ORIGINAL RESEARCH

Investigating the Impact of the Community of Inquiry Presence on Online Learning Satisfaction: A Chinese College Student Perspective

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Purpose: This study investigated how teaching, social, and cognitive presence within the community of inquiry (CoI) framework impacts Chinese college students' online learning satisfaction through self-regulated learning and emotional states.

Methods: A total of 2608 Chinese college students from 112 universities completed a 38-item Likert scale survey measuring teaching, social and cognitive presence, self-regulated learning, emotional states, and online learning satisfaction after COVID-19 restrictions were lifted on December 7, 2022. The study examined the influence of teaching, social, and cognitive presence on online learning satisfaction, mediated by self-regulated learning and moderated by emotional states using SmartPLS. It also analyzed demographic differences using multi-group analysis in the model.

Results: The results indicated a significant positive relationship between a) self-regulated learning and online learning satisfaction, b) teaching presence, cognitive presence, and self-regulated learning, but no relationship between social presence and self-regulated learning. Additionally, self-regulated learning partially mediated the relationship between teaching and cognitive presence and online learning satisfaction. In contrast, self-regulated learning did not mediate the association between social presence and online learning satisfaction. Positive emotional states moderated the relationship between self-regulated learning and online learning satisfaction.

Implications: The study advances the knowledge of these factors influencing online learners' satisfaction, which can help create efficient programs and regulations for students, teachers, and policymakers.

Keywords: the CoI framework, self-regulated learning, emotional states, online learning satisfaction, structural equation modeling

Introduction

Since the beginning of 2020, the global Corona Virus Disease 2019 (COVID-19) pandemic has brought a huge impact on college student's everyday life, emotional states, and academic learning around the world.[1–4] Online learning has become a common phenomenon at all levels of education.[1,5–7] Researchers in higher education have started to investigate college students' online learning experiences, performance, and satisfaction.[1,2,8–15] The community of inquiry (CoI) framework, which was proposed by Garrison et al,[16,17] was adopted by many of them in their empirical investigations.[1,2,18–20] It is a prevailing theoretical framework to describe the process of online learning experienced by students. Its three interrelating elements are teaching, social, and cognitive presence.[1,2,21–26]

Teaching presence refers to the direct instruction and organization and the facilitating discourse to enhance students' learning.[2,16,17,19,27,28] Social presence is how students demonstrate their social and emotional nature to other students in an online learning community.[1,16–18] Cognitive presence refers to students' knowledge construction through ongoing communication and reflection.[2,17,19] According to Garrison et al,[16,17] the process of students' online learning is outlined by the cognitive process; the inquiry of knowledge is guided by teaching presence, and the experience of students' online

learning is described by social presence; further, effective and meaningful online learning is caused by the interaction of these three interrelating elements perceived by online learners.

Research in higher education has shown that the COVID-19 pandemic has caused great changes in college students' emotional states and learning satisfaction, especially when the campuses were locked down and after the lockdown was lifted.[1,3,10] Chinese college students have experienced all these COVID-19 procedures. It is well known that the Chinese government suddenly lifted all COVID-19 restrictions nationwide on December 7, 2022. All colleges and universities in China decided to either switch back to online teaching or send students home for online learning upon hearing the unexpected news, which was believed to greatly impact college students' self-regulated learning, emotional states, and online learning satisfaction. Thus, it becomes urgent to examine the effects of college students' self-regulated learning and emotional states on their online learning satisfaction within the CoI framework after lifting all COVID-19 restrictions in China. This study would generate implications for Chinese college students, their teachers, leaders, and policymakers at different levels.

The Relationships Between the CoI Elements and Students' Learning Satisfaction

Many researchers examined the relationships between the CoI elements and students' online learning satisfaction.[29–34] For example, Akyol and Garrison[29] reported strong positive correlations between the three CoI elements and students' online learning satisfaction. Later, Kozan and Richardson[32] confirmed the strong positive correlations among these elements. Moreover, several other researchers reported that teaching and social presence significantly influenced cognitive presence.[30,31,33,34]

During the past three years, several researchers investigated the relationships between the CoI elements and students' online learning satisfaction during the global pandemic of COVID-19.[2,35,36] For example, Patwardhan et al[36] found that course design mediated the relationship between CoI presence and students' satisfaction. Recently, Lim and Richardson[35] reported differences across disciplines in how each presence could predict students' online learning satisfaction and achievement. Most recently, Hu et al[2] reported that social presence significantly impacted students' learning satisfaction in an asynchronous online course.

During the past three years, several researchers used the structural equation modeling approach to examine the effects of these three elements on college students' online learning performance and satisfaction during the global pandemic of COVID-19.[1,2,12,18,35,36] For example, Patwardhan et al[36] found that course design mediated the relationship between CoI presence and students' satisfaction. Recently, Lim and Richardson[35] reported differences across disciplines in how each presence could predict students' online learning satisfaction and achievement. Most recently, Hu et al[2] reported that social presence significantly impacted students' learning satisfaction in an asynchronous online course. These investigations would help us better understand college students' learning satisfaction and how they learn in an online learning environment during the global pandemic of COVID-19.[37–39]

To conclude, learning satisfaction becomes essential for online learners.[2,40] Previous literature has reported evidence for the significant effects of the CoI elements on students' online learning satisfaction.[2,41–45] Therefore, it is important to examine the relationships between the CoI elements and Chinese college students' online learning satisfaction after lifting all COVID-19 restrictions in China.

Students' Emotional States Affecting Their Online Learning

Previous research has indicated that students' emotional states could affect their online learning during the COVID-19 pandemic.[5,28,46,47] For example, Watzek et al[47] examined the dynamics of emotional reactions in online collaboration of learner communities and their relationships with learning outcomes. The results indicated that positive and negative emotional reactions could significantly stimulate students' online cooperation; positive emotional reactions could help them achieve high online learning performance.

This global pandemic caused considerable changes in students' emotional states during the past three years when the communities were locked down and after the lockdown was lifted.[3,5,10] For example, Huang et al[5] examined Chinese students' emotional states when their communities were locked down, and their emotional states changed after the lockdown was lifted. The results suggested that their emotional states changed substantially at different time nodes during this pandemic, eventually affecting their online learning.

Chinese students generally felt secure because there were strict restriction procedures nationwide.[5] However, it remains unclear how their emotional states would impact their perceived CoI presence and online learning satisfaction after December 7, 2022, when the Chinese government announced the lifting all COVID-19 restrictions. Therefore, examining the moderating effect of Chinese students' emotional states on their online learning satisfaction is urgent.

