Factors Impacting Undergraduate's Satisfaction and Continuance Intention to Use Online Courses in Chengdu, China

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Abstract

Background and Aim: During the COVID-19 pandemic in China, the adoption of online education for college students uncovered various benefits and challenges, reflecting a distinct set of circumstances shaped by the global health crisis. This study aimed to evaluate the impact of pivotal factors—including learning involvement, validation, informational quality, system excellence, service standard, and user contentment on the overall assessment, and affect college students' commitment to ongoing participation in online courses.

Materials and Methods: This study adopted a quantitative approach, collecting data through questionnaires distributed among the targeted demographic. To validate the hypotheses and analyze the data, A variety of methods were utilized, including the Index of Item–item-objective congruence (IOC) assessment, a preliminary study, Confirmatory Factor Analysis (CFA), and Structural Equation Modeling (SEM).

Results: The results indicated that every component—engagement, confirmation, information quality, system quality, service quality, and satisfaction—had a positive impact on students' intention to continue with online courses, either directly or through mediating variables. Remarkably, satisfaction emerged as the most influential factor driving the desire to continue using online educational platforms.

Conclusion: To enhance college students' ongoing engagement with online courses, efforts should concentrate on elevating aspects such as learning engagement, confirmation, information quality, system quality, and service quality.

Keywords: Online learning; Participation in learning; Verification; Information quality; System quality; Service quality; Satisfaction; CFA; SEM

Introduction

Education provides numerous opportunities for individuals regardless of their socioeconomic background. Online courses have emerged as a fundamental concept in supporting distance education through the use of innovative technologies. Geographically dispersed groups of individuals (students) engage with instructors through the utilization of computing and telecommunication resources in online education. These courses are disseminated via either an open (internet) or closed (intranet) distribution network, comprising educational content accessible through web-based resources.

During the COVID-19 pandemic in China, the adoption of online education for college students uncovered various benefits and challenges, reflecting a distinct set of circumstances shaped by the global health crisis. (Gopal, Singh, and Aggarwal 2021). Adaptation to Remote Learning became imperative as the epidemic propelled a rapid shift from traditional classroom settings to virtual instruction for undergraduates in China. (Yong et al. 2021). Universities swiftly adjusted to this new reality, leveraging diverse digital platforms and technologies to ensure the uninterrupted flow of education. (Yong et al. 2021). This adaptation underscored the adaptability of online learning in responding to unforeseen circumstances and upholding academic progress despite the adversities brought by the pandemic.

The transition to online courses accentuated the existing challenge of limited face-to-face interaction. (Al Masud et al. 2023). Amidst the pandemic, social distancing protocols mandated virtual classrooms, amplifying the complexity of replicating the personalized engagement and real-time discussions characteristic of physical learning environments. This diminished interaction posed hurdles to student-teacher dynamics, potentially impacting the quality of feedback and academic support.

Online courses have proliferated in both domestic and international educational landscapes. (Ahn, Ryu, and Han 2007). Esteemed educational institutions have joined the online learning wave, launching diverse courses spanning across nations and disciplines. However, existing studies predominantly investigated how learners' attributes, such as motivation, influenced Massive Open Online Course (MOOC) outcomes. (Hew 2016).

Thus, the present study is focused on exploring the elements that influence the satisfaction and ongoing use intentions of social science students at a public university in Sichuan, China, concerning their engagement with online courses. The theoretical model delineates the relationships among learning involvement, expectation fulfillment, data quality, platform quality, support quality, user satisfaction, and the inclination to continually employ digital learning environments.

Objectives

The objectives were to elucidate the causal relationships among learning engagement, satisfaction, continuance intention, course design, instructor's prompt feedback, student emotional engagement, and student behavioral engagement in the context of undergraduate online courses in Chengdu, China.

1) To identify the significant impact of learning engagement on student satisfaction with online courses.

2) To identify the significant impact of satisfaction toward continuance intention of online courses.

3) To identify the significant impact of course design on student satisfaction with online courses.

4) To identify the significant impact of instructor's prompt feedback on Student Satisfaction with online courses.

5) To identify the significant impact of student emotional engagement on student satisfaction with online courses.

6) To identify the significant impact of student behavioral engagement on student satisfaction with online courses.

Literature Review

Online course in China

The context of undergraduate online education in China during the COVID-19 pandemic illustrated a unique landscape characterized by both opportunities and challenges, emblematic of the educational adjustments necessitated by the global health crisis (Ali et al., 2023). Embracing Remote Learning: The Global COVID-19 outbreak catalyzed a rapid shift from conventional classroom pedagogy to virtual instruction for Chinese undergraduate students Universities swiftly pivoted to this new paradigm, harnessing a myriad of digital platforms and technologies to ensure the seamless continuation of educational endeavors (Yong et al. 2021). This adaptation underscored the agility of

online learning in addressing unexpected circumstances and sustaining academic progress despite the adversities posed by the pandemic.

As students found themselves compelled to engage in remote learning from their homes during the pandemic, the issue of potential distractions escalated (Armah, Bervell, and Bonsu 2023). Home environments may lack the structured academic ambiance of a traditional classroom, thereby heightening the susceptibility to diversions such as household duties and the omnipresence of digital diversions. Striving to maintain focus and concentration within such a milieu emerged as a notable challenge, impacting scholarly achievements and the depth of comprehension.

Expectation-Confirmation Model

The Anticipation-Confirmation Theory (ACT), which was initially developed by Oliver (1980), has gained widespread application in exploring customer satisfaction and repurchase intentions within marketing studies. Its influence extends well beyond the boundaries of marketing, ACT has exerted its influence in areas such as sociology, social psychology, and public policy. (Al Masud et al. 2023). At its core, ACT posits that post-purchase satisfaction is intricately linked to the interplay between anticipated expectations and perceived performance. (Chiu et al. 2005). When the actual performance falls short of expectations, it instigates negative disconfirmation, which leads to dissatisfaction. The misalignment can manifest as confirmation if performance matches expectations, positive disconfirmation if it surpasses them, or negative disconfirmation if it falls short (Chiu et al., 2005; Hsu et al, 2004).

