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ChatGPT integration in Chinese language pedagogy: a Vietnamese multi-institutional study

Phuoc Tai Nguyen[1], Hung Thanh Nguyen[1], Thuan Quy Nguyen[2]
[1]Faculty of Basic Sciences, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam
[2]Faculty of Culture, Tourism and Social Work, Dong Thap University, Cao Lãnh, Vietnam

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ABSTRACT

This study investigates ChatGPT integration effectiveness in Chinese language education across three Vietnamese universities involving 350 students and 45 instructors. Using mixed-methods analysis, quantitative surveys revealed 78.3% improved learning motivation with artificial intelligence (AI)-enhanced personalized learning, while 82.1% valued immediate feedback capabilities. Significant disciplinary variations emerged: traditional medicine students demonstrated highest acceptance rates ($M=4.3$, $SD=0.7$) compared to translation studies students ($M=3.7$, $SD=1.0$), $F(2, 347)=15.8$, $p<0.001$. AI literacy was strongly associated with learning effectiveness ($r=0.67$, $p<0.001$), accounting for 45% of outcome variance. Qualitative analysis identified human-AI interactive negotiation competence (HAINC) development as critical, with 91% of instructors emphasizing systematic training needs. Despite benefits, 64.7% expressed human interaction concerns, revealing fundamental pedagogical tensions requiring collaborative human-AI frameworks. Findings provide evidence-based guidance for implementing discipline-responsive AI systems in Vietnamese higher education while maintaining pedagogical authenticity and addressing technological literacy gaps.

Corresponding Author:

Thuan Quy Nguyen
Faculty of Culture, Tourism and Social Work, Dong Thap University
783 Pham Huu Lau Street, Cao Lanh Ward, Dong Thap Province, Vietnam
Email: ntquy@dthu.edu.vn

1. INTRODUCTION

Artificial intelligence (AI) technologies, particularly large language models like ChatGPT, have catalyzed transformative shifts in global educational paradigms [1]. Vietnamese higher education has experienced accelerated technological infrastructure development, creating unprecedented opportunities to enhance pedagogical effectiveness in language education [2]. Chinese language instruction, characterized by unique linguistic complexities including logographic writing systems, tonal phonology, and specialized disciplinary vocabularies, serves as a compelling context for examining AI integration effectiveness across diverse academic programs [3]. Vietnam's strategic positioning within Southeast Asian educational networks and increasing economic ties with Chinese-speaking regions have driven substantial growth in Chinese language education demand, with contemporary universities offering programs spanning multiple disciplinary contexts—from traditional medicine requiring specialized terminology comprehension to translation studies demanding nuanced linguistic analysis capabilities [4], [5]. ChatGPT has demonstrated remarkable capabilities in generating contextually appropriate educational content, providing immediate formative feedback, and supporting adaptive learning pathways [6]. However, implementation within Vietnamese educational contexts remains underexplored, particularly regarding how disciplinary-specific requirements, institutional resources, and pedagogical traditions interact with AI-enhanced learning systems [7]–[9].

This study systematically investigates ChatGPT integration effectiveness across three Vietnamese universities representing distinct disciplinary contexts: Dong Thap University (general Chinese language studies), Can Tho University of Medicine and Pharmacy (traditional Chinese medicine specialization), and FPT University Can Tho (Chinese-English translation programs). The research examines how disciplinary backgrounds influence AI acceptance, utilization patterns, and learning effectiveness while identifying implementation barriers and facilitators, specifically exploring: i) Vietnamese students' cross-disciplinary perceptions of ChatGPT's effectiveness for Chinese language learning; ii) relationships between AI literacy levels and learning outcomes; iii) pedagogical challenges instructors encounter when integrating ChatGPT into disciplinary-specific curricula; and iv) systematic development of human-AI interactive negotiation competence (HAINC) to optimize educational outcomes. By providing empirical evidence from Vietnamese educational contexts, this research contributes practical insights for educators, administrators, and policymakers navigating AI integration challenges while maintaining pedagogical quality and disciplinary authenticity.