Self-Regulated Learning is Vital for Online Learning

Zimmerman and Schunk[48] defined self-regulated learning as learners' systematic effort to manage their learning process so that they can attain personal goals. Learners' motivation and use of cognitive strategies become important in their self-regulated learning process.[2,49,50] Self-regulated learners usually know how to set their learning goals, plan their learning tasks, monitor their learning progress, and evaluate their learning achievement and satisfaction.[2,51] Therefore, self-regulated learning becomes important for students' online learning.

Research has shown that through self-regulated learning, the CoI elements could affect students' learning performance and satisfaction in an online learning environment.[1,2,52] Self-regulated learning has become important in students' online learning satisfaction.[2,53] For example, Hu et al[2] examined the extent to which Chinese university students' self-regulated learning and cognitive presence mediated the influence of social presence on their learning satisfaction. The results indicated that their self-regulated learning had a significant positive effect on their learning satisfaction; it also had a significant mediation effect between social presence and their learning satisfaction as well as between social and cognitive presence; in addition, social presence played a significant role in participants' self-regulated learning and their learning satisfaction through the mediation of self-regulated learning and cognitive presence.

Research Gaps

Examining students' online learning satisfaction and its influencing factors is complex and challenging. The CoI-related literature has paid little attention to the effects of mediators and moderators; further, few studies examined the structural model differences. Since online learning has become a common phenomenon in higher education during the COVID-19 global pandemic, this area of research is essential and urgent.

In China, it is unclear how university students' emotional states would impact their perceived teaching, social, and cognitive presence after December 7, 2022, when the Chinese government announced the lifting all COVID-19 restrictions and online learning resumed for university students all over the country. Therefore, it is urgent to investigate the moderating and mediating effects of Chinese university students' emotional states and self-regulated learning in their online learning based on the CoI framework. Such an investigation could improve our understanding of the CoI framework and yield important implications for Chinese university students, their teachers, and the leaders and policymakers at different levels.

The Hypothesized Model and Specific Hypotheses

The following hypothesized model (see Figure 1) was generated according to the CoI framework[16,17] and earlier literature.[1,2,17,21,52,54,55] The dependent variable in this model is online learning satisfaction, with teaching, social, and cognitive presence believed to be independent variables, self-regulated learning acting as a mediator, and emotional states being a moderator. The following eight hypotheses were also developed.

H1: Self-regulated learning has a positive relationship with online learning satisfaction.

H2: Teaching presence is positively associated with self-regulated learning.

H3: Social presence is positively associated with self-regulated learning.

H4: Cognitive presence is positively associated with self-regulated learning.

H5: Emotional states moderate the relationship between self-regulated learning and online learning satisfaction.

Additionally, specific hypotheses about mediation were derived from the theoretical framework;
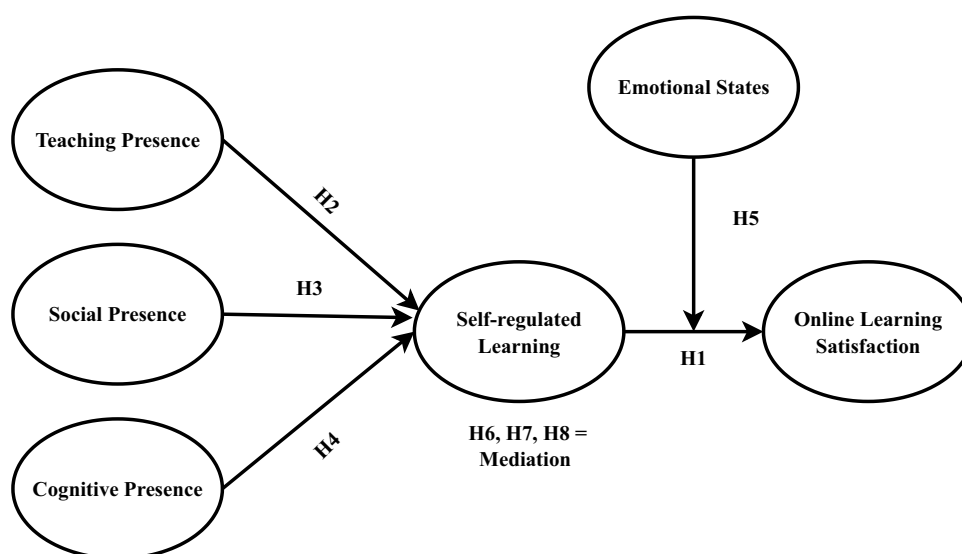
Figure 1 The hypothesized model.

H6: Self-regulated learning mediates the relationship between teaching presence and online learning satisfaction.

H7: Self-regulated learning mediates the relationship between social presence and online learning satisfaction.

H8: Self-regulated learning mediates the relationship between cognitive presence and online learning satisfaction.

Research Questions

Through self-regulated learning and emotional states, this study aimed to investigate how teaching, social, and cognitive presence within the CoI framework affected the online learning satisfaction of Chinese university students. In particular, the degree to which participants' self-regulated learning mediated and their emotional states moderated the influences of teaching, social, and cognitive presence on their online learning satisfaction, respectively, as well as the significant differences across demographic variables of gender (ie, male versus female), subject discipline (ie, arts versus sciences), academic status (ie, undergraduate versus graduate students), and COVID-19 health status (ie, affected versus not affected) were examined.

Four research questions guided this study: a) how do the three elements within the CoI framework affect Chinese university students' online learning satisfaction? b) How do Chinese university students' emotional states affect the relationship between their self-regulated learning and online learning satisfaction? c) How does the self-regulated learning variable mediate the link between presence and online learning satisfaction? And d) are there any significant structural equation modeling differences across demographic variables of gender, subject discipline, academic status, and COVID-19 health status?

Research Methods

Participants

The participants in this study included 2608 university students from 112 universities across China (see Table 1). Undergraduate and graduate students from these Chinese universities made up the sample group, although there were no standards for university selection. Among them, 1067 (40.9%) were male, and 1541 (59.1%) were female participants; a total of 1374 (52.7%) of them majored in the arts, 1234 (47.3%) in the sciences; 2184 (83.8%) were currently enrolled in undergraduate programs, 413 (15.8%) in graduate programs, and 11 (0.4%) working toward other diplomas. At the time of data collection, 1538 (59.0%) were COVID-19 affected, but 1070 (41.0%) were not.