Within the Information Systems (IS) field, the Expectation-Confirmation Model (ECM) has arisen as a branch of ACT. This model investigates the ongoing intentions of IS users, which are viewed as a more credible measure of IS success than the initial adoption of IS (Bhattacherjee, 2001). The ECM demonstrates the effect of perceived utility and confirmation on user satisfaction, and it also underscores that the intention to continue using IS is shaped by both satisfaction and perceived utility. Building upon this theoretical framework, the ECM functions as a valuable perspective for scrutinizing the persistent usage patterns of IS. By delving into the intricate interplay among user satisfaction, perceived usefulness, and continuation intention, this model offers insights into the multifaceted essence of IS success. Furthermore, the ECM emphasizes the importance of surpassing user expectations and fostering positive disconfirmation to enhance overall satisfaction and, subsequently, the sustained commitment to utilizing IS.

Information Systems Success Model

Within the realm of literature, a myriad of models aims to evaluate the efficacy of information systems while delineating the impact of constructs on this efficacy. Among these models, the Information Systems Success Model emerges as a prominent choice, frequently embraced in scholarly investigations. In its foundational iteration in 1992, DeLone and McLean explored factors affecting the success of information systems in various contexts. In their original model, they underscored how both system quality and information quality impact use and user satisfaction, establishing a reciprocal correlation between usage and satisfaction (DeLone and McLean 1992). A significant enhancement occurred in 2003, introducing a service quality variable and enriching the model's dynamism by incorporating usage intention alongside satisfaction and usage (Delone and McLean 2003). A subsequent refinement in 2013 incorporated a plethora of variables into the model, with task characteristics, project and organizational attributes, as well as user and social aspects serving as independent variables, The dependent variable was comprised of technology aspects, including usage,

user satisfaction, and net benefits (Petter, DeLone, and McLean 2013).

Even though the model was introduced more than two decades ago, the factors of system quality, information quality, usage, and satisfaction continue to provide significant explanatory power. These variables retain their pivotal role in the contemporary rendition of the model. Scholars credit the model's continuous development to the evolving characteristics of information systems, which parallel the fundamental shifts occurring in the digital age. In a discussion titled "The past, present, and future of IS Success" (Petter, DeLone, and McLean 2012), researchers highlight the critical need to recognize the essential role of "information" within these systems, cultivating adaptable research methodologies and frameworks, promulgating pragmatic approaches for measurement, and dismantling silos in IS Success research.

While initially conceived within an organizational milieu, The Information Systems Success Model has been validated as a potent tool for evaluating the success, uptake, and endurance of diverse educational systems within learning contexts. This model has been extensively merged with a range of educational frameworks or theories in scholarly research, underscoring its adaptability and relevance in educational settings (Alsabawy et al, 2013; Balaban et al, 2013).

Learning engagement

The Expectation-Confirmation Model (ECM), which was presented by Bhattacharjee in 2001 (Bhattacherjee, 2001), emerged as a significant framework, emerged as a significant framework. This cognitive paradigm delves into users' post-adoption behaviors concerning their continuous engagement with information systems (IS) and information technology (IT). Through the years, adaptations of ECM have been applied across diverse IS/IT contexts, as evidenced by the works of Bhattacherjee. (2001), Cheng (2018), and M.-C. Lee (2010). In a recent development, Cheng (2022) Enriched the ECM by integrating the concept of learning engagement (LE) to provide a comprehensive insight into both extrinsic and intrinsic motivations driving MOOCs' continuation intention. Jung and Lee (2018) Specifically, learning engagement as the mental energy and endeavor that learners invest in the MOOC learning journey to achieve their envisioned objectives.

The MOOC learning activities, such as active participation in forums, diminish the likelihood of attrition. Furthermore, Breslow (2013) Noted that a significant portion of students who obtain certificates actively participate in course forums, indicating that learner behavioral engagement serves as a dependable indicator of MOOC completion. The learning engagement, including activities like attending lectures, exhibits robust predictive capabilities for MOOC achievement. After an extensive review of the literature, it is postulated that learning engagement significantly impacts the intention to complete a MOOC, with learning persistence within the MOOC serving as a mediating factor.

Confirmation

Confirmation involves users' assessment of how well their anticipated outcomes from the information system match up with the system's real-world functionality (Dağhan and Akkoyunlu, 2016). It addresses users' assessment of how closely the performance of the information system aligns with their expectations for IS/IT use (Bhattacherjee, 2001). Although many studies have explored intention, research on the sustained use of online learning environments remains scarce. As an example, Jin et al. (2010) proposed a framework aimed at forecasting the endurance of online communities, concentrating on aspects such as the continuity of information systems, practical and pleasurable values, and emotional dedication.

Moreover, when an e-learning system fulfills users' expectations, it can enhance their intrinsic

motivation to engage in e-learning activities (Cheng, 2019). Moreover, validating learners' expectations concerning the e-learning platform can encourage its use, thereby enriching their deeply engrossing experiences (Roca, Chiu,2006).

Information quality

In this research, we merge the Information Systems Success Model, established by DeLone and McLean in 2003, which includes factors like information quality, system quality, and service quality, with the confirmation component from Bhattacharjee's Information Systems Expectation Confirmation Model, published in 2001. As per DeLone and McLean's framework for evaluating IS success, the efficacy of an Information System is gauged through two key aspects: information quality (IQ) and system quality (SQ).

The influence of IS success elements encompasses both system usage and user contentment, with a direct effect on the latter sometimes being mediated through the former. Additionally, the interplay between system adoption and user approval can subsequently shape personal impact. This perspective is supported by further research aligned with the IS Success Model, which underscores the pivotal importance of information quality, system quality, and service quality in fostering the intent to persist with Massive Open Online Courses (MOOCs) (Jung and Lee 2018).

Previous investigations into e-learning have demonstrated that specific quality aspects considerably influence student satisfaction. Specifically, studies conducted by Mohammadi (2015) Have demonstrated that Satisfaction with System Quality (SYQ) serves as a predictor of learner satisfaction. Additionally, research by Mohammadi (2015) Has indicated that Information and Functional Quality (IFQ) influences user satisfaction. Moreover, Mohammadi (2015) Has recognized the Service Quality (SEQ) factor as a crucial determinant of learner satisfaction. Building upon these findings, the present study suggests that the higher the quality factors, including SYQ, IFQ, and SEQ, of online courses, the more probable it is for learners to experience increased satisfaction with their usage of online courses.

System quality

System quality represents the operational effectiveness and capabilities of an information system (IS), encompassing attributes like accuracy, user-friendliness, productivity, flexibility, reliability, and responsiveness (Delone and McLean 2003). In the context of e-learning platforms, when learners discern that the system delivers superior and pertinent functions that align with their learning objectives, they are prone to perceive the system as invaluable and gratifying (Roca et al. 2006). This perception is fortified when learners recognize appropriate system functionality, prompt responses, and efficacious communication avenues with educators and peers. (Cho et al, 2009). Furthermore, as educators cultivate engagement among students and provide compelling learning experiences via the e-learning platform, learners are likely to achieve a state of deep absorption and enjoyment, often referred to as flow (Cho et al., 2009).

