Journal of Liberal Arts, Thammasat University
วารสารศิลปศาสตร์ มหาวิทยาลัยธรรมศาสตร์
Journal homepage: https://so03.tci-thaijo.org/index.php/liberalarts/index

Factors Affecting Satisfaction and Continuance Intention of Thai Undergraduate Students Using Chinese Learning Apps[i]

Chao Zhang, Nathakarn Thaveewatanaseth*, and Kanokporn Numtong

Faculty of Humanities, Kasetsart University, Thailand

Article Info

Research Article

Article History:
Received 24 March 2025
Revised 23 April 2025
Accepted 6 May 2025

Keywords :

apps,
Chinese learning,
Continuance Intention,
satisfaction,
Thai undergraduate students

* Corresponding author
E-mail address:
nathakarn.th@ku.th

Abstract

This study explores factors influencing Thai undergraduates' satisfaction and continued use of Chinese learning apps. The framework includes Perceived Usefulness (UF), Autonomy (AN), Interactivity (IA), Confirmation (CF), Interest (IT), Satisfaction (SF), and Continuance Intention (CI). A survey of 455 students from five Thai universities was conducted using a non-probability sampling method. Data was collected online and offline, then analyzed with SEM and CFA. Results show all factors significantly impact outcomes. UF, AN, IA, CF, and IT influence SF, with IT being the strongest predictor. SF directly affects CI and serves as a mediator. All six hypotheses were supported. The findings suggest developers should strengthen these key elements to improve user satisfaction and retention.

[i] This article is part of a thesis entitled "Factors Affecting Satisfaction and Continuance Intention of Thai Undergraduate Students Using Chinese Learning Apps" for the degree of Doctor of Philosophy (Eastern Languages), Department of Eastern Languages, Faculty of Humanities, Kasetsart University.

1. Introduction

The number of Chinese language learners in Thailand has increased significantly, with more than 3,000 schools offering Chinese courses and over one million Chinese language learners in 2019 (Fei, 2023). By 2027, global Chinese language learners are projected to exceed six million (HolonIQ, 2023). The rapid advancement of technology, particularly language learning apps, has played a crucial role in this growth, especially in Thai universities. This study investigates the factors influencing student satisfaction and continuance intention in using these apps.

Chinese online learning platforms have evolved from basic supplementary tools to sophisticated, AI-driven systems. Early platforms had limited functionalities, but recent developments, such as real-time communication, adaptive learning, and gamification, have enhanced engagement and learning outcomes (Ayeni et al., 2024; Xu et al., 2022; Zhang, 2024). Mobile accessibility and collaborations with educational institutions ensure these platforms align with local learning needs, while AI and data analytics are expected to drive future innovations (Wongwatkit et al., 2023).

The advancement of mobile technology has significantly influenced Chinese language learning, particularly through app development. Key research highlights the benefits of gamification, the necessity for advanced algorithms in personalized learning, and user-centered design (Rabaa'i, 2021). Additionally, AR technology has shown promise for character learning, and social learning theories contribute to motivation enhancement (P. Li & Lan, 2021). Despite their increasing popularity, with over one million downloads on Google Play as of September 2024, there remains a research gap in evaluating user satisfaction and continuance intention in the Thai context.

However, the adoption of Chinese language learning apps in Thai universities faces challenges. Issues such as the need for culturally relevant content, user-friendly interfaces, and social interaction features impact learner engagement and satisfaction (Hsu & Lin, 2022). The absence of localized research suggests a misalignment between app offerings and Thai learners' expectations. Enhancing app effectiveness requires integrating technological innovation with pedagogical strategies and incorporating user feedback (Kumar et al., 2021).

2. Research Objectives and Significance

This study focuses on identifying the main factors that influence the satisfaction of Thai university students and their willingness to continue using Chinese language learning applications. The research begins with an overview of current usage trends and common challenges faced by students when using such apps. Building on this foundation, a theoretical framework is developed to analyze how specific factors shape students' learning experiences and sustained engagement.

To explore these issues in depth, the study adopts a quantitative approach, using survey data and statistical analysis to examine the impact of five key variables—Perceived Usefulness, Perceived Autonomy, Interactivity, Confirmation, and Perceived Interest—on student Satisfaction and Continuance Intention. These seven variables form the core of the conceptual framework guiding the research.

The objectives of the study are as follows:

1. To investigate the influence of Perceived Usefulness on student Satisfaction.
2. To examine how Perceived Autonomy affects student Satisfaction.
3. To assess the impact of Interactivity on student Satisfaction.
4. To explore the relationship between Confirmation and student Satisfaction.
5. To determine the effect of Perceived Interest on student Satisfaction.
6. To evaluate how student Satisfaction influences Continuance Intention.

By clarifying these relationships, the study aims to offer practical recommendations for improving Chinese language learning apps. The findings are expected to assist developers and educators in enhancing app design, meeting learners' needs more effectively, and creating a more engaging learning environment. Ultimately, the study contributes to the improvement of digital learning tools by emphasizing user experience and supporting long-term learning outcomes.

3. Literature Review

3.1 Factors affecting satisfaction and continuance intention

3.1.1 Perceived Usefulness (PU)

Perceived Usefulness is the user's subjective belief in a technology's ability to enhance task performance. Originating from the Technology Acceptance Model (TAM), Perceived Usefulness predicts the adoption of technology products and services (Davis, 1989a, 1989b; Legramante et al., 2023). In education, Perceived Usefulness is associated

with Learning Management Systems like Moodle, reflecting the belief in increased productivity and effectiveness. Perceived Usefulness as a key indicator for the acceptance and continued use of technology, while it to the practicality and benefit of content in decision-making (Gani et al., 2023). Perceived usefulness is a fundamental concept in e-learning research, particularly highlighted during the COVID-19 pandemic. PU significance in the adoption of e-learning by medical staff and sports science students, respectively (Zalat et al., 2021).

3.1.2 Perceived Autonomy (AN)

Perceived autonomy in education signifies an individual's capacity to self-direct their learning experiences, encompassing goal setting, strategy selection, and self-regulation (Maru et al., 2021). This concept is integral to online learning, where it manifests as the student's sense of control over the learning process and their willingness to take responsibility for their educational journey. In language learning, perceived autonomy involves learners managing their own learning goals, methods, and outcomes (Ningsih & Yusuf, 2021). Perceived autonomy's importance in effective learning, particularly in distance education, where self-directed approaches are essential. Intrinsic motivation is crucial for deep engagement and resilience in learning challenges (Lazorak et al., 2021).

3.1.3 Interactivity (IA)

Interactivity in e-learning, as defined by Ho et al. (2021), involves dynamic teacher-learner communication, fostering a collaborative environment. It is crucial for the quality of e-learning systems, allowing for real-time interaction, immediate feedback, and active participation. Interactivity's role in immediate feedback and learner engagement, with systems that respond to user input and support communication and collaboration (Kim et al., 2022). Alam and Mohanty (2023) demonstrate that interactivity significantly shapes user experiences and drives e-learning platform adoption by enhancing perceived utility, usability, and satisfaction. High interactivity levels lead to increased satisfaction and continued use of e-learning platforms, aligning with Steils et al. (2019), who note interactivity's encouragement of exploration and control in online learning.

3.1.4 Confirmation (CF)

Cheng (2022) conceptualizes confirmation as the match between learners' preconceived expectations and the actual performance of cloud-based e-learning systems, influencing continued engagement. Confirmation is the validation of initial expectations through system use, a process that shapes user satisfaction and future use intentions. Confirmation as a cognitive assessment comparing pre-use expectations with system

performance, critical for understanding users' intentions to continue using the system. Jami Pour et al. (2021) highlight confirmation's role in learning effectiveness, measuring the fulfillment of expected needs and the facilitation of the learning process. Tawafak et al. (2023) identify confirmation as the alignment between students' expectations and the performance of e-learning platforms, which is pivotal for satisfaction and continued use. Confirmation's impact on perceived usefulness and cognitive absorption, essential for system success.