The Instrument

A 38-item five-point Likert scale survey (see Appendix A) ranging from 1 (strongly disagree) to 5 (strongly agree) was used as the instrument for data collection. These items were adopted from the previous literature to measure participants' teaching

Table 1 Participants' Demographic Information

Characteristics		Frequency	%
Gender	Male Female	1067 1541	40.9 59.1
Subject discipline	Arts Science	1374 1234	52.7 47.3
Academic status	Undergraduate Graduate Other	2184 413 11	83.8 15.8 0.4
COVID-19 Health status	Affected Not affected	1538 1070	59.0 41.0
Total		2608	100

(seven items), social (six items), and cognitive (six items) presence in the online learning environment,[1,2,34,56,57] self-regulated learning (seven items),[2,53,58,59] emotional states (six items),[5,60–62] and online learning satisfaction (six items).[2,63,64]

The survey was initially written in English before being translated into Chinese before data collection. The forward and backward translation approach was used on every item to confirm the accuracy of the translation.[65] Two professors instructing English-Chinese translation at a Chinese university translated the survey from English to Chinese. To ensure the survey questions were precise and consistent, the first two authors translated them from Chinese into English. For final validation, 55 university students participated in a pilot test. After a few minor revisions, the survey was utilized to gather the final data for analysis.

Data Collection Procedures

Primary data for this study were collected from Chinese college students. After all COVID-19 restrictions in China were lifted in December 2022, and data collecting was completed online utilizing the Survey Star platform. With the aid of university lecturers and student supervisors, the WeChat survey link was sent to more than 150 university student groups. All the participants received consent forms and information about the study from the researchers. They knew participation was optional and that answers provided would be kept entirely confidential. Before the final data collection, ethical review approval was acquired.

Data Analysis Methods

Using IBM SPSS 22.0 and Smart PLS 3.0, the collected data were put through the following statistical tests: measurement model analysis, structural model analysis, moderation analysis, mediation analysis, and multi-group analysis. PLS-SEM is a well-liked tool for evaluating novel research patterns and developing models rather than just providing confirmation.[66] A contributing element in using PLS-SEM was its capacity to simultaneously estimate causal links across all latent components and correct measurement errors in the structural model.[67]

Results
The Measurement Model Analysis results

The present study investigated reliability, composite reliability, discriminant and convergent validity, and the measurement model's average variance extracted (AVE). The measurement model analysis first investigated the questionnaire's validity and reliability. When the constructs' reliability was initially evaluated, the literature suggested it should be.70 or above.[67] The Cronbach alpha (0.70 or greater), as evaluated in SmartPLS, indicates that the construct is reliable and stable with repeated assessment. The "composite reliability" (CR) parameter was also used in this analysis. The suggested cut-off point for CRs for each construct was 0.70.[67] The AVE was also used to test the convergent and divergent validity, and it is suggested that the cut-off value should be greater than 0.50.[68] These values stand in for the reliability, composite reliability, and convergent and divergent validity criteria established by literature and other computer programs.

Table 2 provides information about constructs' reliability, CR, and AVE. According to the suggested criteria, all constructs had high-reliability values. The CR for all six constructs varied from 0.809 to 0.964, greater than the cut-off value, as stated in the literature, indicating that the model was convergent. The AVE for all variables was substantially higher than the cut-off, ranging from 0.605 to 0.816.

The discriminant validity of the instrument was then assessed by ensuring that none of its constructs had a significant correlation with one another.[69] The square root of the average variance retrieved for each construct was greater than the square of the inter-construct correlations.[68] The results of further evaluating the discriminant validity of the measurement model's component are shown in Table 3.

The Heterotrait-Monotrait ratio (HTMT) is reliable for evaluating discriminant validity. It overcomes the drawbacks of the less demanding Fornell-Larcker criterion.[70] To satisfy the HTMT standards, all values must be less than 0.90.[70,71] As shown in Table 4, the HTMT ratio for all constructs was less than 0.90, which also met the requirements. Therefore, the discriminant validity of the notions was established.

The Structural Model Analysis Results

Based on the body of literature, several hypotheses were developed to answer these four research questions. The first research question was evaluated in this section. Four hypotheses were developed to examine the structural model. Online learning satisfaction was assumed to be directly correlated with self-regulated learning. It was also suggested that three elements – teaching, social, and cognitive – affect self-regulated learning. If the t-value was more than 1.196, the hypothesis was significant.

Path coefficients were computed when data were gathered to verify the hypothesis. Table 5 presents the results of structural equation modeling for the suggested model using PLS. According to the model, the adjusted R^2 values of 61.5% for OLS and 68.8% for SRL were sufficient. The online satisfaction of Chinese university students and all crucial routes to self-regulated learning was significant at the 99.9% confidence level, except for social presence.

The relationship between SRL and OLS in H1 was statistically significant ($\beta = 0.442$, $t = 16.275$, $p < 0.01$). H2 investigated the impact of TecP on SRL. TecP substantially affected SRL ($\beta = 0.206$, $t = 8.327$, $p < 0.01$). Consequently,

Table 2 Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE)

Constructs	Cronbach's Alpha	CR	AVE
CP	0.955	0.964	0.816
ES	0.756	0.809	0.605
OLS	0.947	0.958	0.791
SP	0.925	0.942	0.729
SRL	0.951	0.96	0.774
TecP	0.951	0.959	0.772

Abbreviations: CP, cognitive presence; ES, emotional states; OLS, online learning satisfaction; SP, social presence; SRL, self-regulated learning; TecP, teaching presence.

Table 3 Discriminant Validity – Fornell-Larcker Criterion

Constructs	CP	ES	OLS	SP	SRL	TecP
CP	0.903					
ES	0.678	0.778				
OLS	0.761	0.714	0.889			
SP	0.667	0.664	0.744	0.854		
SRL	0.616	0.664	0.714	0.725	0.88	
TecP	0.696	0.555	0.607	0.672	0.675	0.879

Note: Diagonals (italic) values are the square root of the AVE values of each respective construct.
Abbreviations: CP, cognitive presence; ES, emotional states; OLS, online learning satisfaction; SP, social presence; SRL, self-regulated learning; TecP, teaching presence.

Table 4 The HTMT

	CP	ES	OLS	SP	SRL	TecP
CP						
ES	0.706					
OLS	0.8	0.754				
SP	0.617	0.717	0.794			
SRL	0.774	0.704	0.751	0.771		
TecP	0.729	0.577	0.639	0.715	0.707	

Abbreviations: CP, cognitive presence; ES, emotional states; OLS, online learning satisfaction; SP, social presence; SRL, self-regulated learning; TecP, teaching presence.