Based on these findings, this investigation posits that in a blended e-learning environment, nurses' views on system quality significantly impact their perception of its utility (PU), their confirmation of expectations, and the immersive experiences they gain from utilizing the system.

Service quality

Within an e-learning framework, learners' assessment of service quality encompasses the overall excellence of personalized support services provided by the digital learning platform. High-quality support services are consistently acknowledged as a vital measure of student satisfaction and their

propensity to engage with the e-learning system (Roca et al., 2006). Exceptional assistance from help desks or system administrators is expected to increase learners' approval and satisfaction with the e-learning platform (Cho et al., 2009). In the context of online education, institutions that provide superior technical support services enhance learners' perception of the e-learning system's value. Additionally, students' favorable evaluations of the online support services offered through the e-learning platform significantly impact their affirmation of the system (Roca et al., 2006). It is also expected that enhanced service quality will motivate users to be more deeply immersed in their activities and derive greater pleasure from them (Ahn et al., 2007). Thus, this research posits that the excellence of support services exerts a positive influence on the flow of experiences generated by the blended e-learning platform. Expanding upon these insights, the investigation indicates that nurses' evaluations of support service quality within the blended e-learning environment considerably shape their levels of satisfaction, confirmation, and the flow experiences engendered by the system.

Satisfaction

The notion of satisfaction relates to an individual's evaluation of a particular object or entity's quality, which is contingent upon the extent to which their needs are met (Wu et al., 2023). There exist several types of satisfaction, including job satisfaction, consumer satisfaction, and learner satisfaction.

The Expectation-Confirmation Model (ECM), formulated by Bhattacharjee in 2001, incorporates the fundamental ideas of the Expectation-Confirmation Theory (ECT) that were originally presented by Oliver in 1980. The ECM acts as a cognitive framework that explains users' behaviors after they have started utilizing Information Systems/Information Technology (IS/IT) and their tendency to continue using these systems. This model has been utilized across diverse IS/IT settings (Bhattacherjee 2001).

The ECM extends the ECT by transforming the gap between initial expectations and real performance into a post-adoption structure designed to predict continuous intention in the IS/IT domain. Moreover, ECM explicates how users' cognitive convictions influence their dedication to sustained use of the IS/IT. In this scenario, satisfaction is associated with a mental or emotional condition that stems from assessing the disparity between expectations and performance. This model has been employed and adapted in various IS/IT studies, showcasing its flexibility and relevance across diverse technological contexts. (Bhattacherjee 2001). It offers a structure for understanding the cognitive processes of users and the elements that impact their decision to persist in using IS/IT.

Satisfaction is widely recognized as a strong indicator of continued use intent across numerous studies (Cheng 2019). When individuals find an e-learning platform satisfying, they are more likely to express a desire to persist in its usage. Specifically, within the realm of online education, it has been established that learner contentment with such courses significantly correlates with their propensity to maintain engagement (Alraimi, et al, 2015). Consequently, this research asserts that student satisfaction with online courses exerts a substantial influence on their intention to continue utilizing these platforms.

Continuance intention

In a research analysis conducted by Jin et al. (2010) that focused on Twitter users, it became clear that both technological and content-related satisfaction significantly influenced user satisfaction. This, in turn, had a notable effect on users' intentions to persist in using the platform. Continuance Intention, defined as users' aspirations for the ongoing utilization of an information system, serves as the key predictive variable in the model (Dağhan and Akkoyunlu 2016). Limited studies exist regarding the use of online learning platforms. Jin et al. (2010) introduced a predictive model focusing on the sustainability of online communities, emphasizing aspects such as continued usage of information

systems, practical and enjoyable benefits, and emotional dedication. A separate investigation explored the intention of online learners to persist using an amalgamated flow framework. Previous studies focused primarily on individual utilitarian motivations while overlooking social or hedonic aspects (Jin et al. 2010). These varied viewpoints facilitate a comprehensive understanding of the multitude of elements impacting users' decisions to continue engaging with online platforms.

Conceptual Framework

Cheng (2022) introduces an innovative conceptual structure that combines the principles of the Expectation Confirmation Model (ECM) and Learning Engagement (LE), complemented by an extension of the DeLone and McLean IS Success Model. The central objective of this unified model is to explore the impact of quality elements, serving as precursors to student perceptions, on their sustained dedication to engaging with Massive Open Online Courses (MOOCs). Alraimi's 2015 investigation highlights several drivers that enhance users' inclination to persist in utilizing MOOCs, encompassing perceived repute, openness, utility, satisfaction, and overall user contentment. These elements collectively account for a considerable amount of the variability in intentions to keep using MOOCs. Moreover, Dağhan and Akkoyunlu's 2016 exploration discloses that indicators like data quality, platform quality, and service caliber can elucidate the endorsement of online learning environments. Additionally, a striking 63% of the fluctuation in user satisfaction is attributable to considerations comprising data quality, platform quality, service quality, validation, practical worth, anticipated outcomes, and perceived valuation.