3.1.5 Perceived Interested (IT)

Hoq (2020) defines perceived interest as learners' subjective appreciation for the participatory and flexible nature of online education independent of specific platforms. Perceived Interest in student engagement and enthusiasm in e-learning, influenced by material accessibility and platform effectiveness. Patricia Aguilera-Hermida (2020) views perceived interest as intrinsic motivation and emotional response critical to academic performance and suggests it's shaped by material clarity, simplicity, and the use of engaging media. Abbasi et al. (2020) reveal the multifaceted nature of student interest in e-learning, influenced by the shift to virtual platforms and the integration of e-learning with traditional methods. Increased interest in Massive Open Online Courses (MOOCs) and e-learning resources, respectively, during the pandemic, indicating a transformative approach to education (Valverde-Berrocoso et al., 2020).

3.1.6 Satisfaction (SF)

Venkatesh (2021) view satisfaction as a complex construct shaped by personal, environmental, and cognitive factors, crucial for a positive educational experience. Rajabalee and Santally (2021) define satisfaction as a reflection of students' perceptions of the educational experience's quality and alignment with their expectations, contributing to a sense of achievement and fulfillment in the learning process. Younas et al. (2022) highlight online learning motivation as a mediator for adapting to new educational landscapes, with digital competence and student willingness to engage critically for satisfaction and academic success. Effective communication, flexible programs, and collaborative activities as positive contributors to the learning experience, while technical issues and workload management can detract from satisfaction. The impact of service quality, trust, and perceived technology usefulness on satisfaction, particularly in the context of cloud services and e-learning opportunities (Y. Li et al., 2021).

3.1.7 Continuance Intention (CI)

Widjaja and Widjaja (2022) define continuance intention as the willingness to persist in using a system, driven by perceived usefulness and fulfillment from interactions, significantly influenced by the system's communication facilitation and learner accommodation. Continuance intention is the tendency to maintain the use of online learning tools, shaped by satisfaction, subjective norms, and behavioral control. Continuance intention is further defined as the ongoing commitment to engage with Learning Management Systems (LMS), based on a framework of expectation fulfillment, technology acceptance, social impact, and enjoyment (Ashrafi et al., 2020). Shao and Chen (2020) find that interactivity attributes like control and communication significantly enhance MOOC users' continuance intention, with engagement as a mediator. Suzianti and Paramadini (2021) emphasize system quality, information quality, teacher self-efficacy, and technical support as key to educators' and students' continuance intention, respectively, crucial for e-learning integration and adaptation in educational settings.

3.2 Research Hypothesis and Relationship between Variables

3.2.1 Relation between Perceived Usefulness (UF) and Satisfaction (SF)

Bansah and Darko Agyei (2022) establish a strong link between perceived usefulness and Learning Management System acceptance, with convenience as a key factor. Landrum (2020) highlights self-efficacy as a critical predictor of online learning satisfaction and usefulness, indicating that student confidence in online learning enhances perceived course value. Oktafiani et al. (2021) demonstrate that perceived usefulness is the key driver of customer satisfaction with e-wallet services. Wilson et al. (2021) reveal that perceived usefulness positively impacts satisfaction and trust among Chinese computer consumers, with trust being a stronger mediator for customer loyalty. Han and Sa (2021) suggest that enhancing online class usability and emphasizing student-preferred features can increase satisfaction and acceptance of online education.

Drawing from the reviewed literature, this study formulates the following hypothesis:

H1: Perceived Usefulness (UF) had significant impact on Satisfaction (SF).

3.2.2 Relation between Perceived Autonomy (AN) and Satisfaction (SF)

Navaneethakrishnan (2020) finds a strong link between autonomy and job satisfaction, suggesting autonomy's role in enhancing professional contentment and mediating student behavior's impact on satisfaction and show that autonomy and

relatedness directly predict autonomous motivation, a key predictor of finding meaningful work. Huescar Hernandez et al. (2020) highlight autonomy support's influence on academic performance through basic psychological needs and intrinsic motivation, with perseverance as a mediator and demonstrate that autonomy-supportive teaching improves student satisfaction and engagement. Hosseini et al. (2020) reveal that perceived autonomy support in physical education boosts students' motivation and intention to participate in leisure activities and associate telework job satisfaction with competencies, autonomy, and a positive organizational climate. Mossman et al. (2022) meta-analyzes the positive impact of autonomy support on autonomy satisfaction being a key intrinsic motivation predictor.

Drawing from the reviewed literature, this study formulates the following hypothesis:

H2: Perceived Autonomy (AN) had significant impact on Satisfaction (SF).

3.2.3 Relation between Interactivity (IA) and Satisfaction (SF)

Cheng (2020b) shows that in cloud-based e-learning, interactivity boosts student satisfaction and continuance intention by increasing perceived usefulness and confirmation. Ting et al. (2020) highlight social interactivity's role in customer engagement and brand loyalty, emphasizing the value of interactive social media strategies. Samarah et al. (2021) suggest that brand trust mediates the link between social media engagement and brand loyalty, indicating the significance of interactive brand communication for consumer trust and satisfaction. While interactivity can initially increase satisfaction, overexposure to information can lead to negative effects on satisfaction and advertising engagement. Papakostas et al. (2021) indicate that perceived interactivity is vital for AR technology acceptance and enhances user satisfaction in training systems, particularly for personalizing the learning experience for firefighters.

Drawing from the reviewed literature, this study formulates the following hypothesis:

H3: Interactivity (IA) had significant impact on Satisfaction (SF).

3.2.4 Relation between Confirmation (CF) and Satisfaction (SF)

Eren (2021) highlights the central role of confirmation in shaping user satisfaction, which is not directly affected by confirmation, but rather mediated by customer expectations shaped by perceived performance. Dai et al. (2020) highlights that in the context of MOOCs, learners' confirmation consistency significantly affects satisfaction, further emphasizing

the importance of confirmation in maintaining learner engagement. Rabaa'i et al. (2021) found that confirmation directly increases user satisfaction by validating users' initial expectations regarding system performance and usefulness. When the actual experience aligns with or exceeds what users anticipated, their level of satisfaction significantly improves, reinforcing their positive perception of the technology. In the field of e-learning, Rajeh et al. (2021) further confirm that confirmation is a key determinant of satisfaction and emphasizes that positive confirmation (i.e., the learning experience meets or exceeds expectations) is essential to achieving high satisfaction levels.

Drawing from the reviewed literature, this study formulates the following hypothesis:

H4: Confirmation (CF) had significant impact on Satisfaction (SF).

3.2.5 Relation between Perceived Interested (IT) and Satisfaction (SF)

Wulandari (2022) highlights that meeting both tangible and intangible customer needs is crucial for loyalty through service satisfaction in banking. Increased interest in learning improves natural science outcomes, showing interest's motivational role in academic success. Learning interest significantly impacts natural science learning outcomes, emphasizing interest's role in enhancing student comprehension and achievement. Norawati et al. (2021) identify product variety and service quality as key to customer satisfaction, showing a strong positive link to consumer contentment. The significant positive correlation between student interest in learning and mathematics outcomes, indicating that higher interest leads to better academic performance. Pozón-López et al. (2020) propose that user satisfaction is a key predictor of MOOC usage intentions, mediating the relationship between course quality and usage intentions.

Drawing from the reviewed literature, this study formulates the following hypothesis:

H5: Perceived Interested (IT) had significant impact on Satisfaction (SF).

3.2.6 Relation between Satisfaction (SF) and Continuance Intention (CI)

Cheng (2020a) identifies interactivity and course quality as key to student satisfaction in cloud-based e-learning, influencing their continuance intention. Usefulness is the main driver of user satisfaction and trust in Fintech, shaping their intention to continue (Pratama, 2024). Cheng (2022) extends this by showing interactivity and course quality directly affect student satisfaction and indirectly influence continuance through perceived usefulness and the mediating role of satisfaction in the relationship between flipped learning

design fidelity and student intention to persist. The joint impact of smart online learning platform characteristics and user traits on satisfaction and continuance intention, multiple factors—information quality, service quality, system quality, perceived usefulness, and confirmation—positively affect e-satisfaction and continuance intention (Al Amin et al., 2023). Garg and Sharma (2020) confirm that usefulness and course content are critical for user satisfaction with e-training systems, with satisfaction predicting continuance intention.

Drawing from the reviewed literature, this study formulates the following hypothesis:

H6: Satisfaction (SF) had significant impact on Continuance Intention (CI).