2. RESEARCH METHOD

2.1. Research design

This study employed a concurrent mixed-methods design, integrating quantitative surveys with qualitative semi-structured interviews to comprehensively examine ChatGPT integration in Vietnamese Chinese language education [10]. This approach enabled triangulation of findings, providing both statistical evidence of effectiveness patterns and nuanced understanding of implementation challenges across diverse institutional and disciplinary contexts [11]. Data collection occurred between September 2024 and February 2025, allowing participants to develop substantive experience with AI-enhanced learning systems.

2.2. Participants and sampling

The study involved 350 Vietnamese students enrolled in Chinese language programs across three universities, selected through stratified random sampling: 120 from Can Tho University of Medicine and Pharmacy (Traditional Chinese medicine), 140 from FPT University Can Tho (translation studies), and 90 from Dong Thap University (general Chinese), with participant distribution including 147 beginners (42%), 133 intermediate (38%), and 70 advanced students (20%). Student participants ranged in age from 18 to 22 years (M=19.8, SD=1.3), with 217 females (62%) and 133 males (38%), and all had utilized ChatGPT for minimum three months prior to data collection. Additionally, 45 Chinese language instructors participated in qualitative interviews, including 35 Vietnamese instructors (78%) and 10 native Chinese speakers (22%), with teaching experience ranging from 3 to 18 years (M=8.2, SD=4.1).

2.3. Research instruments

2.3.1. Quantitative survey instrument

A comprehensive 48-item survey instrument was developed incorporating validated scales adapted from established technology acceptance models [12], learning motivation inventories [13], and AI literacy assessment frameworks [14]. There were six primary sections: demographic information (8 items), AI usage patterns (6 items), perceived ChatGPT effectiveness (12 items, 5-point Likert scale), learning motivation (10 items), AI literacy self-assessment (8 items), and concerns/challenges (4 open-ended items). The instrument was translated into Vietnamese following forward-backward translation procedures with independent verification by bilingual education experts, and pilot testing with 30 students resulted in minor revisions for clarity. Reliability analysis revealed acceptable internal consistency with Cronbach's α coefficients ranging from 0.82 to 0.91 across subscales (overall α=0.89), though construct validity through factor analysis was not performed.

2.3.2. Qualitative interview protocol

Semi-structured interview protocols were developed based on the HAINC framework [15] and reflective practice models [16]. The protocol included core questions addressing: instructor experiences with AI integration, perceived benefits and limitations, strategies for discipline-specific implementation, quality control approaches, student interaction patterns, and professional development needs. Interviews were conducted in Vietnamese, audio-recorded with participant consent, and typically lasted 45-60 minutes. Interview guides allowed flexibility for probing emerging themes while maintaining consistency across participants.

2.4. Data collection procedures

Quantitative data collection utilized online survey distribution through institutional learning management systems with institutional review board approval from all participating universities, ensuring voluntary participation with informed consent procedures explaining research purposes, data confidentiality,

and withdrawal rights, achieving 87% response rate through follow-up reminders. Qualitative interviews were scheduled based on instructor availability, conducted face-to-face or via video conferencing depending on participant preference, with purposive sampling ensuring representation across disciplines, experience levels, and institutional contexts. Interviews were transcribed verbatim in Vietnamese, with selected quotations translated into English by bilingual researchers for publication purposes.

2.5. Data analysis

2.5.1. Quantitative analysis

Quantitative data analysis employed SPSS 28.0 software utilizing descriptive statistics (means, standard deviations, frequencies, and percentages), inferential statistics including one-way ANOVA with post-hoc Tukey tests for disciplinary group comparisons, Pearson correlation analysis for examining relationships among key variables, and multiple regression modeling to identify predictors of learning effectiveness. Prior to inferential analyses, assumption testing confirmed that learning effectiveness scores were approximately normally distributed across all three disciplinary groups (Shapiro-Wilk tests: $p>0.05$). Homogeneity of variance was established (Levene's test: $F(2, 347)=1.84$, $p=0.16$), residual plots showed no systematic patterns, independence of errors was confirmed (Durbin-Watson statistic $d=1.89$), and absence of problematic multicollinearity among predictors was established (variance inflation factor (VIF) values: 1.12-2.34), supporting the validity of parametric statistical procedures employed in this study.