**Table 5** Structural Relationships and Hypothesis Testing

Hypothesis	Path	Path Coefficient	t Statistics	p value	Decision
H1	SRL→OLS	0.442	16.275	< 0.01	Supported
H2	TecP→SRL	0.206	8.327	< 0.01	Supported
H3	SP→SRL	0.01	0.337	> 0.01	Not supported
H4	CP→SRL	0.664	19.841	< 0.01	Supported

Abbreviations: SRL, self-regulated learning; OLS, online learning satisfaction; TecP, teaching presence; SP, social presence; CP, cognitive presence.

H2 was advised. H3 investigated how SP affects SRL. The results showed SP and SRL had an insignificant relationship ($\beta = 0.01$, $t = 0.337$, $p > 0.01$). Cognitive presence and SRL had a significant connection, and so H4 was supported ($\beta = 0.664$, $t = 19.841$, $p < 0.01$). Table 5 and Figure 2 detail all the results for the hypotheses.

The Moderation Analysis Results

Moderation analysis was used in the present study to address the second research question. The current study used the PLS product-indicator technique to analyze the moderating role of emotional states on the connection between self-regulated learning and Chinese university students' online learning satisfaction.[72] The current research initially calculated the influence of ES on SRL and OLS to explore the moderating effect. No matter how strong the other linked route
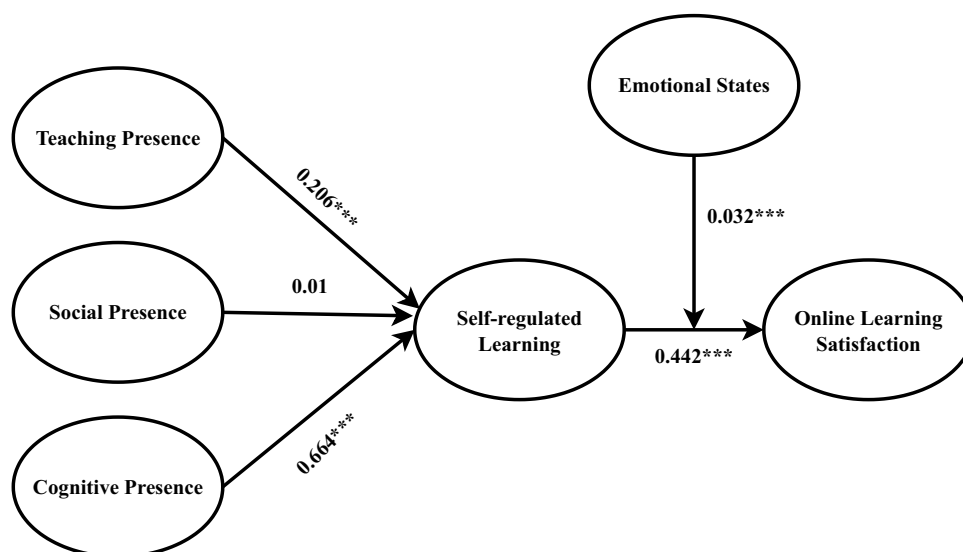
Figure 2 Path coefficients of the hypothesized model.
Note: ***p < 0.001.

Table 6 The Moderation Analysis Results

Hypothesis	Moderating Relationship	Original Sample	STDEV	t Statistics	p value	Decision Supported
H5	Moderating effect 1 -> OLS	0.032	0.011	2.972	0.003	Yes

Abbreviation: OLS, online learning satisfaction.

coefficients are, a moderator's relevance can be demonstrated where the interaction influence is strong.[72] The results showed a significant ($t = 2.972$) standardized path coefficient of 0.032 for the interaction construct in the case of OLS. In this respect, H5 received support. All moderation outcomes are explained in Table 6 and Figure 3.

The findings demonstrated that emotional states were critical in the current study and served as a moderator. Emotional states played a moderating role in the SRL-OLS relationship and were considerable and favourable. This might be the case because the students had positive emotional states; they could self-regulate their learning, and their online learning satisfaction would be enhanced.

The Mediation Analysis Results

Additionally, to answer the third research question, mediation analysis was performed to understand better how self-regulated learning affected the relationships between three presence and online learning satisfaction. The current study focused on bootstrapping and examined the mediating roles of H6, H7, and H8 in several constructs using the most recent conventions.[73–75]

The indirect impact must also be substantial to mediate.[76] A model study supported H6, H7, and H8 by demonstrating that SRL mediated the connection between the CoI elements and online learning satisfaction. A model study supported H6 by indicating that SRL mediated the association between teaching presence and OLS. Table 5 demonstrated that the direct relationship between social presence and SRL was inconsequential. It was likewise insignificant when SRL was a mediator between social presence and OLS, so H7 was not supported. Additionally, SRL supported H8 by demonstrating a substantial link and mediating between cognitive presence and OLS. The complete set of mediation research results is shown in Table 7.

The Multi-Group Analysis Results

The multi-group analysis (MGA) method was then used to answer the fourth research question. When comparing PLS-MGA groups, if the p-values are more than 0.95 and lower than 0.05, there is a significant difference.[70,71] The results showed no significant differences for the demographic variable of gender. However, there were significant differences in
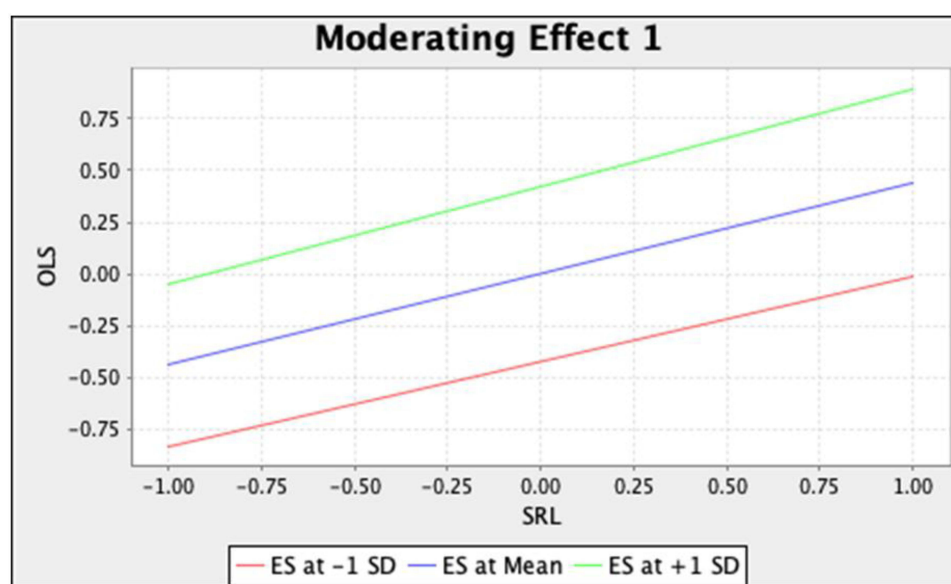

Figure 3 The moderation effect.