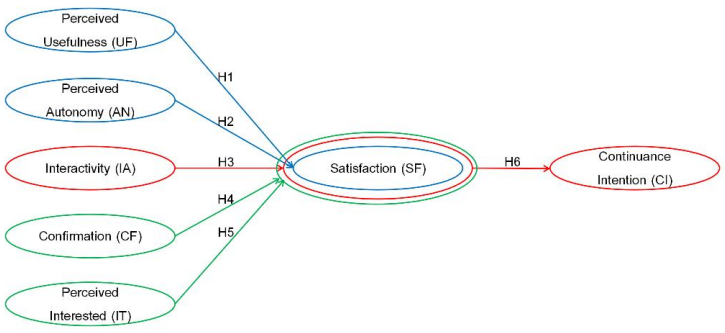
4. Research Methods and Materials

4.1 Research Framework

The researcher developed a refined theoretical framework by synthesizing three influential studies and incorporating key insights from relevant literature. The conceptualization draws upon Faozi and Handayani (2023) investigation into the determinants of continuance intention in mobile-assisted language learning, exploration of social factors influencing learners' intentions in online learning environments, and Shanshan and Wenfei (2022) analysis of satisfaction and continuance intention in MOOCs. These foundational studies were integrated with a literature review to construct a framework addressing the factors shaping satisfaction and continuance intention of Chinese language learners using Chinese learning apps in Thai universities, as illustrated in Figure 1.

Figure 1

Conceptual Framework



Note. Constructed by author

This study explored the dynamics among seven key variables: Perceived Usefulness (UF), Perceived Autonomy (AN), Interactivity (IA), Confirmation (CF), Perceived Interest (IT), Satisfaction (SF), and Continuance Intention (CI). By analyzing the interrelationships and causal pathways among these constructs, the research identified the underlying mechanisms that influence learner satisfaction and their continued use of Chinese learning apps. The findings offer practical insights for app developers and educators seeking to enhance user engagement and improve learning effectiveness.

4.2 Methodology

This study adopts a non-probabilistic quantitative and empirical approach, utilizing online surveys[1] to collect data from the target population. The participants consist of Chinese language learners from five universities in Thailand, encompassing both Chinese majors and students taking Chinese as an elective or for personal interest. The collected data aim to investigate the factors influencing satisfaction and continuance intention in using Chinese learning apps.

For this study, six apps were selected based on their high popularity, each exceeding one million downloads as of September 2024: ChineseSkill, Duolingo, HelloChinese, HSK Study and Exam - SuperTest, Pleco Chinese Dictionary, and SuperChinese. These apps were chosen because they are widely used by Thai learners, offer structured learning paths, and cover key skills such as vocabulary, grammar, listening, speaking, reading, and writing. Their diverse features and user bases make them suitable for examining factors related to learner satisfaction and continued usage.

The survey instrument consisted of three sections: eligibility screening, demographic data collection, and measurement of key variables using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). A pilot test with 30 participants confirmed item relevance through expert-rated Index of Item-Objective Congruence (IOC). Reliability was verified using Cronbach's Alpha. The finalized questionnaire was administered to the target population, yielding 455 valid responses. Data was analyzed using SPSS and AMOS. Confirmatory Factor Analysis (CFA) assessed construct validity and model fit, while Structural Equation Modeling (SEM) tested causal relationships among the study variables.

4.3 Population and Sample Size

This study adopted a non-probabilistic sampling approach, combining judgment sampling and quota sampling to select participants. Judgment sampling was used to

[1] The questionnaire details can be viewed at the following website: https://kdocs.cn/l/cuvhxYBm6M5w

target students who had experience using Chinese language learning apps, ensuring the relevance of the data collected. Quota sampling was then applied to include a balanced number of students across five universities in Thailand, covering both Chinese majors and non-majors who were learning Chinese either as an elective or for personal interest. Surveys were distributed through an online platform to enhance accessibility and participation. Table 1 summarizes the sampling procedures used in the study.

Table 1

Population and sample size of each selected universities

No.	Five Selected Universities	Number of Chinese learners	Sample Size
1	Bangkok University	400	142
2	Bangkokthonburi University	135	48
3	Nakhon Ratchasima Rajabhat University	340	120
4	Rajamangala University of Technology Isan	100	35
5	Songkhla Rajabhat University	440	155
	Total	1415	500

Note. Constructed by author

The survey targeted Chinese language learners at five Thai universities: Bangkok University, Bangkokthonburi University, Nakhon Ratchasima Rajabhat University, Rajamangala University of Technology Isan, and Songkhla Rajabhat University. Participants were students with prior or current experience using Chinese learning apps. To ensure data validity, each student submitted only one response, and questionnaires were distributed via affiliated teachers.

The selection of universities was guided by key considerations. Geographically, they cover diverse regions of Thailand, providing a broader view of students' satisfaction and continuance intention in using Chinese learning apps. Including both public and private institutions ensured varied student backgrounds. Faculty connections supported smooth data collection and participant access. While the focus was on these five universities, students from other institutions with relevant experience were also invited, enhancing the study's generalizability. A total of 489 responses were collected, with 455 valid questionnaires retained after screening.

5. Results and Discussion

5.1 Demographic Information

The study analyzed demographic and behavioral characteristics of 455 survey participants, focusing on gender, age, academic level, major, university location, and patterns of Chinese language app usage. Table 2 presents a summary of these respondent profiles and usage behaviors.

The gender ratio skewed significantly towards female participants, with 67% of the responses from females and 33% from males. The age distribution revealed that most of the sample, 49%, were aged 20-21, while 45% were in the 22-23 age bracket, 5% were 24-25 years old, and 1% were above 25 years old. Participants were evenly distributed across academic levels, with 25% in Year 1, 25% in Year 2, 25% in Year 3, and 25% in Year 4. In terms of university location, 38% of the students are from the central region, 31% from the northeast and 31% from the south. 50% are from Chinese and 50% are from non-Chinese majors.

Regarding app usage patterns, ChineseSkill emerged as the most frequently used Chinese language learning app, with 60% of respondents identifying it as their preferred choice. Other popular apps included HSK Study and Exam – SuperTest (59%), HelloChinese (58%), Duoling (55%), and Pleco Chinese Dictionary (55%). It is worth noting that 2% of respondents used SuperChinese. It is also worth noting that among the respondents who chose “others”, a large proportion of them used ChatGPT.

The dataset reveals key trends in demographics and app usage among Chinese language learners in Thai universities, providing a strong basis for analyzing factors influencing their satisfaction and continued use of learning apps.

Table 2

Demographic Characteristics of Respondents

Demographic and Behavior Data		Frequency	Percentage
Gender	Male	150	33%
	Female	305	67%
Age	20-21 years old	223	49%
	22-23 years old	205	45%
	24-25 years old	22	5%
	Above 25 years old	5	1%

Table 2

Demographic Characteristics of Respondents (Cont.)

Demographic and Behavior Data		Frequency	Percentage
Current grade	Year 1	114	25%
	Year 2	113	25%
	Year 3	113	25%
	Year 4	115	25%
Your major	Chinese major	227	50%
	Non-Chinese majors	228	50%
University location	Central	173	38%
	Northeastern	142	31%
	Southern	140	31%
What Chinese learning APPs do you often use? (Multiple choice)	ChineseSkill	273	60%
	Duoling	249	55%
	HelloChinese	266	58%
	HSK Study and Exam-SuperTest	267	59%
	Pleco Chinese Dictionary	251	55%
	SuperChinese	7	2%
	others	112	25%

Note. Constructed by author.

5.2 Confirmatory Factor Analysis (CFA)

Before conducting the main analyses, the dataset was examined for normality, missing values, and outliers. Skewness and kurtosis values for all items fell within the acceptable range of -2 to +2 (Hair et al., 2019), indicating approximate normality. Missing data was minimal and handled through mean substitution, while no significant outliers were detected based on standardized z-scores.

Multicollinearity was assessed using a correlation matrix. Following Etaga et al. (2021), coefficients above 0.80 were considered problematic. The highest correlation was 0.402 (between CI and SF), and no values exceeded the threshold, suggesting that multicollinearity was not a concern.

To assess the potential presence of common method bias (CMB), Harman's single-factor test was conducted. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.854, indicating that the data was suitable for factor analysis. Bartlett's test of sphericity was significant (χ^2 = 5118.443, *df* = 325, $p < .001$), further supporting the factorability of the dataset (Zhonglin, 2020).