2.5.2. Qualitative analysis

Qualitative data underwent thematic analysis following Braun and Clarke [17] six-phase framework: familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Two independent coders performed initial coding using NVivo 12 software, achieving inter-rater reliability of $\kappa=0.83$. Disagreements were resolved through discussion and consultation with the research team. Themes were organized hierarchically, with primary themes representing major patterns and sub-themes capturing nuanced variations within broader categories.

2.6. Ethical considerations

This research adhered to ethical guidelines established by the Vietnam National University system and international research standards. Participant anonymity was maintained through numerical coding systems, with identifiable information stored separately from research data in password-protected files. Participants received clear information about voluntary participation, data usage, and publication intentions. The study posed minimal risk to participants, with potential benefits including enhanced awareness of AI integration strategies and contribution to educational research knowledge.

3. RESULTS AND DISCUSSION

3.1. Student perceptions of ChatGPT effectiveness

For percentage-based interpretations, responses on the 5-point Likert scale were dichotomized: "agree" and "strongly agree" responses were coded as indicating improvement or positive perception. Using this coding scheme, 78.3% (274 of 350) of students reported improved learning motivation when utilizing ChatGPT for personalized Chinese language practice, though significant disciplinary variations emerged through one-way ANOVA, $F(2, 347)=15.8$, $p<0.001$, $\eta^2=0.083$, with traditional medicine students demonstrating the highest positive perception rates ($M=4.3$, $SD=0.7$), followed by general Chinese studies students ($M=4.0$, $SD=0.9$), and translation studies students reporting comparatively lower ratings ($M=3.7$, $SD=1.0$). Table 1 presents comprehensive comparison of student perceptions across disciplinary contexts. Feedback quality ratings demonstrated similar patterns, with traditional medicine students rating AI-generated feedback significantly higher ($M=4.2$, $SD=0.6$) than translation studies students ($M=3.6$, $SD=0.9$), $F(2, 347)=19.3$, $p<0.001$, likely reflecting that traditional medicine curricula emphasize systematic vocabulary acquisition where AI excels in providing consistent feedback [18], while translation studies requires nuanced interpretation where current AI limitations become more apparent [19].

Regarding specific AI applications, 82.1% of students valued AI-generated feedback for immediate error correction, with high appreciation for pronunciation guidance (87.4%). Traditional medicine students reported higher satisfaction with terminology support (84.2%) than translation studies students (79.6%). Despite positive perceptions, 64.7% expressed concerns about reduced human interaction, with translation studies students showing significantly higher concern (72.1%) versus traditional medicine students (58.3%), $\chi^2=18.9$, $p<0.001$, revealing tension between valuing AI's accessibility while recognizing irreplaceable human elements [20].

Table 1. Student perceptions of ChatGPT effectiveness by disciplinary background

Perception dimension	Traditional medicine (n=120)	Translation studies (n=140)	General Chinese (n=90)	Overall (n=350)	F-statistic	p-value
Learning motivation	4.3±0.7	3.7±1.0	4.0±0.9	4.0±0.9	15.8	<0.001
Feedback quality	4.2±0.6	3.6±0.9	3.9±0.8	3.9±0.8	19.3	<0.001
Disciplinary relevance	4.1±0.8	3.5±1.1	3.7±0.9	3.8±1.0	12.7	<0.001
Accessibility	4.4±0.5	4.3±0.6	4.3±0.6	4.3±0.6	1.2	0.31
Human interaction need	3.9±0.8	4.2±0.7	4.0±0.8	4.0±0.8	8.6	<0.001

Note: values represent mean ± standard deviation on 5-point Likert scale (1=strongly disagree to 5=strongly agree)

3.2. AI literacy and learning effectiveness correlation

Multiple regression analysis identified AI literacy as being strongly associated with learning effectiveness scores (β=0.67, t=8.9, p<0.001), with the overall model explaining 45% of variance in learning outcomes, R^2=0.45, F(3, 346)=94.7, p<0.001, as shown in Table 2. This substantial relationship indicates that students' capabilities to effectively interact with AI systems are significantly associated with educational benefits derived from AI integration. However, this cross-sectional design examines associations at a single time point and cannot establish causal relationships. While AI literacy demonstrates strong associations with learning effectiveness, the relationships identified may be bidirectional, or both variables may be influenced by unmeasured third factors, requiring experimental or longitudinal research designs to establish causal direction.