Table 7 The Mediation Effects

Hypothesis	Mediating Relationship	Path Coefficient	STDEV	t Statistics	p value	Decision Supported
H6	TecP ->SRL ->OLS	0.091	0.012	7.803	< 0.01	Yes
H7	SP ->SRL ->OLS	0.004	0.013	0.336	> 0.01	No
H8	CP ->SRL ->OLS	0.294	0.024	12.226	< 0.01	Yes

Abbreviations: TecP, teaching presence; SRL, self-regulated learning; OLS, online learning satisfaction; SP, social presence; CP, cognitive presence.

the demographic variables of subject discipline, academic status, and COVID-19 health status. The results are presented in Tables 8–10.

As shown in Table 8, the *p*-values in PLS-MGA were less than 0.05 for subject discipline, showing that the effect of SP on SRL varied between arts and science student groups. That significant difference showed that social presence impacted self-regulated learning in science majors probably because the students must interact with teachers to learn and support their experimental work more than in the art majors.

Moreover, as shown in Table 9, the *p*-values in PLS-MGA were less than 0.05 for academic status, showing that the effect of SP on SRL varied significantly between the undergraduate and graduate groups ($p < 0.05$). Undergraduate students were less motivated than graduate students. Graduate students were considered to work more independently and had more self-regulated learning motives than undergraduate students.

Finally, as shown in Table 10, the PLS-MGA *p*-values were less than 0.05 for the demographic variable of COVID-19 health status. This indicated that the affected and not affected responses to TecP's impact on SRL were significantly different ($p < 0.05$). The values were much higher in non-affected than affected, suggesting that non-affected students valued the implications of teaching presence for self-regulated learning more and were more concerned with teaching presence than the affected university students.

Table 8 MGA Results for the Demographic Variable of Subject Discipline

	Path Coefficients-Diff (Arts - Sciences)	p-value Original 1-Tailed (Arts vs Sciences)	p-value New (Arts vs Sciences)
CP -> SRL	−0.01	0.555	0.891
ES -> OLS	0.037	0.235	0.47
Moderating Effect 1 -> OLS	0.024	0.137	0.274
SP -> SRL	−0.119	0.975	0.049
SRL -> OLS	−0.038	0.758	0.483
TecP -> SRL	0.072	0.067	0.134

Abbreviations: CP, cognitive presence; SRL, self-regulated learning; OLS, online learning satisfaction; SP, social presence; TecP, teaching presence.

Table 9 MGA Results for the Demographic Variable of Academic Status

	Path Coefficients-Diff (Undergraduate - Graduate)	p-value Original 1-Tailed (Undergraduate vs Graduate)	p-value New (Undergraduate vs Graduate)
CP -> SRL	−0.078	0.832	0.337
ES -> OLS	0.037	0.291	0.582
Moderating Effect 1 -> OLS	0.046	0.097	0.193
SP -> SRL	0.155	0.016	0.033
SRL -> OLS	0.09	0.12	0.24
TecP -> SRL	0.028	0.32	0.639

Abbreviations: CP, cognitive presence; SRL, self-regulated learning; ES, emotional states; OLS, online learning satisfaction; SP, social presence; TecP, teaching presence.

Table 10 MGA Results for the Demographic Variable of COVID-19 Health Status

	Path Coefficients-Diff (Affected - Not Affected)	p-value Original 1-Tailed (Affected vs Not Affected)	p-value New (Affected vs Not Affected)
CP -> SRL	0.097	0.093	0.187
ES -> OLS	−0.038	0.764	0.472
Moderating Effect 1 -> OLS	−0.047	0.975	0.05
SP -> SRL	0.015	0.404	0.807
SRL -> OLS	0.064	0.126	0.252
TecP -> SRL	−0.125	0.99	0.019

Abbreviations: CP, cognitive presence; SRL, self-regulated learning; ES, emotional states; OLS, online learning satisfaction; SP, social presence; TecP, teaching presence.

Discussion

The first research question asked how the three elements within the CoI framework affected Chinese university students' online learning satisfaction. The result indicated that teaching and cognitive presence affected their online learning satisfaction significantly through self-regulated learning ($p < 0.01$);[1,2,41,42] however, social presence was not found to significantly affect their online learning satisfaction, which was different from previous research findings.[1,2] Further research is needed to validate this finding. The first research question elaborated and supported H1, H2, and H4, while H3 was not proven in the present research.

The second research question asked how Chinese university students' emotional states affected the relationship between their self-regulated learning and online learning satisfaction. The results showed that emotional states played a significant moderating role in the relationship between self-regulated learning and online learning satisfaction ($p < 0.01$). This finding confirmed that students having positive and stable emotional states were more likely to adopt self-regulated learning, which was helpful to enhance their online learning satisfaction, hence proving H5.

The third research question asked how the self-regulated learning variable mediated the link between the three presence and online learning satisfaction. The findings suggested that self-regulated learning was a significant mediator between teaching presence, cognitive presence, and online learning satisfaction, respectively ($p < 0.01$).[1,2] However, it was not a significant mediator between social presence and online learning satisfaction. These findings suggested that self-regulated learning was developed in university students during the COVID-19 era. After lifting all the restrictions, students were well-equipped with online learning. The present study also proved that these teaching and cognitive presence were crucial to online satisfaction through self-regulated learning. Hence, these findings also supported H6 and H8. Students were not socially connected to their teachers, so social presence impacted inversely and showed no impact on self-regulated learning due to a lack of motivation and self-enthusiasm. So, H7 was not supported in the present research question.

The final research question asked about the significant structural equation modeling differences across demographic variables of gender, subject discipline, academic status, and COVID-19 health status. The results indicated significant differences for all these demographic variables except for gender. There was a substantial difference between the arts and sciences major students for the subject discipline variable. Because science major students need to connect with teachers to learn and support their experimental work more than arts major students, the significant differences demonstrated that social presence had an impact on self-regulated learning in the science majors ($p < 0.05$). For the variable of academic status, there was a significant difference between undergraduate and graduate students. Undergraduate students were less driven and less capable of learning novel things independently. Therefore, undergraduate students must meet with their instructors regularly to learn more. In contrast, graduate students were thought to work autonomously and had self-regulated learning goals ($p < 0.05$). For the variable of COVID-19 health status, there was a significant difference between affected and non-affected ($p < 0.05$). The values were significantly higher in the non-affected group than in the affected group, indicating that the non-affected group valued teaching presence more and were more concerned about it.