An unrotated exploratory factor analysis revealed that the first factor accounted for 25.224% of the total variance, which is below the critical threshold of 40% (Samuels, 2016). This result suggests that common method bias is unlikely to pose a significant threat to the validity of the findings.

Confirmatory Factor Analysis (CFA) serves as an essential step in Structural Equation Modeling (SEM), offering a robust framework for assessing the reliability and validity of measurement constructs. Convergent validity is evaluated using several statistical indicators, including Cronbach's Alpha, factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE). According to the guidelines, factor loadings should ideally exceed 0.50 to be deemed significant (Hair et al., 2019). In this study, all individual item factor loadings surpassed 0.65, ranging from 0.651 to 0.785, as detailed in Table 3.

Table 3

Confirmatory Factor Analysis Result, Composite Reliability (CR) and Average Variance Extracted (AVE)

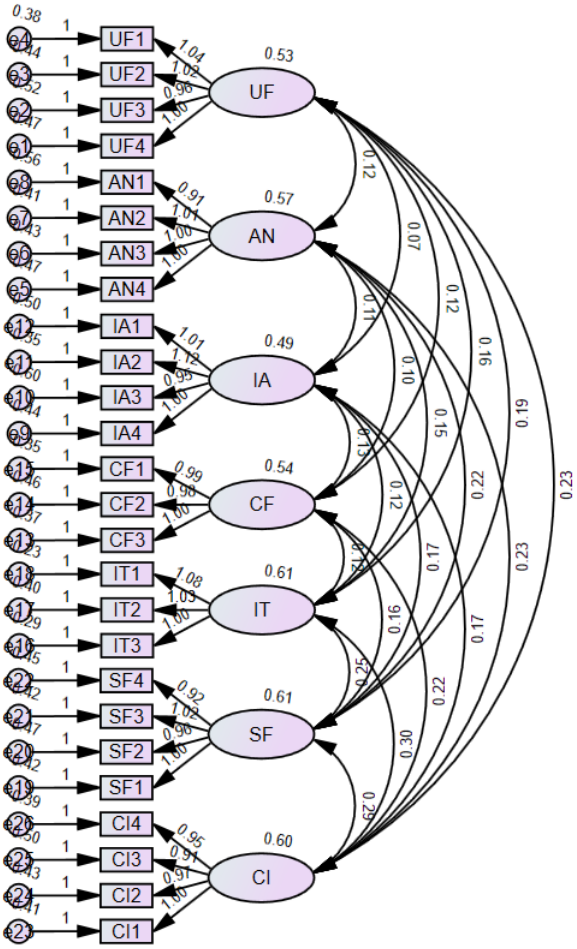
VBs	Source of Questionnaire (Measurement Indicator)	No. of Item	Cronbach's Alpha	Factors Loading	CR	AVE
UF	Faozi and Handayani (2023)	4	0.825	0.694-0.776	0.825	0.542
AN	Faozi and Handayani (2023)	4	0.823	0.675-0.766	0.824	0.540
IA	Guo et al. (2022)	4	0.811	0.651-0.799	0.814	0.523
CF	Lu and Wang (2019)	3	0.803	0.730-0.778	0.804	0.577
IT	Lu and Wang (2019)	3	0.864	0.785-0.869	0.866	0.683
SF	Faozi and Handayani (2023)	4	0.839	0.727-0.775	0.839	0.567
CI	Faozi and Handayani (2023)	4	0.835	0.704-0.771	0.836	0.561

Note. CR = Composite Reliability, AVE = Average Variance Extracted

Created by the author.

Figure 2

Measurement Model



Note. Constructed by author.

For CR and AVE, recommended thresholds are 0.70 or higher for CR and 0.50 or greater for AVE. The results aligned with these standards, as all CR values exceeded 0.80, ranging from 0.804 to 0.866, and AVE values ranged between 0.523 and 0.683. Cronbach's Alpha, which measures internal consistency, indicated strong reliability across all constructs, with values ranging from 0.803 to 0.864, all exceeding the recommended minimum threshold of 0.70 (Hinkin, 1998).

The results validate the constructs' dependability and credibility. Discriminant validity, which assesses the constructs' distinctiveness, is evidenced by the comparison between the square roots of the average variance extracted (AVE) and the correlations between constructs. The square roots of AVE for each construct surpass their respective construct correlations, thereby establishing satisfactory discriminant validity. As depicted in Table 4, the discriminator validity is deemed adequate, with all variables' AVE square exceeding their inter-construct correlations. Table 5's fit indices gauge the model's suitability, utilizing measures such as CMIN/DF, GFI, AGFI, NFI, CFI, TLI, and RMSEA. All CFA values surpass the acceptable criteria, confirming the mode's excellent fit.

Table 4

Discriminant Validity - Factor Correlations

VBs	UF	AN	IA	CF	IT	SF	CI
UF	0.736						
AN	0.180	0.735					
IA	0.116	0.163	0.723				
CF	0.182	0.152	0.200	0.760			
IT	0.241	0.216	0.174	0.181	0.826		
SF	0.282	0.314	0.248	0.226	0.355	0.753	
CI	0.344	0.317	0.253	0.313	0.417	0.402	0.749

Note. The diagonally listed value is the AVE square roots of the variables. (Created by the author.)

5.3 Structural Equation Model (SEM)

The structural model's goodness of fit was evaluated using a range of fit indices, as presented in Table 5. A CMIN/DF value below 5.00 is generally regarded as indicative of an acceptable fit. In this study, the CMIN/DF value was calculated as 2.094, demonstrating a satisfactory model fit (Awang, 2012).

The Goodness of Fit Index (GFI) should meet or exceed 0.85 for an acceptable fit. The GFI value for this study was 0.896, exceeding the recommended threshold. Similarly, the Adjusted Goodness of Fit Index (AGFI), which accounts for model complexity, achieved a value of 0.871, surpassing the acceptable threshold of 0.80 (Sica & Ghisi, 2007).

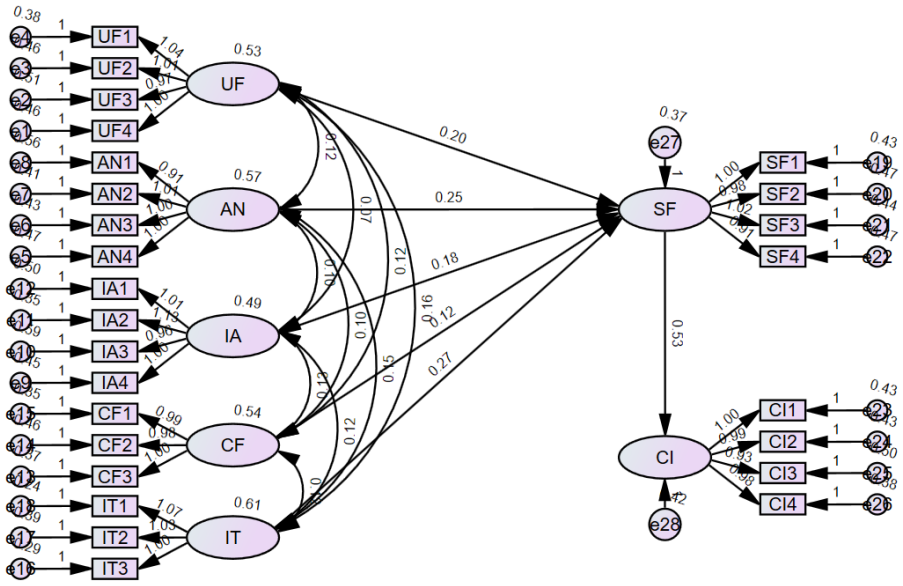
Incremental fit indices were also assessed. The Normed Fit Index (NFI) met the criterion of being greater than or equal to 0.80, achieving a value of 0.887 (Wu & Wang, 2006). The Comparative Fit Index (CFI), which is widely regarded as robust, recorded a value of 0.937, well above the recommended minimum of 0.80 (Bentler, 1990). Additionally, the Tucker-Lewis Index (TLI), which compares the model fit to a baseline model, reached a value of 0.927, confirming its adequacy (Sharma et al., 2005).