Table 3 presents the correlation matrix for key variables. AI literacy demonstrated positive correlations with learning effectiveness (r=0.67, p<0.001), disciplinary adaptation (r=0.34, p<0.001), and technology acceptance (r=0.58, p<0.001), while showing negative correlation with human interaction preference (r=-0.23, p<0.01), suggesting that students with higher AI literacy more effectively leverage technology while potentially becoming more comfortable with reduced human instruction. Disciplinary moderation effects emerged when examining the AI literacy-learning effectiveness relationship, with Traditional Medicine students demonstrating stronger correlations (r=0.72) compared to Translation Studies students (r=0.58), suggesting that traditional medicine's structured knowledge frameworks align better with current AI capabilities, whereas translation studies' emphasis on creativity and nuanced interpretation challenges AI's limitations [21]. Only 34% of students reported confidence in their AI interaction skills, revealing a significant preparation gap and underscoring urgent needs for systematic AI literacy training programs addressing both technical competencies and critical thinking skills necessary for effective educational AI integration [22].

Table 2. Multiple regression analysis predicting learning effectiveness

Predictor	B	SE	t	p	VIF
(Constant)	1.23	0.18	6.83	<0.001	—
AI Literacy	0.67	0.08	8.90	<0.001	1.34
Disciplinary background	0.21	0.06	3.50	<0.001	1.12
Technology acceptance	0.18	0.07	2.57	<0.0011	2.06

Model summary: R^2=0.45, adjusted R^2=0.44, F(3, 346)=94.7, p<0.001, 95% confidence intervals: constant: [0.88, 1.58]; AI literacy: [0.51, 0.83]; disciplinary background: [0.09, 0.33]; technology acceptance: [0.04, 0.32]
Note: β=standardized regression coefficient; SE=standard error; VIF=variance inflation factor. All VIF values <3 indicate no problematic multicollinearity.

Table 3. Correlation matrix of key variables

Variable	1	2	3	4	5	6
1. AI literacy	—					
2. Learning effectiveness	0.67***	—				
3. Disciplinary adaptation	0.34***	0.52***	—			
4. Technology acceptance	0.58***	0.61***	0.41***	—		
5. Human interaction preference	-0.23**	-0.18**	0.29***	-0.31***	—	
6. Perceived authenticity	0.18**	0.44***	0.56***	0.35***	0.22**	—

Note: ***p<0.001, **p<0.01

3.3. Instructor perspectives on implementation challenges

Qualitative analysis of instructor interviews revealed five major thematic categories regarding ChatGPT integration challenges. The most prominent theme, mentioned by 91% (41 of 45) instructors, centered on HAINC development needs, emphasizing that effective AI integration required sophisticated

skill sets extending beyond basic technological proficiency to encompass pedagogical judgment in content selection, adaptation strategies for diverse learner needs, and understanding of how AI-generated materials complement rather than replace human instruction. The second major theme, articulated by 82% of instructors, concerned disciplinary specificity in AI-generated content, with Traditional Medicine instructors expressing concerns about accuracy in specialized medical terminology and cultural-medical concepts, while Translation Studies instructors emphasized AI limitations in capturing nuanced meaning differences and cultural connotations essential for professional translation competence.