In this exploration, the independent variables encompass learning engagement, The evaluation of information quality, system quality, and service quality, with satisfaction serving as a mediating factor, is encompassed within confirmation. The choice to continue using the system is seen as the outcome variable. This study is anchored in the Expectation Confirmation Model (ECM) and the Information Systems (IS) Success Model. The study outlines seven interrelations between these constructs and posits seven associated hypotheses. The conceptual framework, founded on the ECM and IS Success Model, amalgamates three theoretical frameworks to elucidate the causal connections among variables. This framework is designed to investigate the elements that impact undergraduate satisfaction, as well as their inclination to persist with online course usage in Chengdu.
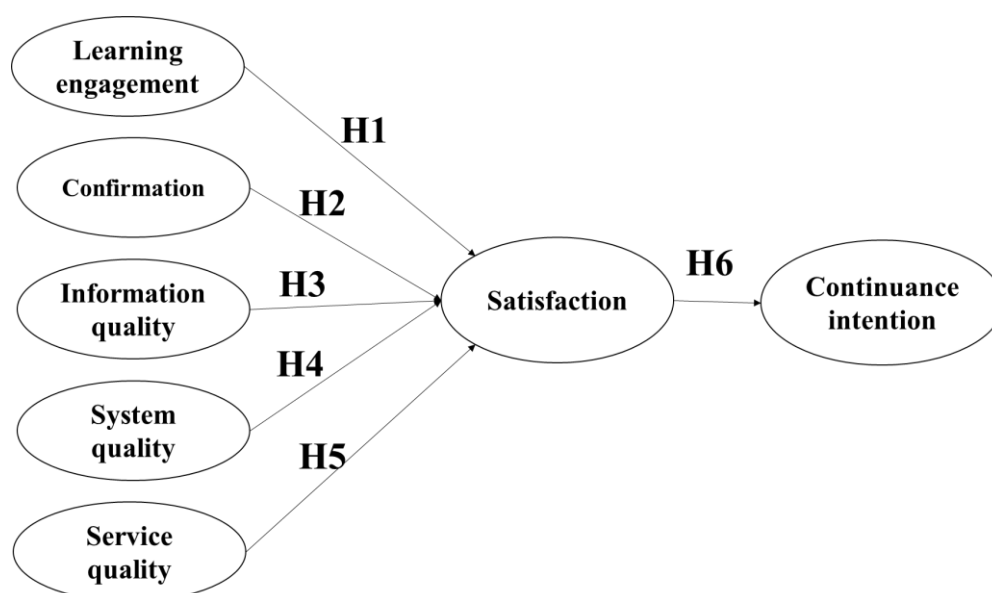
Figure 1 Conceptual Framework

Note: Crafted by the Author

Aligned with the architectural design of the framework, the researcher seeks to verify these hypotheses, thereby enhancing comprehension of the connections linking the independent and dependent variables.

H1. A substantial effect of learning engagement on satisfaction is evident.

H2. The impact of confirmation on satisfaction is significant.

H3. User satisfaction is greatly influenced by the quality of information.

H4. System quality has a substantial impact on satisfaction.

H5.   The level of service quality significantly shapes overall satisfaction.

H6. The intention to continue with online learning is significantly affected by user satisfaction.

Methodology

Research Instrument

Demographic surveys were used to gather participant background information, including gender, field of study, and relevant university specifics (Balaban et al., 2013). The researcher incorporated three items to gather students' demographic information, including gender, university data, and academic years, with one screening question employed by the researcher to confirm the suitability of the samples for subsequent interviews. Furthermore, To gather the background characteristics of the participants, such as gender, field of study, and relevant university specifics (as per Balaban et al., 2013), demographic surveys were employed. Three questions were included by the researcher to collect demographic data on the students, covering gender, university information, and academic standing.

Furthermore, a comprehensive set of 30 measurement items, derived from previous research, was employed to assess the latent constructs. This comprised 4 items related to learning engagement, Four items addressed satisfaction, four targeted continuance intention, three focused on the confirmation, five evaluated information quality, five assessed system quality, and four measured service quality. Each statement was scored using a five-point Likert scale, with respondents indicating their level of agreement or disagreement. A score of 5 represented strong agreement with positive statements, whereas a score of 1 denoted strong disagreement with negative statements (as detailed by Salkind, 2016). Appendix A provides comprehensive descriptions of these measurement items.

Validation of the Research Instrument

To validate the scale items, four educational experts—each possessing a Ph.D. and at least the rank of associate professor, with a minimum of nine years of experience in researching online education—were recruited to conduct an Item-Objective Congruence (IOC) assessment. This evaluation focused on assessing the specific goals outlined by the instrument's creator for the current study. The IOC assessment yielded a minimum score of 0.75, indicating adequate content validity for all items on the scale.

Furthermore, an initial study was implemented to appraise the internal consistency reliability of the research tool. In alignment with guidance from various academics (Jazayeri et al., 2023), a participant pool of 10 to 30 individuals was deemed suitable for the preliminary testing phase. However, 50 students participated in the pilot study, The internal consistency reliability was assessed using Cronbach's Alpha. The pilot study's outcomes showed that the lowest Cronbach's Alpha value across the dimensions was 0.731, which signifies a robust level of reliability for the scale items. For a

comprehensive breakdown of these results, refer to Table 1.

Table 1 Results for the Evaluation of Internal Consistency Reliability from the Pilot Test

Variables	No. of Items	Cronbach's Alpha
Learning engagement (LE)	4	0.938
Confirmation (CNF)	3	0.856
Information quality (IQ)	6	0.920
System quality (SQ)	5	0.947
Service quality (SEQ)	4	0.916
Satisfaction (SAT)	4	0.939
Continuance intention (CI)	4	0.731

Note: Assembled by the Author

Data Collection and Analysis

Before initiating comprehensive data collection, evaluations of content validity and internal consistency reliability were carried out. Following this, paper-based questionnaires were manually delivered to 500 undergraduate students studying art design at the four selected universities. The researchers employed JAMOVI and AMOS, two statistical software packages, for analyzing the collected data. Furthermore, a Confirmatory Factor Analysis (CFA) was executed to assess factor loadings, t-values, composite reliability (CR), average variance extracted (AVE), and discriminant validity. Thereafter, a Structural Equation Model (SEM) was applied to explore the hypothesized outcomes, including the direct, indirect, and total effects among latent variables.

Population and Sample Size

The investigation was aimed at all art design undergraduates enrolled in four leading public universities situated in Sichuan Province, China. These institutions include Chengdu University (CDU) the Sichuan Conservatory of Music (SCM), Xihua University (XHU), and Southwest Minzu University (SMU). Following the suggestion of a minimum sample size of 200–500 respondents for complex methodological approaches in structural equation modeling, 500 students were purposefully selected after rigorous screening and quota allocation from a population of 1466.

The survey was administered to undergraduate students majoring in art design at four renowned public institutions in Sichuan Province, China: Chengdu University (CDU), Sichuan Conservatory of Music (SCM), Xihua University (XHU), and Southwest Minzu University (SMU). In line with the recommendations by Hair et al. (2009) for employing complex structural equation modeling techniques, a minimum sample size of 200-500 participants is desirable, 500 students were meticulously selected from a total pool of 1466 through a detailed screening procedure and quota allocation.

Sampling Strategy

From a pool of 1466 undergraduates enrolled at the four key public universities in Sichuan Province, China, who participated in a two-month online education program initially, a sample of 500 participants was carefully chosen from 12 divisions using quota selection as the final stage of sampling. Upon questionnaire collection, 500 responses were deemed valid, while 0 entries were identified as containing invalid data.