Finally, the Root Mean Square Error of Approximation (RMSEA) was evaluated, with a value of 0.049, falling below the threshold of 0.08, thus indicating a good fit (Pedroso et al., 2016).

In summary, all fit indices suggest that the structural model fits the data well, with all statistical values falling within acceptable ranges. This confirms the adequacy of the measurement model and supports its use for further analysis.

Figure 3

Structural Model



Note. Constructed by author.

Table 5

Goodness of Fit

Fit Index	Acceptable Criteria	CFA Values	SEM Values
CMIN/DF	< 5.00 Awang (2012); Al-Mamary and Shamsuddin (2015)	497.477 / 278 or 1.789	592.730 / 283 or 2.094
GFI	≥ 0.85 Sica and Ghisi (2007)	0.908	0.896
AGFI	≥ 0.80 Sica and Ghisi (2007)	0.884	0.871
NFI	≥ 0.80 Wu and Wang (2006)	0.905	0.887
CFI	≥ 0.80 Bentler (1990)	0.955	0.937
TLI	≥ 0.80 Sharma et al. (2005)	0.948	0.927
RMSEA	< 0.08 Pedroso et al. (2016)	0.042	0.049

Note. CMIN/DF = the ratio of the chi-square value to degree of freedom, GFI = goodness-of-fit index, AGFI = adjusted goodness-of-fit index, NFI = normalized fit index, IFI = Incremental Fit Indices, CFI = comparative fit index, TLI = Tucker Lewis index, and RMSEA = root mean square error of approximation
Source: Created by the author

5.4 Research Hypothesis Testing Result

The significance of the research model was determined by analyzing the regression coefficients and R^2 variance for each predictor variable, as detailed in Table 6. This analysis confirms the validity of all study hypotheses. Notably, Perceived Usefulness (UF), Perceived Autonomy (AN), and Interactivity (IA) significantly influence Satisfaction (SF) with respective β values of 0.201, 0.246, and 0.181. Confirmation (CF) and Perceived Interest (IT) also have a substantial impact on SF, with β values of 0.123 and 0.265. Furthermore, Satisfaction (SF) significantly predicts Continuance Intention (CI), indicated by a β value of 0.532.

Table 6

Hypothesis Result of the Structural Model

Hypotheses	Paths	Standardized Path Coefficients (β)	T-Value	Tests Result
H1	UF⟶SF	0.201	3.574 ***	Supported
H2	AN⟶SF	0.246	4.506 ***	Supported
H3	IA⟶SF	0.181	3.147 *	Supported
H4	CF⟶SF	0.123	2.237 *	Supported
H5	IT⟶SF	0.265	5.071 ***	Supported
H6	SF⟶CI	0.532	9.129 ***	Supported

Note. * = p-value < 0.05 *** = p-value < 0.001 (Created by the author.)

The data presented in Table 6 and Figure 4 provides a detailed analysis of the structural model hypotheses, offering empirical evidence to validate the relationships between the variables examined in this study. The results are as follows:

Hypothesis 1 (H1) proposed a significant relationship between Perceived Usefulness (UF) and Satisfaction (SF). The path analysis yielded a standardized path coefficient (β) of 0.201, which is statistically significant with a T-value of 3.574 ($p < .001$). This supports the hypothesis, suggesting that higher perceived usefulness positively influences satisfaction.

Hypothesis 2 (H2) examined the effect of Perceived Autonomy (AN) on Satisfaction (SF). The path coefficient was $\beta = 0.246$, significant at a T-value of 4.506 ($p < .001$). This finding highlights the significant role of autonomy in enhancing satisfaction.

Hypothesis 3 (H3) investigated the influence of Interactivity (IA) on Satisfaction (SF). The analysis produced a path coefficient of $\beta = 0.181$, significant with a T-value of 3.147 ($p < .05$). This result confirms the hypothesis, demonstrating that increased interactivity positively affects satisfaction.

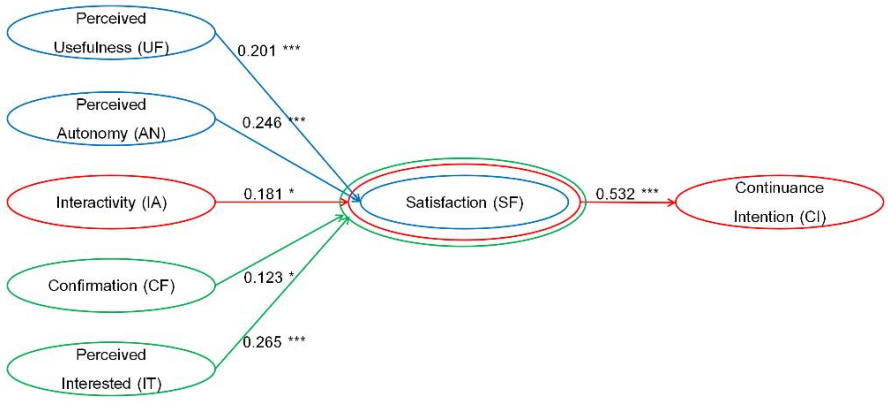
Hypothesis 4 (H4) proposed that Confirmation (CF) would influence Satisfaction (SF). The path coefficient was $\beta = 0.123$, with a T-value of 2.237 ($p < .05$), which is statistically significant. Although the effect size is smaller compared to other variables, it still contributes meaningfully to satisfaction.

Hypothesis 5 (H5) predicted that Perceived Interest (IT) would significantly affect Satisfaction (SF). The analysis supported this hypothesis with a path coefficient of $\beta = 0.265$ and a T-value of 5.071 ($p < .001$), emphasizing the strong impact of perceived interest on satisfaction.

Lastly, Hypothesis 6 (H6) proposed that Satisfaction (SF) would significantly influence Continuance Intention (CI). The data confirmed this hypothesis, with a path coefficient of $\beta = 0.532$ and a T-value of 9.129 ($p < .001$), indicating that higher satisfaction strongly correlates with the intention to continue using the service.

Figure 4

Path Diagram Result



Note. Solid line reports the Standardized Coefficient with * as $p < 0.05$ *** = p-value < 0.001, and t-value in Parentheses. (Created by the author.)

The empirical findings on Thai undergraduates' use of Chinese learning apps indicate that developers can enhance user satisfaction and continued usage by focusing on key factors, particularly Perceived Usefulness (UF), which shows a significant positive effect on Satisfaction (SF) (β = 0.201, $p < .001$). To improve UF, apps should offer rich learning content—such as varied vocabulary, grammar support, and cultural materials—tailored to different proficiency levels. Practical features like interactive dialogues, writing tasks with automated feedback, and real-life listening exercises also add value. Moreover, personalized learning paths help users target their specific goals, whether academic, professional, or cultural.

Perceived Autonomy (AN) and Interactivity (IA) also play important roles, with AN showing a strong positive effect on Satisfaction (SF) (β = 0.246, $p < .001$) and IA a significant impact (β = 0.181, $p < .05$). To enhance AN, apps should allow flexible learning schedules, goal setting, and topic selection, while options like interface language choice and customizable notifications can further support user control. To strengthen IA, developers can include peer chat features, group workspaces, and discussion forums. Real-time feedback on speaking and writing, supported by tools such as AI-based pronunciation and grammar checks, can also improve interactive engagement and provide timely learning support.

Confirmation (CF) and Perceived Interest (IT) also warrant attention, with CF showing a significant impact on Satisfaction (SF) (β = 0.123, $p < .05$) and IT emerging

as the strongest predictor (β = 0.265, p < .001). To enhance CF, app performance should consistently meet user expectations through stable functionality, regular content updates, and responsive support. User feedback can help identify and address issues promptly. To boost IT, gamified features like badges, leaderboards, and unlockable cultural content can make learning more engaging. Multimedia resources—such as subtitled videos, music with lyric translations, and virtual tours of Chinese landmarks—can further sustain user interest.

6. Conclusions and Recommendation

6.1 Conclusion

This empirical investigation targets the factors that affect the satisfaction and continued use intentions of Chinese language learners in Thai universities who utilize Chinese learning apps. Drawing on established academic literature and theoretical underpinnings, the research identifies pivotal independent variables that influence satisfaction and intent to continue using these apps, guided by the Technology Acceptance Model (TAM) by Davis (1989a, 1989b), the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003), and the Expectation-Confirmation Model (ECM) by Oliver (1980) This exploration arms app developers with insights to refine and innovate apps that align with user satisfaction and foster ongoing engagement.