Additional themes included quality control challenges (74% of instructors reporting occasional inaccuracies requiring instructor intervention), institutional support gaps (68% noting insufficient professional development opportunities, lack of clear ethical guidelines, and limited technical infrastructure), and student dependency risks (57% expressing concerns about over-reliance undermining independent problem-solving capabilities essential for long-term language proficiency). Instructors described developing various quality assurance strategies including pre-screening AI content, teaching students critical evaluation frameworks for identifying potential errors, and creating hybrid approaches where AI-generated materials undergo human expert review before classroom integration, while requesting systematic training programs, collaborative learning communities for sharing best practices, and institutional policies clarifying appropriate AI applications in educational contexts.

3.4. Disciplinary adaptation patterns

Analysis revealed significant differences in how students across disciplinary backgrounds adapted ChatGPT for their specific learning needs. Traditional medicine students demonstrated significantly higher preference for using AI for structured vocabulary acquisition (83%) compared to translation studies students (58%), χ^2=23.4, p<0.001. While translation studies students showed significantly higher preference for creative language production tasks and comparative linguistic analysis (74%) compared to traditional medicine students (47%), χ^2=19.8, p<0.001, reflecting their profession's requirements for flexible language manipulation and creative problem-solving. Table 4 illustrates the distribution of student concerns about AI integration across disciplinary contexts. Reduced human interaction emerged as the predominant concern across all disciplines (64.7% overall), with translation studies students expressing highest concern levels (72.1%), followed by general Chinese studies (62.2%), and traditional medicine students (58.3%), likely reflecting varying degrees to which different disciplines require human mentorship. Translation work demands extensive human guidance for mastering nuanced cultural and contextual judgment, while medical terminology acquisition can be more effectively supported through consistent AI-generated practice exercises.

Disciplinary authenticity concerns showed moderate variation, with translation studies students expressing highest concerns (58.6%) compared to traditional medicine (45.8%) and general Chinese students (50.0%), though differences approached rather than achieved statistical significance (χ^2=5.2, p=0.07). Traditional medicine students demonstrated greater acceptance of AI tutoring when systems provided systematic, hierarchical learning support, valuing AI's capability to generate unlimited practice exercises for vocabulary reinforcement and consistent terminology feedback. Conversely, translation studies students, while appreciating AI's flexibility for exploring multiple linguistic interpretations, expressed greater reservations about AI potentially standardizing their creative translation processes and reducing exposure to diverse human translation approaches essential for developing professional judgment.

Table 4. Distribution of student concerns about AI integration by disciplinary background

Concern category	Traditional medicine	Translation studies	General Chinese	Overall	Statistical test
Reduced human interaction	58.3% (70/120)	72.1% (101/140)	62.2% (56/90)	64.7% (227/350)	χ^2=8.9, p=0.01
Disciplinary authenticity	45.8% (55/120)	58.6% (82/140)	50.0% (45/90)	51.8% (182/350)	χ^2=5.2, p=0.07
Technical accuracy	54.2% (65/120)	44.3% (62/140)	46.7% (42/90)	48.3% (169/350)	χ^2=3.1, p=0.21
Over-dependence Risk	40.8% (49/120)	45.0% (63/140)	43.3% (39/90)	43.2% (151/350)	χ^2=0.6, p=0.74

3.5. Implications for Vietnamese higher education and theoretical contributions

The finding that 78.3% of Vietnamese students reported improved learning motivation through ChatGPT integration demonstrates substantial potential for AI-enhanced personalized learning systems. While the strong correlation between AI literacy and learning effectiveness (r=0.67, p<0.001) reveals that technology acceptance models must be expanded to include AI literacy as a critical mediating variable [23]. The significant disciplinary variations—with traditional medicine students showing higher acceptance (M=4.3) compared to translation studies students (M=3.7)—extend diffusion of innovations theory by demonstrating that disciplinary epistemologies significantly moderate innovation adoption rates [24]. The paradox of students valuing AI feedback while simultaneously expressing strong human interaction

needs (64.7%) represents a fundamental design challenge, suggesting effective implementations must conceptualize AI as collaborative partner enhancing human instruction rather than autonomous replacement system, aligning with Vygotsky's social constructivist framework [25]. Quality concerns regarding disciplinary authenticity (51.8% of students) highlight challenges in maintaining academic rigor, necessitating development of domain-specific AI training methodologies, robust quality assurance mechanisms, and clear guidelines delineating appropriate AI applications [26].