Table 2 Sample Units and Sample Size

Four Main Subjects	Judgmental Size Total=1466	Proportional Sample Size Total = 500
English students	680	232
Art students	320	109
Math students	268	91
Physics students	198	68
Total	1466	500

Note: Constructed by the Author

Results

Demographic Information

Table 3 offers an exhaustive summary of the demographic characteristics of the 500 participants, indicating that 52.6% of the total sample were male students, while the rest, 47.4%, were female students. Of the participants, 46.4% specialized in English, 21.8% in Art, 18.2% in Math, and 13.6% in Physics. In terms of academic year, the distribution was: 27.2% sophomores, 33.6% juniors, and 39.2% seniors.

Table 3 Demographic Profile

Demographic Information (n=500)		Frequency	Percentage
Gender	Male	263	52.6%
	Female	237	47.4%
Major	English students	232	46.4%
	Art students	109	21.8%
	Math students	91	18.2%
	Physics students	68	13.6%
Academic Year	Sophomore	136	27.2%
	Junior	168	33.6%
	Senior	196	39.2%

Note: Constructed by the Author

Confirmatory Factor Analysis (CFA)

CFA was used to validate scale items' loadings against theoretical predictions. Results confirmed the model's appropriateness, with factor loadings meeting the criteria. Absolute and incremental fit indices (e.g., CMIN/DF, GFI, AGFI, RMSEA, CFI, NFI, TLI) met pre-set standards, indicating good model fit. Overall, CFA assessment metrics were deemed adequate.

Table 4 Goodness of Fit for Confirmatory Factor Analysis

Index	Criterion	Source	Practical Values
CMIN/DF	<3	Hair et al. (2006)	1.193
GFI	>0.9	Arbuckle, (1995)	0.943
AGFI	>0.8	Sica and Ghisi, (2007)	0.932
NFI	>0.9	Hairet al., (2006); Arbuckle, (1995)	0.953
TLI	>0.9	Hair et al. (2006)	0.991
CFI	>0.9	Hairet al., (2006; Arbuckle, (1995)	0.992
RMSA	<0.08	Pedroso et. al., (2016)	0.020

Note: Constructed by the Author

Table 5 This section presents the outcomes of the Confirmatory Factor Analysis (CFA), alongside the metrics for Composite Reliability (CR) and Average Variance Extracted (AVE).

Latent Variables	Source of Questionnaire	Item	Factors Loading	t-value		CR	AVE
Learning engagement (LE)	Cheng, (2022)	LEE4	0.852			0.911	0.718
		LEE3	0.863	24.060	***		
		LEE2	0.845	23.339	***		
		LEE1	0.829	22.632	***		
Confirmation (COF)	(Alraimi et al. 2015)	CNF3	0.861			0.879	0.709
		CNF2	0.862	21.976	***		
		CNF1	0.801	20.472	***		
Information quality (IQ)	(Alraimi et al. 2015)	IQ6	0.820			0.923	0.666
		IQ5	0.791	20.349	***		
		IQ4	0.785	20.148	***		
		IQ3	0.832	21.878	***		
		IQ2	0.841	22.204	***		
		IQ1	0.825	21.609	***		
System quality (SQ)	(Alraimi et al. 2015)	SQ5	0.806			0.909	0.667
		SQ4	0.839	21.208	***		
		SQ3	0.819	20.520	***		
		SQ2	0.835	21.072	***		
		SQ1	0.784	19.378	***		
Service quality (SEQ)	(Alraimi et al. 2015)	SEQ4	0.757			0.867	0.620
		SEQ3	0.794	17.374	***		
		SEQ2	0.777	16.996	***		
		SEQ1	0.820	17.888	***		
Satisfaction (SAT)	(Cheng 2022)	SAT4	0.809			0.890	0.670
		SAT3	0.816	19.960	***		
		SAT2	0.832	20.423	***		

Latent Variables	Source of Questionnaire	Item	Factors Loading	t-value		CR	AVE
		SAT1	0.817	20.004	***		
Continuance intention (CI)	(Cheng 2022)	CI4	0.814			0.881	0.650
		CI3	0.792	19.214	***		
		CI2	0.796	19.309	***		
		CI1	0.822	20.081	***		

Note: *** $p<0.001$, ** $p<0.01$, * $p<0.05$
Note: Constructed by the Author

Table 5 indicates that all the average variance extracted (AVE) exceeded 0.50, the composite reliability (CR) was more than 0.70, and the factor loadings consistently stayed above 0.50 (in line with Jafari et al., 2011). Table 6 outlines the results for discriminant validity. Here, the diagonal entries denote the square roots of the AVE values, and no correlation between any pair of latent variables reached above 0.80 (Savalei, 2012). Consequently, these quantitative assessments confirm discriminant validity.

Table 6 Discriminant Validity

	LE	CNF	IQ	SQ	SAT	SEQ	CI
LE	0.847						
CNF	0.246	0.842					
IQ	0.294	0.184	0.816				
SQ	0.261	0.204	0.188	0.817			
SAT	0.223	0.239	0.256	0.203	0.787		
SEQ	0.297	0.267	0.313	0.282	0.293	0.819	
CI	0.319	0.347	0.311	0.291	0.310	0.377	0.806

Note: Constructed by the Author

Structural Equation Model (SEM)

After the CFA assessment, the research proceeded to validate the structural equation model (SEM) by examining a precise set of linear coefficients. This examination aimed to evaluate the suitability of the proposed causal explanation using SEM methodologies. Moreover, SEM explores the causal relationships among variables within the established model while addressing potential biases or inaccuracies in the coefficients, as noted by Liu et al (2009). As illustrated in Table 7, when analyzed using AMOS version 24, The SEM's adequacy of fit was substantiated, as the indices for CMIN/DF, GFI, AGFI, CFI, NFI, TLI, and RMSEA all exceeded the requisite benchmarks.

Table 7 Goodness of Fit for Structural Equation Modeling

Index	Acceptable Values	Source	After Adjust Values
CMIN/DF	<3	Hair et al. (2006)	2.046
GFI	>0.8	(Doll et al, 1994)	0.886
AGFI	>0.8	Sica and Ghisi, (2007)	0.867

Index	Acceptable Values	Source	After Adjust Values
NFI	>0.9	Hairet al., (2006); Arbuckle, (1995)	0.916
TLI	>0.9	Hair et al. (2006)	0.951
CFI	>0.9	Hairet al., (2006; Arbuckle, (1995)	0.955
RMSEA	<0.08	Pedroso et. al., (2016)	0.046

Note: Constructed by the Author

Discussion

The findings outlined in Table 7 reveal that confirmation exerted a direct and substantial influence on satisfaction, showcasing the strongest effects within this quantitative analysis, as evidenced by a standardized path coefficient (β) of 0.168 (t-value = 3.437***). The second most potent impact on satisfaction was exhibited by service quality, which had a β value of 0.207 (t-value = 4.152***).