To fulfil the research goals and establish a solid theoretical framework, a meticulously crafted questionnaire was employed to gather data from Chinese language learners across various Thai universities. The quantitative data collected was subjected to factor and regression analyses to elucidate causal relationships and interpret results. The study's findings provide a robust theoretical basis for app developers to enhance app quality, inform strategic market positioning, and leverage advanced technologies like artificial intelligence.

The findings highlight Perceived Interest (IT) as the strongest predictor of learner satisfaction, followed by Perceived Autonomy (AN). In terms of Continuance Intention (CI), Satisfaction (SF) emerges as the most influential factor. Additionally, IT and AN show an indirect effect on CI through their impact on satisfaction. These results are consistent with previous studies. For instance, Harefa (2023) also identified interest as a key motivator in sustaining learner engagement, while Al Amin et al. (2022) emphasized the role of autonomy in enhancing satisfaction and promoting continued use of learning platforms. Although conducted in different contexts, these studies support the current findings and reinforce the importance of internal motivation in digital language learning.

Chinese language learners in Thai universities are a pivotal demographic for language learning app adoption, with their satisfaction and intent to continue using apps being critical measures of app success. By pinpointing and enhancing the key factors that drive satisfaction and continuance intention, app providers can significantly boost these metrics among this demographic, thereby solidifying a strong presence and fostering a loyal customer base in the educational sector.

6.2 Recommendation

For App Developers

This study highlights practical implications for both app developers and educators. For developers, enhancing Perceived Usefulness (UF) and Perceived Autonomy (AN) should be a priority. This can be achieved by integrating personalized learning features such as adaptive content, customizable topics, and flexible learning paths, which help users perceive the app as valuable and user oriented. Improvements to interface design and interactive functions—such as real-time feedback, peer collaboration tools, and gamified learning—can further promote engagement and satisfaction.

Developers should enhance the visibility and personalization of app features by incorporating intuitive designs and user-friendly tracking mechanisms, such as feedback systems or progress indicators. Implementing personalized learning paths can effectively support this goal by improving user experience and fostering sustained engagement.

For Policymakers

Policymakers play a crucial role in encouraging developers to enhance app quality through supportive policies. They can establish standards for usability, user autonomy, and interactive features, ensuring apps meet educational goals. Incentive mechanisms, such as tax breaks and grants for developers who improve user satisfaction and promote long-term engagement, can drive innovation. Policymakers should also focus on data privacy and security regulations to build user trust and create a safer learning environment.

For Academic Institutions

From an educational perspective, institutions can apply these research findings by integrating digital literacy and app evaluation training into curriculum design, particularly in courses related to language learning or educational technology. Educators can design assignments that require students to critically assess and compare learning apps, fostering both digital competence and autonomous learning. Furthermore, instructors can incorporate app-based learning into classroom activities, using real-time feedback tools and progress tracking features to monitor student engagement and adjust instruction accordingly.

Establishing clear guidelines for selecting and integrating learning apps can provide a practical framework for educators, ensuring that the tools used align with pedagogical goals and student needs.

In conclusion, the study recommends a collaborative approach involving policymakers, developers, and academic institutions to enhance the quality and accessibility of Chinese learning apps. Efforts should focus on improving perceived usefulness, autonomy, and interactivity while maintaining a user-centered design to support ongoing satisfaction. With the increasing adoption of AI technologies in language learning, integrating intelligent features can help deliver more personalized, adaptive experiences that align with learners' evolving needs in a digital environment.

6.3 Limitation and Further Study

This study provides valuable insights into the factors influencing Chinese language learners' satisfaction and continuance intention with learning applications (APPs) in Thai universities. However, several limitations must be considered. First, the study focuses on a limited number of universities, which may not fully represent the diversity of Chinese language learners in different educational contexts. While including both Chinese majors and non-majors offers a broad perspective, it may overlook the unique needs of each group.

The cross-sectional design restricts the ability to observe changes over time, and future research could benefit from a longitudinal approach. The reliance on self-reported data also introduces potential biases, which could be mitigated by incorporating mixed methods such as interviews or focus groups for a more comprehensive understanding.

Additionally, the study does not differentiate between Chinese majors and non-majors, which could provide more specific insights for app developers. Future research could also explore the impact of advanced APP features, such as AI-driven content, and consider demographic factors like age and technological proficiency to better understand their influence on satisfaction and continuance intention.

In summary, while this study offers a strong foundation, addressing these limitations in future research could lead to deeper insights and more effective Chinese language learning tools.

References

Abbasi, M. S., Ahmed, N., Sajjad, B., Alshahrani, A., Saeed, S., Sarfaraz, S., Alhamdan, R. S., Vohra, F., & Abduljabbar, T. (2020). E-Learning perception and satisfaction among health sciences students amid the COVID-19 pandemic. *WORK*, *67*(3), 549-556. https://doi.org/10.3233/WOR-203308

Al Amin, M., Muzareba, A. M., Chowdhury, I. U., & Khondkar, M. (2023). Understanding e-satisfaction, continuance intention, and e-loyalty toward mobile payment application during COVID-19: An investigation using the electronic technology continuance model. *Journal of Financial Services Marketing*, 29(2), 318-340. https://doi.org/10.1057/s41264-022-00197-2

Al Amin, M., Razib Alam, M., & Alam, M. Z. (2022). Antecedents of students' E-learning continuance intention during COVID-19: An empirical study. *E-Learning and Digital Media*, *20*(3), 224-254. https://doi.org/10.1177/20427530221103915

Alam, A., & Mohanty, A. (2023). Educational technology: Exploring the convergence of technology and pedagogy through mobility, interactivity, AI, and learning tools. *Cogent Engineering*, *10*(2), Article 2283282.

Al-Mamary, Y. H., & Shamsuddin, A. (2015). Testing of the technology acceptance model in context of Yemen. *Mediterranean Journal of Social Sciences*, *6*(4), 268-273. https://doi.org/10.5901/mjss.2015.v6n4s1p268

Ashrafi, A., Zareravasan, A., Rabiee Savoji, S., & Amani, M. (2020). Exploring factors influencing students' continuance intention to use the learning management system (LMS): A multi-perspective framework. *Interactive Learning Environments*, *30*(8), 1475-1497. https://doi.org/10.1080/10494820.2020.1734028

Awang, Z. (2012). A handbook on SEM structural equation modelling: SEM using AMOS graphic (5th ed.). Universiti Teknologi Mara Kelantan Press.

Ayeni, O. O., Al Hamad, N. M., Chisom, O. N., Osawaru, B., & Adewusi, O. E. (2024). AI in education: A review of personalized learning and educational technology. *GSC Advanced Research and Reviews*, *18*(2), 261-271.

Bansah, A. K., & Darko Agyei, D. (2022). Perceived convenience, usefulness, effectiveness and user acceptance of information technology: Evaluating students' experiences of a Learning Management System. *Technology, Pedagogy and Education*, *31*(4), 431-449. https://doi.org/10.1080/1475939x.2022.2027267

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychol Bull*, *107*(2), 238-246. https://doi.org/10.1037/0033-2909.107.2.238

Cheng, Y.-M. (2020a). Investigating medical professionals' continuance intention of the cloud-based e-learning system: An extension of expectation–confirmation model with flow theory. *Journal of Enterprise Information Management*, *34*(4), 1169-1202. https://doi.org/10.1108/jeim-12-2019-0401

Cheng, Y.-M. (2020b). Students' satisfaction and continuance intention of the cloud-based e-learning system: Roles of interactivity and course quality factors. *Education + Training*, *62*(9), 1037-1059. https://doi.org/10.1108/et-10-2019-0245

Cheng, Y.-M. (2022). What roles do quality and cognitive absorption play in evaluating cloud-based E-learning system success? Evidence from medical professionals. *Interactive Technology and Smart Education*, *20*(2), 228-256. https://doi.org/10.1108/itse-12-2021-0222

Dai, H. M., Teo, T., Rappa, N. A., & Huang, F. (2020). Explaining Chinese university students' continuance learning intention in the MOOC setting: A modified expectation confirmation model perspective. *Computers & Education*, *150*, Article 103850. https://doi.org/10.1016/j.compedu.2020.103850

Davis, F. D. (1989a). Technology Acceptance Model: TAM. In M. N. Al-Suqri & A. S. Al-Aufi (Eds.), *Information Seeking Behavior and Technology Adoption* (pp. 205-219). IGI Global.