Limitations of the Study

This study was limited in the following four ways. First, the sample size was large, but more than 80% of the participants were undergraduate students. The imbalance between undergraduate and graduate student participants might have limited the interpretation and generalization of the findings. Second, only four demographic variables were considered in this study; other demographic variables such as household income, marital status, and urban vs rural areas were not included, which might have limited the generalization of the results to university students across China. Thirdly, the main focus of the study was the students from universities across China, while missing the teachers' viewpoint in the present study. Teacher-students are dyads and depend on each other stimulatingly. So, teachers' viewpoints should be studied in future research to make the research more concise and valuable. Finally, the present study discussed only the positive emotional states of the students, ignoring the negative ones, which can be discussed in future studies.

Conclusion

This study investigated how teaching, social, and cognitive presence within the community of inquiry (CoI) framework impacts Chinese students' online learning satisfaction through self-regulated learning and emotional states. The following three conclusions are drawn. First, teaching and cognitive presence significantly affect Chinese university students' online learning satisfaction after lifting all COVID-19 restrictions. Second, emotional states act as a significant moderator, which significantly moderates the relationship between self-regulated learning and online learning satisfaction. Third, self-regulated learning is a significant mediator, an important binding force between teaching and cognitive presence, and university students' online learning satisfaction.

Implications of the Study

The results of this study would have the following important implications for Chinese university students and their teachers as well as the leaders and policymakers at different levels. First, Chinese university students are suggested to enhance their self-regulated learning skills, build online learning confidence, manage their time effectively, and complete online learning tasks promptly.[1,2] Further, they are encouraged to adjust their emotional states in online learning. Positive emotional states would help them self-regulate online learning and eventually feel satisfied. Second, university teachers should create a shared online learning environment and increase students' perceived social presence in teaching online courses.[2] In addition, they are suggested to develop students' self-regulated skills and adjust their emotional states for online learning. Finally, leaders and decision-makers at different levels should know university students' online learning challenges and understand teachers' online teaching difficulties. It is suggested that specific policies and procedures be implemented to create supportive online learning communities and increase students' learning satisfaction by encouraging students to maintain positive emotional states and manage their online learning. It also suggests that teachers increase teacher-student and student-student interactions in online classrooms.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Hu Y, Huang J, Kong F. College students' learning perceptions and outcomes in different classroom environments: a community of inquiry perspective. *Front Psychol*. 2022;13. doi:10.3389/fpsyg.2022.1047027
2. Hu Y, Huang J, Kong F, Hussain S. Examining self-regulated learning as a significant mediator among social presence, cognitive presence, and learning satisfaction in an asynchronous online course: a partial least squares structure equation modeling approach. *Austral J Educ Technol*. 2023;39(2):16–32.
3. Liu J, Zhu X, Huang C, Wang Y, Chang L. Study on factors influencing college students' motivation to engage with online learning during the COVID-19 pandemic. In: *Innovations in Education and Teaching International*. Taylor & Francis; 2022:1–12. doi:10.1080/14703297.2022.2130394
4. Zurlo MC, Cattaneo Della Volta MF, Vallone F. Psychological health conditions and COVID-19-related stressors among university students: a repeated cross-sectional survey. *Front Psychol*. 2022;12:741332. doi:10.3389/fpsyg.2021.741332
5. Huang Y, Huang J, Wang T, Xu S, Li J. The impact of the corona virus disease 2019 pandemic on Chinese middle school students' self-perceived emotional states: a Wuhan perspective. *Front Psychol*. 2021;12:1–12. doi:10.3389/fpsyg.2021.740879
6. Li L. Students' isolation challenges in blended EFL learning during covid-19: how can social presence and interaction help develop sense of community? *Psychol Res Behav Manag*. 2022;15:3117–3131. doi:10.2147/prbm.s388317

7. Qiu X. Revisiting the cognition hypothesis: the impact of task complexity on L2 learner engagement in task performance in computer-mediated and face-to-face communication. *Comput Assist Lang Learn*. 2022;1–23. doi:10.1080/09588221.2022.2142245

8. Avcı Ü, Ergün E. Online students' LMS activities and their effect on engagement, information literacy and academic performance. *Interact Learn Environ*. 2022;30(1):71–84. doi:10.1080/10494820.2019.1636088

9. Curran R, Arroteia N, Blesa A, Musteen M, Ripollés M. Improving cultural intelligence, psychological empowerment, and task performance in the classroom: global game challenge. *J Teach Int Bus*. 2021;32(1):36–56. doi:10.1080/08975930.2021.1906380

10. Galanza MA, Aruta JJ, Mateo NJ, Resurreccion RR, Bernardo ABI. Mental health of Filipino university students during the COVID-19 pandemic: the distinct associations of fear of COVID-19 and financial difficulties. *Educ Dev Psychol*. 2023;40(1):125–130. doi:10.1080/20590776.2021.1999168

11. Li Y, Wang A, Wu Y, Han N, Huang H. Impact of the COVID-19 pandemic on the mental health of college students: a systematic review and meta-analysis. *Front Psychol*. 2021;12. doi:10.3389/fpsyg.2021.669119

12. Lim JRN, Rosenthal S, Sim YJM, Lim ZY, Oh KR. Making online learning more satisfying: the effects of online-learning self-efficacy, social presence and content structure. *Technol Pedag Educ*. 2021;30(4):543–556. doi:10.1080/1475939x.2021.1934102

13. Slack HR, Priestley M. Online learning and assessment during the Covid-19 pandemic: exploring the impact on undergraduate student well-being. *Assess Eval High Educ*. 2022;48(3):333–349. doi:10.1080/02602938.2022.2076804

14. Takır A. The qualitative study of Cypriot parents' views about online education during COVID-19 pandemic: the challenges and responsibilities. *Education*. 2022;1–11. doi:10.1080/03004279.2022.2155483

15. Wang Y, Stein D. Effects of online teaching presence on students' cognitive conflict and engagement. *Distance Educ*. 2021;42(4):547–566. doi:10.1080/01587919.2021.1987837

16. Garrison DR, Anderson T, Archer W. Critical inquiry in a text-based environment: computer conferencing in higher education. *Internet High Educ*. 2000;2(2–3):87–105. doi:10.1016/s1096-7516(00)00016-6