Furthermore, the impact of satisfaction on continuance intention was substantial, indicated by a β value of 0.361 (t-value = 7.08***). Learning engagement also exerted a significant effect on satisfaction, as evidenced by a β of 0.096 (t-value = 2.001). In addition, satisfaction was considerably influenced by information quality, which is reflected in a β of 0.167 (t-value = 3.498***). System quality similarly demonstrated a notable effect on satisfaction, with a β of 0.102 (t-value = 2.127).

Table 8 Hypothesis Result of the Structural Equation Modeling

Hypothesis	Paths	Standardized path coefficient β	S. E.	t-value	p	Test Result
H1	SAT<---LEE	0.096	0.043	2.001	*	Supported
H2	SAT<---CNF	0.168	0.043	3.437	***	Supported
H3	SAT<---IQ	0.167	0.044	3.498	***	Supported
H4	SAT<---SQ	0.102	0.044	2.127	*	Supported
H5	SAT<---SEQ	0.207	0.052	4.152	***	Supported
H6	CI<---SAT	0.361	0.05	7.08	***	Supported

Note: *** p<0.001, ** p<0.01, * p<0.05
Note: Constructed by the Author

The outcomes detailed in Table 8 illustrate that, within the structural model, H1 posits a substantial effect of learning engagement on satisfaction, as evidenced by a standardized path coefficient that surpasses the benchmark value of 0.096. Several studies provide empirical evidence supporting the strong relationship between Learning engagement and satisfaction (Cho et al. 2009).

Regarding H2, the analysis underscores confirmation as a principal driver of satisfaction, boasting a standardized path coefficient of 0.168. Cheng (2022)Suggests that satisfaction with the adoption of specific technologies is influenced by Confirmation, which significantly impacts students' perceptions of instructional approaches.

The results supporting H3 confirm the substantial influence of information quality on user satisfaction, indicated by a standardized coefficient value of 0.167. This finding aligns with extensive research demonstrating that high-quality information is pivotal in determining satisfaction with

educational methods (Ahn et al., 2007).

Furthermore, Hypothesis 4 suggests that system quality has a substantial impact on participant satisfaction, supported by a standardized coefficient of 0.102. Within the scope of this investigation, this hypothesis highlights a central claim—that the overall quality of the system significantly influences the degree of satisfaction among participants (Cheng 2012).

Similarly, Hypothesis 5 indicates a substantial contribution of service quality to satisfaction within this research, evidenced by a standardized coefficient of 0.052. The clear association between the perceived excellence of provided services and the resultant satisfaction underscores the critical importance of superior service in defining the holistic educational experience.

Concerning H6, the inquiry substantiates a link between satisfaction and continuance intention, as evidenced by a standardized coefficient value of 0.05. This association indicates that the level of satisfaction reported by participants has a direct impact on their propensity for ongoing involvement and dedication. The profound implication of this association underscores the critical role that satisfaction plays in shaping individuals' ongoing intentions within the educational domain. (Roca et al. 2006).

As illustrated in Figure 2, the study's conceptual framework includes four independent variables, two mediators, and a single dependent variable. Here, the dependent variable, Satisfaction, exhibits an R2 value of 0.119, indicating that the cumulative effect of the independent and mediating variables accounts for 19.3% of the variation in satisfaction levels. Significantly, the latent Satisfaction variable has a direct impact on Continuance Intention, as evidenced by a coefficient of 7.08***. Furthermore, five factors—Learning Engagement, Confirmation, Information Quality, System Quality, and Service Quality—exert significant effects on Satisfaction, bearing coefficients of 2.001*, 3.437***, 3.498***, 2.127*, and 4.152***, respectively.

In the quantitative analysis, the initial mediator is satisfaction, which explains 11.9% of the variance. Furthermore, a substantial and direct relationship of 7.08*** is observed between perceived ease of use and perceived usefulness. Finally, continuance intention (e) serves as an additional mediating factor in this research, explaining 13.0% of the variance.
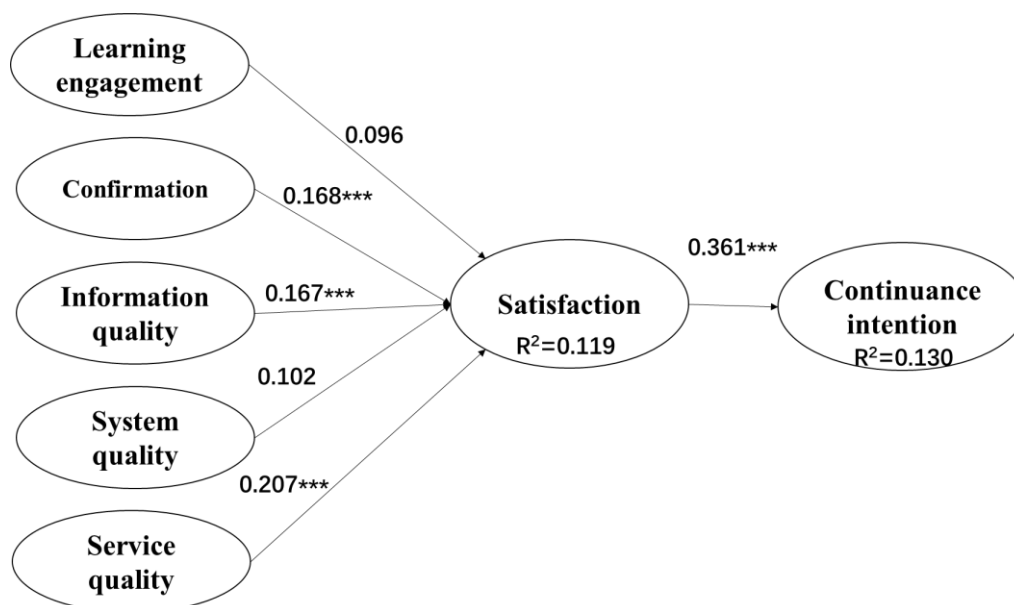