Davis, F. D. (1989b). Perceived usefulness, perceived ease of use, and user ccceptance of information technology. *MIS Quarterly*, *13*(3), 319-340. https://doi.org/10.2307/249008

Eren, B. A. (2021). Determinants of customer satisfaction in chatbot use: evidence from a banking application in Turkey. *International Journal of Bank Marketing*, *39*(2), 294-311. https://doi.org/10.1108/ijbm-02-2020-0056

Etaga, H. O., Ndubisi, R. C., & Oluebube, N. L. (2021). Effect of multicollinearity on variable selection in multiple regression. *Science Journal of Applied Mathematics and Statistics*, *9*(6), 141-153. https://doi.org/10.11648/j.sjams.20210906.12

Faozi, F., & Handayani, P. (2023). The antecedents of mobile-assisted language learning applications continuance intention. *Electronic Journal of e-Learning*, *21*(4), 299-313. https://doi.org/10.34190/ejel.21.4.2744

Fei, H. (2023). Research on the Development of Chinese Teaching Resources in Thailand. *BCP Education & Psychology*, *10*, 297-308. https://doi.org/10.54691/bcpep.v10i.5398

Gani, M. O., Rahman, M., Bag, S., & Mia, M. (2023). Examining behavioural intention of using smart health care technology among females: Dynamics of social influence and perceived usefulness. *Benchmarking: An International Journal*, *31*(2), 330-352. https://doi.org/10.1108/BIJ-09-2022-0585

Garg, S., & Sharma, S. (2020). User satisfaction and continuance intention for using E-training: A structural equation model. *Vision: The Journal of Business Perspective*, *24*(4), 441-451. https://doi.org/10.1177/0972262920926827

Guo, Q., Zeng, Q., & Zhang, L. (2022). What social factors influence learners' continuous intention in online learning? A social presence perspective. *Information Technology & People*, *36*(3), 1076-1094. https://doi.org/10.1108/ITP-02-2021-0151

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis*. Cengage. https://books.google.co.th/books?id=0R9ZswEACAAJ

Han, J.-H., & Sa, H. J. (2021). Acceptance of and satisfaction with online educational classes through the technology acceptance model (TAM): The COVID-19 situation in Korea. *Asia Pacific Education Review*, *23*(3), 403-415. https://doi.org/10.1007/s12564-021-09716-7

Harefa, D. (2023). The relationship between students' interest in learning and mathematics learning outcomes. Afore*: Jurnal Pendidikan Matematika*, *2*(2), 1-11. https://doi.org/10.57094/afore.v2i2.1054

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods*, *1*(1), 104-121. https://doi.org/10.1177/109442819800100106

Ho, I. M. K., Cheong, K. Y., & Weldon, A. (2021). Predicting student satisfaction of emergency remote learning in higher education during COVID-19 using machine learning techniques. *PLoS One*, *16*(4), Article e0249423. https://doi.org/10.1371/journal.pone.0249423

HolonIQ. (2023, March 22). *Chinese language learning: A $7.4B market powered by over 6 million learners, set to double in the next five years*. HolonIQ. https://www.holoniq.com/notes/chinese-language-learning-a-7-4b-market-powered-by-over-6-million-learners-set-to-double-in-the-next-five-years

Hoq, M. Z. (2020). E-learning during the period of pandemic (COVID-19) in the kingdom of Saudi Arabia: An empirical study. *American Journal of Educational Research*, *8*(7), 457-464.

Hosseini, F., Ghorbani, S., & Rezaeeshirazi, R. (2020). Effects of perceived autonomy support in the physical education on basic psychological needs satisfaction, intrinsic motivation and intention to perform physical activity in high school students. *International Journal of School Health*, *7*(4), 39-46. https://doi.org/10.30476/intjsh.2020.88171.1106

Hsu, H.-T., & Lin, C.-C. (2022). Factors influencing university students' intention to engage in mobileassisted language learning through the lens of action control theory. *Educational Technology & Society*, *25*(4), 29-42. https://www.jstor.org/stable/48695979

Huescar Hernandez, E., Moreno-Murcia, J. A., Cid, L., Monteiro, D., & Rodrigues, F. (2020). Passion or perseverance? The effect of perceived autonomy support and grit on academic performance in college students. *Int J Environ Res Public Health*, *17*(6), Article 2143. https://doi.org/10.3390/ijerph17062143

Jami Pour, M., Mesrabadi, J., & Asarian, M. (2021). Meta-analysis of the DeLone and McLean models in E-learning success: The moderating role of user type. *Online Information Review*, *46*(3), 590-615. https://doi.org/10.1108/oir-01-2021-0011

Kim, S., Lee, J., Yoon, S.-H., & Kim, H.-W. (2022). How can we achieve better E-Learning success in the new normal? *Internet Research*, *33*(1), 410-441. https://doi.org/10.1108/intr-05-2021-0310

Kumar, P., Saxena, C., & Baber, H. (2021). Learner-content interaction in E-learning- the moderating role of perceived harm of COVID-19 in assessing the satisfaction of learners. *Smart Learning Environments*, *8*, Article 5. https://doi.org/10.1186/s40561-021-00149-8

Landrum, B. (2020). Examining students' confidence to learn online, self-regulation skills and perceptions of satisfaction and usefulness of online classes. *Online Learning*, *24*(3), 128-146.https://doi.org/10.24059/olj.v24i3.2066

Lazorak, O. V., Belkina, O. V., & Yaroslavova, E. N. (2021). Changes in student autonomy via e-learning courses. *International Journal of Emerging Technologies in Learning (iJET)*, *16*(17), 209-225. https://doi.org/10.3991/ijet.v16i17.23863

Legramante, D., Azevedo, A., & Azevedo, J. M. (2023). Integration of the technology acceptance model and the information systems success model in the analysis of Moodle's satisfaction and continuity of use. *The International Journal of Information and Learning Technology*, *40*(5), 467-484. https://doi.org/10.1108/ijilt-12-2022-0231

Li, P., & Lan, Y.-J. (2021). Digital Language Learning (DLL): Insights from behavior, cognition, and the brain. *Bilingualism: Language and Cognition*, *25*(3), 361-378. https://doi.org/10.1017/S1366728921000353

Li, Y., Nishimura, N., Yagami, H., & Park, H.-S. (2021). An empirical study on online learners' continuance intentions in China. *Sustainability*, *13*(2), Article 889. https://doi.org/10.3390/su13020889

Lu, Y., & Wang, B. (2019). Understanding key drivers of MOOC satisfaction and continuance intention to use. *Journal of Electronic Commerce Research*, *20*(2), 105-117.

Maru, M. G., Pikirang, C. C., Setiawan, S., Oroh, E. Z. O., & Pelenkahu, N. (2021). The internet use for autonomous learning during COVID-19 pandemic and its hindrances. *International Journal of Interactive Mobile Technologies (iJIM)*, *15*(18), 65-79. https://doi.org/10.3991/ijim.v15i18.24553

Mossman, L. H., Slemp, G. R., Lewis, K. J., Colla, R. H., & O'Halloran, P. (2022). Autonomy support in sport and exercise settings: a systematic review and meta-analysis. *International Review of Sport and Exercise Psychology*, *17*(1), 540-563. https://doi.org/10.1080/1750984x.2022.2031252

Navaneethakrishnan, K. (2020). The effects of teacher autonomy, student behavior and student engagement on teacher job satisfaction. *Educational Sciences: Theory & Practice*, *20*(4), 1-15. https://doi.org/10.12738/jestp.2020.4.001

Ningsih, S., & Yusuf, F. (2021). Analysis of teachers' voices of learner autonomy in efl online learning context. In *Proceedings of the Thirteenth Conference on Applied Linguistics (CONAPLIN 2020): Advances in Social Science, Education and Humanities Research* (pp. 556-561). Atlantis Press. https://doi.org/10.2991/assehr.k.210427.084

Norawati, S., Arman, A., Ali, A., Ihsan, A., & Putra, E. (2021). Analysis of product variation, quality of service and their effect on customer satisfaction. *IJEBD (International Journal Of Entrepreneurship And Business Development)*, *4*(6), 954-960. https://doi.org/10.29138/ijebd.v4i6.1554

Oktafiani, H., Yohana, C., & Saidani, B. (2021). Pengaruh perceived ease of use dan perceived usefulness terhadap customer satisfaction E-wallet X. *Jurnal Bisnis, Manajemen, Dan Keuangan-JBMK*, *2*(2), 562-576.

