89	0.64~0.83	0.82	0.57
Learning engagement	0.79	0.78~0.86	0.82	0.61

Table 2. Correlation analysis of variables (N = 3872)

Variable	Mean	Standard Deviation	1	2	3	4	5	6
1. Information quality	3.48	0.56	**0.73**					
2. System quality	3.67	0.61	0.43**	**0.76**				
3. Service quality	2.52	0.78	0.04	−0.15*	**0.75**			
4. Intention to use	3.17	0.81	0.22**	0.16**	0.23**	**0.80**		
5. User satisfaction	3.72	0.79	0.41**	0.62**	−0.16	0.31**	**0.71**	
6. Learning engagement	3.24	0.68	0.34*	0.28*	0.12	0.32*	0.04	**0.72**

Notes: 1. *<0.05, **<0.01, ***<0.001; 2. Bold diagonal values represent the square roots of AVE.

3.4 Common variance

To mitigate the issue of common variance, measures were taken both before and after data collection. In the design of the questionnaire, consideration was given to the privacy concerns of respondents to reduce their apprehension and eliminate effects due to consistency motivation, implicit theories, or transient emotional states. Items were arranged in a randomized order to decrease common method bias (CMB) resulting from certain respondents' tendencies towards leniency or default responses. For the post hoc tests, the "controlling for the effects of a single unmeasured latent method factor" was employed to examine CMB. Comparative validation of the factorial analysis model M1 and the method-factor-included model M2 showed the following changes: $\Delta\chi^2/d = 0.023$, $\Delta GFI = 0.013$, $\Delta IFI = 0.011$, $\Delta NFI = 0.012$, and $\Delta RMSEA = 0$. According to Liu et al. (2015), changes in all fit indices were less than 0.03, indicating no substantial improvement with the inclusion of a common method factor. Therefore, the study does not exhibit significant common method bias.

3.5 Model validation and mediation testing

Regression analysis of platform quality on learning engagement. Table 3 presents the direct effects. Information quality was found to positively predict learning engagement ($\beta = 0.43$, $p < 0.001$; $R^2 = 0.13$, $p < 0.001$). System quality also showed

a positive predictive impact on learning engagement (β = 0.31, p < 0.01; R^2 = 0.11, p < 0.001). Service quality had a positive influence on learning engagement as well (β = 0.02, p < 0.05; R^2 = 0.09, p < 0.001).

Mediating effect testing of organizational commitment. The mediation effects were tested using PROCESS v3.2, employing the Bootstrap method with a sample size of 5000 for Model 4. The bias-corrected non-parametric percentile Bootstrap method was selected, with a 95% confidence interval. Results are depicted in Table 3.

a) The direct effect of information quality on learning engagement was not significant (LLCI = –0.28, ULCI = 0.31; confidence interval includes 0). However, the mediating effect of intention to use was significant (LLCI = –0.52, ULCI = –0.21; confidence interval does not include 0), and the mediating effect of user satisfaction was significant (LLCI = –0.19, ULCI = –0.04; confidence interval does not include 0). Both factors fully mediated the main effect of information quality on learning engagement.

b) The direct effect of system quality on learning engagement was not significant (LLCI = –0.18, ULCI = 0.31; confidence interval includes 0). The mediating effect of intention to use was significant (LLCI = –0.35, ULCI = –0.12; confidence interval does not include 0), and the mediating effect of user satisfaction was significant (LLCI = –0.19, ULCI = –0.05; confidence interval does not include 0). Both factors fully mediated the main effect of system quality on learning engagement.

c) The direct effect of service quality on learning engagement was not significant (LLCI = –0.19, ULCI = 0.27; confidence interval includes 0). The mediating effect of intention to use was significant (LLCI = –0.11, ULCI = –0.01; confidence interval does not include 0), whereas the mediating effect of user satisfaction was not significant (LLCI = –0.18, ULCI = 0.03; confidence interval includes 0).

4 CONCLUSION

4.1 Direct impact of platform quality on learning engagement

Both information and system quality significantly predicted positive effects on students' intention to use, user satisfaction, and learning engagement. However, the positive prediction of service quality on user satisfaction did not reach significance, although it positively influenced the intention to use.

4.2 Mediation testing

Intention to use and user satisfaction both acted as mediators in the principal effects of both information and system quality. Only the intention to use served as a mediator in the principal effect of service quality on learning engagement, while the mediating effect of user satisfaction did not meet the threshold.

5 THEORETICAL AND PRACTICAL IMPLICATIONS

5.1 Theoretical implications

This study innovatively combines students' online learning behavioral data with cross-sectional data, utilizing the established D&M success model to

quantitatively fit the quality of student learning on the English online platform at Shandong University. The results provide crucial guidance for subsequent English teaching reforms, student learning, and the optimization of assessment strategies.

5.2 Practical implications

- User base: The study involves a large number of users from Jinan and Qingdao, including undergraduate and postgraduate students, representing a diverse sample across the disciplines of humanities, sciences, medicine, and engineering.
- User engagement: Online learning forms an integral part of formative assessments, requiring students to complete designated tasks and tests. Consequently, a wealth of rich experimental data is available, providing a solid foundation for model construction and fitting.
- Scalability: Directors of teaching and research departments are members of the project team, which facilitates the implementation of findings in teaching practices. Their extensive experience in frontline teaching ensures effective supervision of the implementation process and offers strong references for subsequent platform improvements.

6 LIMITATIONS AND PROSPECTS

This study confirmed the positive impact relationships between information quality, system quality, service quality, and variables such as user intention, user satisfaction, and learning engagement. However, enhancing user engagement remains a challenge that mobile learning platforms need to address. Future construction of university English platforms should place further emphasis on the design of system interfaces, the quality of research content, online services, and personalized information dissemination. These improvements are aimed at increasing students' intention to use and satisfaction, ultimately benefiting their performance (learning engagement).

Table 3. Regression analysis and mediation testing (N = 3872)

Regression Analysis				
	Control Variables	Learning Engagement		
		Model 1	Model 2	Model 3
	−0.28***	0.43***	0.33***	0.35***
Information quality				
System quality		0.22***	0.31**	0.02**
Service quality				
R^2	0.08***	0.13***	0.11***	0.09***

(Continued)

Table 3. Regression analysis and mediation testing (N = 3872) *(Continued)*

Mediation Testing												
Independent Variable	Model	Effect	Se	t	P	LLCI	ULCI	Bootse	BootLLCI	BootULCI	Sig	
Information quality –> learning engagement	Direct effect	0.02	0.16	–0.07	0.84	–0.28	0.31				N	
	Total indirect effect	–0.37						0.12	–0.63	–0.24	Y	
	Intention to use	–0.34						0.13	–0.52	–0.21	Y	Support
	User satisfaction	–0.06						0.03	–0.19	–0.04	Y	Support
System quality –> learning engagement	Direct effect	0.04	0.23	0.18	0.67	–0.18	0.31				N	
	Total indirect effect	–0.26						0.75	–0.47	–0.17	Y	
	Intention to use	–0.18						0.05	–0.35	–0.12	Y	Support
	User satisfaction	–0.15						0.03	–0.19	–0.05	Y	Support
Service quality –> learning engagement	Direct effect	0.03	0.06	0.52	0.55	–0.19	0.17				N	
	Intention to use	–0.05						0.02	–0.11	–0.01	Y	Support
	User satisfaction	–0.07						0.02	–0.18	0.03	N	Not support

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