Figure 2 Path Diagram Analysis

Note: *** p<0.001, ** p<0.01, * p<0.05
Note: Created by the Author

Conclusions

This study aimed to explore the factors influencing the satisfaction of undergraduate students participating in digital education programs in Chengdu, China. To elucidate the interconnections between learning involvement, confirmation, information caliber, system standards, service quality, satisfaction, and the desire for ongoing participation, six conjectures were established using a theoretical model. As part of the methodological process, a survey was designed and distributed to 500 postgraduate students with previous exposure to digital learning environments. The theoretical model's soundness and consistency were evaluated using Confirmatory Factor Analysis (CFA). Furthermore, Structural Equation Modeling (SEM) was employed to identify the critical factors that influence satisfaction, with all conjectures being corroborated. The study's outcomes demonstrated that satisfaction had the most significant effect on the intention to continue, directly influencing the dependent variable. Confirmation and information quality were the subsequent most impactful factors on satisfaction, showcasing nearly identical standardized path coefficients. Additionally, service quality and system quality were recognized as crucial components affecting satisfaction.

Recommendations

Drawing upon the illuminating insights garnered from this comprehensive quantitative investigation concerning the myriad factors influencing satisfaction levels among undergraduate students in Chengdu, a series of pragmatic recommendations have been formulated to bolster academic achievement significantly:

To amplify the engagement levels in the realm of learning, it is imperative for educators to intricately tailor their instructional methodologies to harmonize seamlessly with the intricacies of online art education. Through this tailored approach, students can be motivated and empowered to autonomously fulfill the rigorous academic requisites, thereby fostering a culture of self-reliance and academic excellence.

Educators and academic entities should extend a nurturing hand to students, guiding them to surmount any hesitations or reservations they may harbor towards the online educational ecosystem. By offering unwavering support, students can navigate the virtual learning domain with confidence and ease, ensuring a harmonious transition and adept utilization of online platforms. Simultaneously, the transformation of traditional teaching materials into digitally optimized formats personalized for the idiosyncrasies of art subjects can further enrich the learning experience for students.

The utmost priority should be accorded to technical maintenance, guidance, and operational support on the online teaching platform, paving the way for a seamlessly curated learning journey replete with convenient access to an extensive reservoir of educational resources. By streamlining the technological facets, students can immerse themselves in a conducive learning atmosphere that nurtures holistic academic growth.

In the domain of performance affirmation, the provision of independent avenues for students to delve deeper into additional theoretical facets and hone practical skills stands as a transformative strategy. This personalized approach not only augments their satisfaction levels but also cultivates a sense of intellectual fulfillment, thereby propelling them toward unparalleled academic prowess and self-discovery.

Reference

Ahn, T., Ryu, S., & Han, I. 2007. "The Impact of Web Quality and Playfulness on User Acceptance of Online Retailing." Information & Management 44(3), 263–75. doi: 10.1016/j.im.2006.12.008.

Al Masud, A.M., Hossain, A., Biswas, S., Ruma, A.P., Rahman, K.S., & Tagore, S. (2023). The Emergence of Digital Learning in Higher Education: A Lesson from the COVID-19 Pandemic. *The International Journal of Information and Learning Technology* 40(3), 202–24. doi: 10.1108/IJILT-08-2022-0176.

Ali, Q., Abbas, A., Raza, A., Khan, M.T.I., Zulfiqar, H., Iqbal, M.A., Nayak, R.K., & Alotaibi, B.A. 2023. Exploring the Students' Perceived Effectiveness of Online Education during the COVID-19 Pandemic: Empirical Analysis Using Structural Equation Modeling (SEM). *Behavioral Sciences.* 13(7), 578. doi: 10.3390/bs13070578.

Alraimi, K.M., Zo, H., & Ciganek, A.P. (2015). Understanding the MOOCs Continuance: The Role of Openness and Reputation. Computers & Education. 80, 28–38. doi:10.1016/j.compedu.2014.08.006.

Alsabawy, A.Y., Cater-Steel, A., & Soar, J. (2013). IT Infrastructure Services as a Requirement for E-Learning System Success." Computers & Education. 69, 431–51. doi: 10.1016/j.compedu.2013.07.035.

Arbuckle, J.L. (1995). *AMOS for Windows Analysis of Moment Structures.* Version 3.5. Chicago: Small Waters Corp

Armah, J.K., Bervell, B., & Bonsu, N.O. (2023). Modeling the Role of Learner Presence within the Community of Inquiry Framework to Determine Online Course Satisfaction in Distance Education. Heliyon. 9(5), e15803. doi: 10.1016/j.heliyon.2023.e15803.

Balaban, I., Mu, E., & Divjak, B. (2013). Development of an Electronic Portfolio System Success Model: An Information Systems Approach." Computers & Education. 60(1), 396–411. doi: 10.1016/j.compedu.2012.06.013.

Bhattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly*, 25(3), 351. doi: 10.2307/3250921.

Breslow, L., Pritchard, D.E., DeBoer, J., Stump, G.S., Ho, A.H., & Seaton, D.T. 2013. Studying Learning in the Worldwide Classroom Research into edX's First MOOC. *Research & Practice in Assessment.* 8, 13–25.

Cheng, Y.M. (2012). The Effects of Information Systems Quality on Nurses' Acceptance of the Electronic Learning System. *Journal of Nursing Research.* 20(1), 19–31. doi: 10.1097/JNR.0b013e31824777aa.

Cheng, Y.M. (2018). What Drives Cloud ERP Continuance? An Integrated View. *Journal of Enterprise Information Management*. 31(5), 724–50. doi: 10.1108/JEIM-02-2018-0043.

Cheng, Y.M. (2019). How Does Task-Technology Fit Influence Cloud-Based e-Learning Continuance and Impact? *Education + Training.* 61(4), 480–99. doi: 10.1108/ET-09-2018-0203.

Cheng, Y.M. (2022). Which Quality Determinants Cause MOOCs Continuance Intention? *A Hybrid Extending the Expectation-Confirmation Model with Learning Engagement and Information Systems Success*. Library Hi Tech. doi: 10.1108/LHT-11-2021-0391.

Chiu, C.M., Hsu, M.H., Sun, S.Y., Lin, T.C., & Sun, P.C. (2005). Usability, Quality, Value and e-

Learning Continuance Decisions. *Computers & Education.* 45(4), 399–416. doi: 10.1016/j.compedu.2004.06.001.