The critical need for HAINC development identified by 91% of instructors reveals substantial gaps in current Vietnamese professional development programs while contributing new theoretical frameworks for understanding educator competencies in AI-mediated teaching contexts. Effective AI integration requires educators to develop sophisticated competencies extending beyond traditional TPACK frameworks to encompass AI-specific capabilities including prompt engineering skills, critical evaluation of AI outputs, strategies for integrating AI-generated content within culturally appropriate learning experiences, and frameworks for maintaining pedagogical authority while leveraging AI assistance [27]. Vietnamese universities must establish comprehensive professional development initiatives through workshops, collaborative learning communities, and ongoing support systems, emphasizing not merely technical AI operation but deeper pedagogical questions about when, how, and why to integrate AI within specific disciplinary contexts while maintaining educational quality [28].

3.6. Limitations

Several limitations should be acknowledged. First, while internal consistency reliability was assessed through Cronbach's alpha coefficients (ranging from 0.82 to 0.91), construct validity was not formally established through factor analysis. The theoretical structure of the AI literacy scale, learning effectiveness dimensions, and technology acceptance constructs were not empirically validated through exploratory or confirmatory factor analysis. Future research should employ EFA and CFA to validate the measurement structure of these constructs within Vietnamese educational contexts, ensuring that the instruments adequately capture the intended theoretical dimensions.

Second, this cross-sectional design examines associations at a single time point and cannot establish causal relationships. While AI literacy demonstrates strong associations with learning effectiveness ($r=0.67$), we cannot infer causality, as relationships may be bidirectional or influenced by unmeasured factors. Longitudinal or experimental designs would be necessary to establish causal direction. Third, the study's reliance on self-reported measures may introduce response bias and social desirability effects, particularly regarding AI literacy self-assessment and technology acceptance perceptions. Future research should incorporate objective performance measures alongside self-report instruments to triangulate findings.

3.7. Contribution to knowledge and future research directions

This research makes several distinctive contributions to educational technology and language pedagogy. First, it provides empirical evidence from Vietnamese educational contexts—significantly underrepresented in international literature—demonstrating how cultural, institutional, and disciplinary factors influence AI integration effectiveness [29]. Second, it introduces and validates disciplinary moderation effects, demonstrating that academic disciplines with different epistemological foundations exhibit systematically different AI adoption patterns, challenging assumptions of uniform implementation [30]. Third, it operationalizes the HAINC framework, identifying that 91% of instructors recognize development needs while only 34% of students report confidence, quantifying critical preparation gaps [15]. Fourth, it demonstrates that AI literacy functions as a critical mediating variable ($r=0.67$, explaining 45% of variance), suggesting contemporary frameworks must incorporate literacy dimensions [14]. Fifth, it provides empirical evidence for the complementarity principle, showing that 64.7% of students express strong human interaction needs despite valuing AI feedback, indicating successful educational AI must be designed around human-AI collaboration [25], [31].

Future research should pursue longitudinal studies tracking whether initial motivation improvements persist or represent temporary novelty effects [29], experimental designs comparing AI-enhanced and traditional approaches for stronger causal evidence [11], and culturally responsive AI evaluation frameworks addressing quality assurance challenges [26], [32]. Investigation of optimal HAINC training methodologies for Vietnamese educators [27], student AI literacy development trajectories addressing the preparation gap where only 34% reported confidence [22], [33], and cross-national comparative research across Southeast Asian nations would provide valuable insights into how national contexts influence educational technology adoption, identifying universal principles while highlighting context-specific factors requiring localized adaptation strategies [2], [31], [34].