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, *17*(4), 460-469. https://doi.org/10.1177/002224378001700405

Papakostas, C., Troussas, C., Krouska, A., & Sgouropoulou, C. (2021). Measuring user experience, usability and interactivity of a personalized mobile augmented reality training system. *Sensors (Basel)*, *21*(11), Article 3888. https://doi.org/10.3390/s21113888

Patricia Aguilera-Hermida, A. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *Int J Educ Res Open*, *1*, Article 100011. https://doi.org/10.1016/j.ijedro.2020.100011

Pedroso, R., Zanetello, L., Guimarães, L., Pettenon, M., Gonçalves, V., Scherer, J., Kessler, F., & Pechansky, F. (2016). Confirmatory factor analysis (CFA) of the crack use relapse scale (CURS). *Archives of Clinical Psychiatry (São Paulo)*, *43*(3), 37-40. https://doi.org/10.1590/0101-60830000000081

Pozón-López, I., Higueras-Castillo, E., Muñoz-Leiva, F., & Liébana-Cabanillas, F. J. (2020). Perceived user satisfaction and intention to use massive open online courses (MOOCs). *Journal of Computing in Higher Education*, *33*(1), 85-120. https://doi.org/10.1007/s12528-020-09257-9

Pratama, S. F. (2024). Analyzing the determinants of user satisfaction and continuous usage intention for digital banking platform in Indonesia: A structural equation modeling approach. *Journal of Digital Market and Digital Currency*, *1*(3), 267-285.

Rabaa'i, A. A., Almaati, S. A., & Zhu, X. (2021). Students' continuance intention to use Moodle: An expectation-confirmation model approach. *Interdisciplinary Journal of Information, Knowledge, and Management*, *16*, 397-434. https://doi.org/10.28945/4842

Rajabalee, Y. B., & Santally, M. I. (2021). Learner satisfaction, engagement and performances in an online module: Implications for institutional e-learning policy. *Educ Inf Technol (Dordr)*, *26*(3), 2623-2656. https://doi.org/10.1007/s10639-020-10375-1

Rajeh, M. T., Abduljabbar, F. H., Alqahtani, S. M., Waly, F. J., Alnaami, I., Aljurayyan, A., & Alzaman, N. (2021). Students' satisfaction and continued intention toward E-learning: a theory-based study. *Med Educ Online*, *26*(1), Article 1961348. https://doi.org/10.1080/10872981.2021.1961348

Samarah, T., Bayram, P., Aljuhmani, H. Y., & Elrehail, H. (2021). The role of brand interactivity and involvement in driving social media consumer brand engagement and brand loyalty: The mediating effect of brand trust. *Journal of Research in Interactive Marketing*, *16*(4), 648-664. https://doi.org/10.1108/jrim-03-2021-0072

Samuels, P. (2016). *Advice on Exploratory Factor Analysis*. Centre for Academic Success, Birmingham City University. https://doi.org/10.13140/RG.2.1.5013.9766

Shanshan, S., & Wenfei, L. (2022). Understanding the impact of quality elements on MOOCs continuance intention. *Educ Inf Technol (Dordr)*, *27*(8), 10949-10976. https://doi.org/10.1007/s10639-022-11063-y

Shao, Z., & Chen, K. (2020). Understanding individuals' engagement and continuance intention of MOOCs: The effect of interactivity and the role of gender. *Internet Research*, *31*(4), 1262-1289. https://doi.org/10.1108/intr-10-2019-0416

Sharma, G. P., Verma, R. C., & Pathare, P. B. (2005). Mathematical modeling of infrared radiation thin layer drying of onion slices. *Journal of Food Engineering*, *71*, 282-286.

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.

Steils, N., Decrop, A., & Crié, D. (2019). An exploration into consumers' e-learning strategies. *Journal of Consumer Marketing*, *36*(2), 276-287. https://doi.org/10.1108/jcm-05-2017-2215

Suzianti, A., & Paramadini, S. A. (2021). Continuance intention of e-learning: The condition and its connection with open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), Article 97. https://doi.org/10.3390/joitmc7010097

Tawafak, R. M., Al-Rahmi, W. M., Almogren, A. S., Al Adwan, M. N., Safori, A., Attar, R. W., & Habes, M. (2023). Analysis of E-learning system use using combined TAM and ECT factors. *Sustainability*, *15*(14), Article 11100. https://doi.org/10.3390/su151411100

Ting, D. H., Abbasi, A. Z., & Ahmed, S. (2020). Examining the mediating role of social interactivity between customer engagement and brand loyalty. *Asia Pacific Journal of Marketing and Logistics*, *33*(5), 1139-1158. https://doi.org/10.1108/apjml-10-2019-0576

Valverde-Berrocoso, J., Garrido-Arroyo, M. d. C., Burgos-Videla, C., & Morales-Cevallos, M. B. (2020). Trends in educational research about E-learning: A systematic literature review (2009-2018). *Sustainability*, *12*(12), Article 5153. https://doi.org/10.3390/su12125153

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D.. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425-478. https://doi.org/10.2307/30036540

Venkatesh, V. (2021). Adoption and use of AI tools: a research agenda grounded in UTAUT. *Annals of Operations Research*, *308*, 641-652. https://doi.org/10.1007/s10479-020-03918-9

Widjaja, A., & Widjaja, Y. (2022). The influence of interaction, learner characteristics, perceived usefulness, and perceived satisfaction on continuance intention in e-learning system. *International Journal of Research in Business and Social Science (2147- 4478)*, *11*(2), 381-390. https://doi.org/10.20525/ijrbs.v11i2.1665

Wilson, N., Keni, K., & Tan, P. H. (2021). The role of perceived usefulness and perceived ease-of-use toward satisfaction and trust which influence computer consumers' loyalty in China. *Gadjah Mada International Journal of Business*, *23*(3), 262-294. https://doi.org/10.22146/gamaijb.32106

Wongwatkit, C., Thongsibsong, N., Chomngern, T., & Thavorn, S. (2023). The future of connectivist learning with the potential of emerging technologies and ai in thailand: Trends, applications, and challenges in shaping education. *Journal of Learning Sciences and Education*, *2*(1), 122-154.

Wu, J.-H., & Wang, Y.-M. (2006). Measuring kms success: A respecification of the Delone and Mclean's model. *Information & Management*, *43*(6), 728-739. https://doi.org/http://dx.doi.org/10.1016/j.im.2006.05.002

Wulandari, D. (2022). Customer satisfaction as a priority in excellent banking services. *KINERJA: Jurnal Manajemen Organisasi dan Industri*, *1*(1), 27-34.

Xu, W., Zhang, H., Sukjairungwattana, P., & Wang, T. (2022). The roles of motivation, anxiety and learning strategies in online Chinese learning among Thai learners of Chinese as a foreign language. *Frontiers in Psychology*, *13*, Article 962492. https://doi.org/10.3389/fpsyg.2022.962492

Younas, M., Noor, U., Zhou, X., Menhas, R., & Qingyu, X. (2022). COVID-19, students satisfaction about e-learning and academic achievement: Mediating analysis of online influencing factors. *Front Psychol*, *13*, Article 948061. https://doi.org/10.3389/fpsyg.2022.948061

Zalat, M. M., Hamed, M. S., & Bolbol, S. A. (2021). The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 pandemic among university medical staff. *PLoS One*, *16*(3), Article e0248758. https://doi.org/10.1371/journal.pone.0248758

Zhang, A. (2024). A study on the life and learning satisfaction of Chinese students in thailand: The moderating role of third-party services. *Rajapark Journal*, *18*(58), 236-257. https://so05.tci-thaijo.org/index.php/RJPJ/article/view/272264

Zhonglin, D. T. W. (2020). Statistical approaches for testing common method bias: problems and suggestions. *Journal of Psychological Science*, *43*(1), 215-223.