17. Garrison DR, Anderson T, Archer W. Critical thinking, cognitive presence, and computer conferencing in distance education. *Am J Distance Educ*. 2001;15(1):7–23. doi:10.1080/08923640109527071

18. Guo P, Saab N, Wu L, Admiraal W. The community of inquiry perspective on students' social presence, cognitive presence, and academic performance in online project-based learning. *J Comput Assist Learn*. 2021;37(5):1479–1493. doi:10.1111/jcal.12586

19. Heilporn G, Lakhal S. Investigating the reliability and validity of the community of inquiry framework: an analysis of categories within each presence. *Comput Educ*. 2020;145:103712. doi:10.1016/j.compedu.2019.103712

20. Shea P, Richardson J, Swan K. Building bridges to advance the Community of Inquiry framework for online learning. *Educ Psychol*. 2022;57 (3):148–161. doi:10.1080/00461520.2022.2089989

21. Castellanos-Reyes D. Twenty years of the community of inquiry framework. *Tech Trends*. 2020;64:557–560. doi:10.1007/s11528-020-00491-7

22. Fiock HS. Designing a community of inquiry in online courses. *Int Rev Res Open Distributed Learn*. 2020;21(1):135–153. doi:10.19173/irrodl. v20i5.3985

23. Garrison DR, Arbaugh JB. Researching the community of inquiry framework: review, issues, and future directions. *Internet High Educ*. 2007;10 (3):157–172. doi:10.1016/j.iheduc.2007.04.001

24. Garrison DR. *E-Learning in the 21st Century: A Framework for Research and Practice*. 2nd ed. London: Routledge /Taylor and Francis; 2011. DOI:10.4324/9780203838761

25. Garrison DR. *E-Learning in the 21st Century: A Community of Inquiry Framework for Research and Practice*. 3rd ed. New York: Routledge; 2017.

26. Garrison DR. Shared metacognition in a community of inquiry. *Online Learn*. 2022;26(1):6–18. doi:10.24059/olj.v26i1.3023

27. Muir T. The influences of social, cognitive, and teaching presence on pre-service teachers' online engagement in productive mathematical discourse. *Int J Mathe Educ Sci Technol*. 2022;1–18. doi:10.1080/0020739x.2022.2119176

28. Wang Y. Effects of teaching presence on learning engagement in online courses. *Distance Educ*. 2022;43(1):139–156. doi:10.1080/ 01587919.2022.2029350

29. Akyol Z, Garrison DR. The development of a community of inquiry over time in an online course: understanding the progression and integration of social, cognitive and teaching presence. *J Asynchron Learn Ntwk*. 2008;12(3):3–22. doi:10.24059/olj.v12i3.72

30. Garrison DR, Anderson T, Archer W. The first decade of the community of inquiry framework: a retrospective. *Internet High Educ*. 2010;13(1–2):5–9. doi:10.1016/j.iheduc.2009.10.003

31. Gutiérrez-Santiuste E, Rodríguez-Sabiote C, Gallego-Arrufat MJ. Cognitive presence through social and teaching presence in communities of inquiry: a correlational–predictive study. *Austral J Educ Technol*. 2015;31(3):349–362. doi:10.14742/ajet.1666

32. Kozan K, Richardson JC. New exploratory and confirmatory factor analysis insights into the community of inquiry survey. *Internet High Educ*. 2014;23:39–47. doi:10.1016/j.iheduc.2014.06.002

33. Lin S, Hung TC, Lee CT. Revalidate forms of presence in training effectiveness:: mediating effect of self-efficacy. *J Educ Comput Res*. 2015;53 (1):32–54. doi:10.1177/0735633115588772

34. Shea P, Bidjerano T. Community of inquiry as a theoretical framework to foster "epistemic engagement" and "cognitive presence" in online education. *Comput Educ*. 2009;52(3):543–553. doi:10.1016/j.compedu.2008.10.007

35. Lim J, Richardson JC. Predictive effects of undergraduate students' perceptions of social, cognitive, and teaching presence on affective learning outcomes according to disciplines. *Comput Educ*. 2021;161(1):104063. doi:10.1016/j.compedu.2020.104063

36. Patwardhan V, Rao S, Thirugnanasambantham C, Prabhu N. Community of inquiry (CoI) framework and course design as predictors of satisfaction in emergency remote teaching: perspectives of hospitality management students. *J e-Learn Knowledge Soc*. 2020;16(4):94–103. doi:10.20368/ 1971-8829/1135315

37. Caskurlu S, Maeda Y, Richardson JC, Lv J. A meta-analysis addressing the relationship between teaching presence and students' satisfaction and learning. *Comput Educ*. 2020;157:103966. doi:10.1016/j.compedu.2020.103966

38. Mallmann GL, Maçada ACG. The mediating role of social presence in the relationship between shadow IT usage and individual performance: a social presence theory perspective. *Behav Inf Technol*. 2021;40(4):427–441. doi:10.1080/0144929x.2019.1702100

39. Ozogul G, Zhu M, Phillips TM. Perceived and actual cognitive presence: a case study of an intentionally-designed asynchronous online course. *Online Learn*. 2022;26(1). doi:10.24059/olj.v26i1.3051

40. Li N, Marsh V, Rienties B, Whitelock D. Online learning experiences of new versus continuing learners: a large-scale replication study. *Assess Eval High Educ*. 2016;42(4):657–672. doi:10.1080/02602938.2016.1176989

41. Johnson RD, Hornik S, Salas E. An empirical examination of factors contributing to the creation of successful e-learning environments. *Int J Hum Comput Stud*. 2008;66(5):356–369. doi:10.1016/j.ijhcs.2007.11.003

42. Joo YJ, Lim KY, Kim EK. Online university students' satisfaction and persistence: examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Comput Educ*. 2011;57(2):1654–1664. doi:10.1016/j.compedu.2011.02.008

43. Richardson JC, Maeda Y, Lv J, Caskurlu S. Social presence in relation to students' satisfaction and learning in the online environment: a meta-analysis. *Comput Human Behav*. 2017;71:402–417. doi:10.1016/j.chb.2017.02.001

44. Richardson JC, Swan K. Examining social presence in online courses in relation to students' perceived learning and satisfaction. *J Asynchron Learn Ntwk*. 2003;7(1):68–88. doi:10.24059/olj.v7i1.1864