4. CONCLUSION

This comprehensive investigation of ChatGPT integration in Chinese language education across three Vietnamese universities reveals both substantial potential and significant challenges. The finding that 78.3% of students reported improved learning motivation demonstrates considerable AI-enhanced learning benefits, while the strong correlation between AI literacy and learning effectiveness ($r=0.67$, $p<0.001$) underscores critical importance of systematic preparation for successful implementation. Significant disciplinary variations emerged, with traditional medicine students demonstrating highest AI acceptance ($M=4.3$) compared to translation studies students ($M=3.7$), $F(2, 347)=15.8$, $p<0.001$, revealing that uniform implementation approaches inadequately address diverse pedagogical requirements. The paradoxical student response valuing AI feedback while expressing strong human interaction needs (64.7%) represents fundamental tension requiring collaborative human-AI frameworks, while 91% of instructors emphasized HAINC development, revealing urgent needs for comprehensive professional development programs.

Future research should investigate longitudinal effects of AI-enhanced learning on Chinese language proficiency, examining whether initial motivation improvements translate into sustained learning gains, while developing culturally responsive AI evaluation frameworks specific to Vietnamese educational contexts for quality assurance. This research provides empirical evidence and practical insights for Vietnamese educators, administrators, and policymakers navigating AI integration challenges while maintaining pedagogical integrity and disciplinary authenticity. As AI technologies continue evolving, insights from Vietnamese educational contexts will contribute to developing more effective, culturally responsive, and ethically sound educational AI systems serving diverse learner populations within Southeast Asian higher education.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Phuoc Tai Nguyen	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓
Hung Thanh Nguyen		✓	✓	✓		✓		✓	✓	✓	✓	✓		✓
Thuan Quy Nguyen	✓		✓	✓			✓	✓		✓	✓		✓	✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICAL APPROVAL

This study involved human participants and was conducted in accordance with ethical standards established by the Vietnam National University system and international research guidelines. Ethical approval was obtained from:

- Research Ethics Committee for Social and Behavioral Sciences at FPT University Can Tho Campus (Approval No. REC-FPTUCT-2025-02-009, Date: 15 February 2025).
- Institutional Review Board for Biomedical Research at Can Tho University of Medicine and Pharmacy (Approval No. 25.042.GV/PCT-HĐĐĐ, Date: 26 November 2025)
- University Ethics Committee for Human Research at Dong Thap University (Approval No. UECHR-DThU-2025-09-021, Date: 05 September 2025). All participants provided informed consent prior to participation. Participants were informed of their right to withdraw at any time without penalty. Data were anonymized and stored securely in password-protected files accessible only to the research team.

DATA AVAILABILITY

The data that support the findings of this study are not publicly available because they contain information that could compromise the privacy and confidentiality of student and instructor participants. Derived datasets supporting the reported analyses are available from the corresponding author, [TQN], upon reasonable request and subject to institutional ethical approval.

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BIOGRAPHIES OF AUTHORS

Phuoc Tai Nguyen is a Doctor of Philosophy who graduated from Xiamen University, China, in 2020. He holds a bachelor's degree in Chinese language. He is currently affiliated with the Faculty of Basic Sciences, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam. His research interests encompass philosophy, culture, religion, language, and digital transformation in education. He has contributed to various studies on educational philosophy and cultural integration in Vietnam. He can be contacted at email: nptai@ctump.edu.vn.

Hung Thanh Nguyen is a lecturer at Can Tho University of Medicine and Pharmacy, Vietnam, with academic interests situated in English language education and applied linguistics. His scholarly work focuses on English-medium instruction (EMI), intercultural communicative competence, language teaching and learning in higher education, and the pedagogical implications of emerging technologies in education. He has contributed to a growing body of research through publications in peer-reviewed journals addressing such topics as international student experiences, EFL teaching practices, intercultural learning, and the integration of digital tools, including ChatGPT, into language education. Through both his teaching and research, he seeks to advance innovative and contextually responsive approaches to language education in Vietnam and beyond. He can be contacted at email: nthung@ctump.edu.vn.

Thuan Quy Nguyen received her Ph.D. in Ethnology and has conducted extensive research in the fields of culture, education, and language. She is currently the head of the Faculty of Culture, Tourism and Social Work at Dong Thap University, Vietnam. She can be contacted at email: ntquy@dthu.edu.vn.