Cho, V.T.C., Cheng, E., & Jennifer Lai, W.M. (2009). The Role of Perceived User-Interface Design in Continued Usage Intention of Self-Paced e-Learning Tools. *Computers & Education.* 53(2), 216–27. doi: 10.1016/j.compedu.2009.01.014.

Dağhan, G., & Akkoyunlu, B. (2016). Modeling the Continuance Usage Intention of Online Learning Environments. *Computers in Human Behavior.* 60, 198–211. doi: 10.1016/j.chb.2016.02.066.

DeLone, W.H., & McLean, E.R. (1992). Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research.* 3(1), 60–95. doi: 10.1287/isre.3.1.60.

Delone, W.H., & McLean, E.R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems.* 19(4), 9–30. doi: 10.1080/07421222.2003.11045748.

Doll, R., Peto, R., Wheatley, K., Gray, R., & Sutherland, I. (1994). Mortality in relation to smoking: 40 years' observations on male British doctors. *BMJ*, **309**, 901–911

Gopal, R., Singh, V., & Aggarwal, A. (2021). Impact of Online Classes on the Satisfaction and Performance of Students during the Pandemic Period of COVID-19. *Education and Information Technologies*. 26(6), 6923–6947. doi: 10.1007/s10639-021-10523-1.

Hair Jr., J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2009). *Multivariate Data Analysis.* 7th Edition, Prentice Hall, Upper Saddle River, 761.

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). *Multivariate Data Analysis.* 6th Edition, Pearson Prentice Hall, Upper Saddle River.

Hew, K.F. (2016). Promoting Engagement in Online Courses: What Strategies Can We Learn from Three Highly Rated MOOCS: Engagement: Lessons from MOOCs. *British Journal of Educational Technology*. 47(2), 320–41. doi: 10.1111/bjet.12235.

Hsu, M.H., Chiu, C.M., & Ju, T.L. (2004). Determinants of Continued Use of the WWW: An Integration of Two Theoretical Models. *Industrial Management & Data Systems.* 104(9), 766–75. doi: 10.1108/02635570410567757.

Jafari, S.M., Ali, N.A., Sambasivan, M., & Said, M.F. (2011). A Respecification and Extension of DeLone and McLean Model of IS Success in the Citizen-Centric e-Governance. *Pp. 342–46 in 2011 IEEE International Conference on Information Reuse & Integration.* Las Vegas, NV, USA: IEEE.

Jazayeri, S., Pourahmad, A., Abdollahi, S.A., Hassanvand, A., Alobaid, F., & Aghel, B. (2023). Experimental Investigation and CFD Simulation of Cryogenic Condenser. *Processes.* 11(6), 1845. doi: 10.3390/pr11061845.

Jin, X.L., Lee, M.K.O., Cheung, C.M.K. (2010). Predicting Continuance in Online Communities: Model Development and Empirical Test. *Behaviour & Information Technology*. 29(4), 383–94. doi: 10.1080/01449290903398190.

Jung, Y., & Lee, J. (2018). Learning Engagement and Persistence in Massive Open Online Courses (MOOCS). *Computers & Education.* 122, 9–22. doi: 10.1016/j.compedu.2018.02.013.

Lee, J.W. (2010). Online Support Service Quality, Online Learning Acceptance, and Student Satisfaction. *Special Issue on Web 2.0*. 13(4), 277–83. doi: 10.1016/j.iheduc.2010.08.002.

Lee, M.C. (2010). Explaining and Predicting Users' Continuance Intention toward e-Learning: An Extension of the Expectation–Confirmation Model. *Computers & Education*. 54(2), 506–16. doi:

[287]

10.1016/j.compedu.2009.09.002.

Liu, S., Liao, H.L., & Pratt, J.A. (2009). Impact of Media Richness and Flow on E-Learning Technology Acceptance. *Computers & Education.* 52(3), 599–607. doi: 10.1016/j.compedu.2008.11.002.

Mohammadi, H. (2015). Investigating Users' Perspectives on e-Learning: An Integration of TAM and IS Success Model. *Computers in Human Behavior*, 45, 359–74. doi: 10.1016/j.chb.2014.07.044.

Oliver, R.L. (1980). "A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions." Journal of Marketing Research 17(4), 460–69. doi: 10.1177/002224378001700405.

Pedroso, C.B., da Silva, A.L., Tate, W.L. (2016). Sales and Operations Planning (S&OP): insights from a multi-case study of Brazilian organizations. *Int J Prod Econ*. 182, 213–229

Petter, S., DeLone, W., & McLean, E. (2012). The Past, Present, and Future of 'IS Success.'*Journal of the Association for Information Systems.* 13(5), 341–62. doi: 10.17705/1jais.00296.

Petter, S., DeLone, W., & McLean, E.R. 2013. "Information Systems Success: The Quest for the Independent Variables." *Journal of Management Information Systems.* 29(4), 7–62. doi: 10.2753/MIS0742-1222290401.

Roca, J.C., Chiu, C.M., & Martínez, F.J. (2006). Understanding E-Learning Continuance Intention: An Extension of the Technology Acceptance Model. *International Journal of Human-Computer Studies*. 64(8), 683–96. doi: 10.1016/j.ijhcs.2006.01.003.

Salkind, N. J. (2016). Statistics for People Who (Think They) Hate Statistics. SAGE Publications.

Savalei, V. (2012). The Relationship Between Root Mean Square Error of Approximation and Model Misspecification in Confirmatory Factor Analysis Models. *Educational and Psychological Measurement.* 72(6), 910–32. doi: 10.1177/0013164412452564.

Sica, C., & Ghisi, M. (2007). The Italian versions of the Beck Anxiety Inventory and the Beck Depression Inventory-II: Psychometric properties and discriminant power. In M. A. Lange (Ed.), *Leading-edge psychological tests and testing research* (pp. 27–50). Nova Science Publishers.

Wu, Y., Xu, X., Xue, J., & Hu, P. 2023. A Cross-Group Comparison Study of the Effect of Interaction on Satisfaction in Online Learning: The Parallel Mediating Role of Academic Emotions and Self-Regulated Learning. *Computers & Education,* 199:104776. doi: 10.1016/j.compedu.2023.104776.

Yong, X., Ling, Q., Li, X. 2021. "Ubiquitous E-Teaching and e-Learning: China's Massive Adoption of Online Education and Launching MOOCs Internationally during the COVID-19 Outbreak" edited by B. B. Gupta. Wireless Communications and Mobile Computing 2021:1–14. doi: 10.1155/2021/6358976.