45. Zhan Z, Hu M. Academic self-concept and social presence in face-to-face and online learning: perceptions and effects on students' learning achievement and satisfaction across environments. *Comput Educ*. 2013;69:131–138. doi:10.1016/j.compedu.2013.07.002

46. Casanova BEC, Felix CAC, Balingit NDZ, de Vera AMF, Briones MDM, Aruta JJ. Social support and bidimensional mental health among primary-level teachers during COVID-19 crisis. *Int J School Educ Psychol*. 2022;1–14. doi:10.1080/21683603.2022.2105998

47. Watzek V, Rehm M, Mulder RH. Exploring dynamics of emotional reactions in online collaboration of communities of learners and their relations with learning outcomes. *Interact Learn Environ*. 2022;1–12. doi:10.1080/10494820.2022.2078985

48. Zimmerman BJ, Schunk DH. Self-regulated learning and performance. In: Zimmerman B, Schunk DH, editors. *Handbook of Self-Regulation of Learning and Performance*. New York: Routledge; 2011. doi:10.4324/9780203839010.ch1

49. Broadbent J, Poon WL. Self-regulated learning strategies and academic achievement in online higher education learning environments: a systematic review. *Internet High Educ*. 2015;27:1–13. doi:10.1016/j.iheduc.2015.04.007

50. Zimmerman BJ. Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. *Am Educ Res J*. 2008;45:166–183. doi:10.3102/0002831207312909

51. Cho MH, Kim Y, Choi D. The effect of self-regulated learning on college students' perceptions of community of inquiry and affective outcomes in online learning. *Internet High Educ*. 2017;34:10–17. doi:10.1016/j.iheduc.2017.04.001

52. Shea P, Bidjerano T. Learning presence as a moderator in the community of inquiry model. *Comput Educ*. 2012;59(2):316–326. doi:10.1016/j.compedu.2012.01.011

53. Barnard L, Lan WY, To YM, Paton VO, Lai SL. Measuring self-regulation in online and blended learning environments. *Internet High Educ*. 2009;12(1):1–6. doi:10.1016/j.iheduc.2008.10.005

54. Alzayed ZA, Alabdulkareem RH. Enhancing cognitive presence in teachers' professional learning communities via reflective practice. *J Educ Teach*. 2021;47(1):18–31. doi:10.1080/02607476.2020.1842134

55. Zhu M, Herring SC, Bonk CJ. Exploring presence in online learning through three forms of computer-mediated discourse analysis. *Distance Educ*. 2019;40(2):205–225. doi:10.1080/01587919.2019.1600365

56. Arbaugh JB, Cleveland-Innes M, Diaz SR, et al. Developing a community of inquiry instrument: testing a measure of the Community of Inquiry framework using a multi-institutional sample. *Internet High Educ*. 2008;11(3–4):133–136. doi:10.1016/j.iheduc.2008.06.003

57. Swan KP, Richardson JC, Ice P, Garrison DR, Cleveland-Innes M, Arbaugh JB. Validating a measurement tool of presence in online communities of inquiry. *E-Mentor*. 2008;2(24):1–12.

58. Barnard L, Paton V, Lan W. Online self-regulatory learning behaviors as a mediator in the relationship between online course perceptions with achievement. *Int Rev Res Open Distributed Learn*. 2008;9(2). doi:10.19173/irrodl.v9i2.516

59. Lan WY, Bremer R, Stevens T, Mullen G. *Self-Regulated Learning in the Online Environment*. San Diego, California: Inannual meeting American Educational Research Association; 2004.

60. Cohen S, Kamarck T, Mermelstein R, Global A. Measure of perceived stress. *J Health Soc Behav*. 1983;24:385–396. doi:10.2307/2136404

61. Moos RH, Moos BS. *Family Environment Scale Manual*. 3rd ed. Palo Alto, CA: Consulting Psychologists Press; 1990.

62. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand*. 1983;67(6):361–370. doi:10.1111/j.1600-0447.1983.tb09716.x

63. Arbaugh JB. How instructor immediacy behaviors affect student satisfaction and learning in a web-based course. *Bus Commun Quart*. 2001;64(4):42–54. doi:10.1177/108056990106400405

64. Kuo YC, Walker AE, Belland BR, Schroder KEE. A predictive study of student satisfaction in online education programs. *Int Rev Res Open Distributed Learn*. 2013;14(1):16–29. doi:10.19173/irrodl.v14i1.1338

65. Sperber AD, Devellis RF, Boehlecke B. Cross-Cultural Translation: methodology and validation. *J Cross Cult Psychol*. 1994;25:501–524. doi:10.1177/0022022194254006

66. Urbach N, Ahlemann F. Structural equation modeling in information systems research using partial least squares. *J Inf Technol Theory Appl*. 2010;11:5–40.

67. Hair JF, Hult GTM, Ringle CM, Sarstedt M. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 2nd ed. Los Angeles: Sage; 2017.

68. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Market Res*. 1981;18:39–50. doi:10.2307/3151312

69. Hubley AM. Encyclopedia of quality of life and well-being research. In: *Discriminant Validity*. Dordrecht: Springer; 2014:1664–1667. doi:10.1007/978-94-007-0753-5_751

70. Henseler J, Hubona G, Ray PA. Using PLS path modeling in new technology research: updated guidelines. *Industr Manage Data Syst*. 2016;116:2–20. doi:10.1108/imds-09-2015-0382

71. Sarstedt M, Henseler J, Ringle CM. Multigroup analysis in partial least squares (PLS) path modeling: alternative methods and empirical results. *Adv Int Market*. 2011;22:195–218. doi:10.1108/s1474-7979(2011)0000022012

72. Henseler J, Fassott G. Testing moderating effects in PLS path models: an illustration of available procedures. In: Vinzi VE, Chin WW, Henseler J, Wang H, editors. *Handbook of Partial Least Squares*. Heidelberg: Springer; 2010. doi:10.1007/978-3-540-32827-8_31

73. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York: Guilford Press; 2013.

74. Hussain S, Li Y, Li W. Influence of platform characteristics on purchase intention in social commerce: mechanism of psychological contracts. *J Theoret Appl Electron Commerce Res*. 2021;16:1–17. doi:10.4067/s0718-18762021000100102

75. Zhao X, Lynch JG, Chen Q. Reconsidering Baron and Kenny: myths and truths about mediation analysis. *J Consumer Res*. 2010;37(2):197–206. doi:10.1086/651257

76. Gaskin J, Godfrey S, Vance A. Successful system-use: it's not just who you are, but what you do. *AIS Transact Human Comp Interact*. 2018;10:1–33. doi:10.17705/1thci.00104