

Utilizing Game-based Technology to Enhance Learning Achievement and Motivation in Chinese Language Speaking for International Students

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Abstract

The development of spoken Chinese proficiency remains a significant challenge for international students, particularly in terms of pronunciation, tonal accuracy, and speaking fluency. Although game-based learning has been widely applied in language education, empirical evidence regarding its effectiveness in improving spoken Chinese skills remains limited. This study investigated the effects of game-based technology on spoken Chinese proficiency and learning motivation among international students. A quasi-experimental design was employed with 40 international students in Chiang Mai, Thailand, who were assigned to either a control group receiving traditional instruction or an experimental group receiving game-based technology instruction over six weeks. Data were collected through spoken Chinese proficiency tests, motivation and engagement questionnaires, classroom observations, and semi-structured interviews. Quantitative data were analyzed using descriptive statistics and t-tests, while qualitative data were analyzed through thematic analysis. The findings revealed that the experimental group achieved significantly higher post-test scores than the control group and demonstrated substantially greater improvement in spoken Chinese proficiency. Students in the experimental group also reported higher levels of motivation, engagement, perceived usefulness, and positive attitudes toward learning. Qualitative findings further indicated that game-based technology reduced speaking anxiety, encouraged repeated practice, promoted peer interaction, and enhanced learners' awareness of tonal accuracy. These findings suggest that game-based technology can serve as an effective pedagogical approach for improving spoken Chinese proficiency and fostering learner motivation in Chinese language education.

Keywords: Game-based learning, spoken Chinese proficiency, learning motivation, international students, educational technology

■ Introduction

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In the current context of globalization, the demand for Chinese language learning has increased significantly, particularly among international students. As Chinese continues to play an increasingly important role in international communication, education, and professional development, many learners seek to develop communicative competence in spoken Chinese. However, mastering spoken Chinese remains a major challenge due to its unique tonal system, grammatical structures, and cultural nuances. Effective oral communication requires learners to accurately produce tones, use appropriate vocabulary and sentence structures, and respond fluently in real-time interactions. Traditional teaching methods often fail to provide sufficient opportunities for interactive and engaging speaking practice, leading to low motivation and limited improvement in oral proficiency. Consequently, many international students experience difficulties in developing confidence and communicative competence in spoken Chinese despite extended periods of language study.

Technology integration into education has revolutionized traditional teaching methods in recent years, introducing innovative approaches that enhance learning experiences and outcomes (Kara et al., 2020). Among these advancements, game-based learning has garnered significant attention as it leverages the engaging and interactive nature of games to create immersive learning environments that foster motivation, participation, and retention (Nadeem et al., 2023). Game-based learning environments typically incorporate elements such as immediate feedback, rewards, challenges, competition, and progression systems that encourage active learner participation. Previous studies have demonstrated that digital games can positively influence language learning outcomes and learners' willingness to communicate. Reinders and Wattana in 2015 found that digital games could significantly enhance learners' willingness to communicate, making them more willing to engage in oral expression in the classroom. Similarly, (Peterson ,2011) studied Japanese learners' interactions in a Massively Multiplayer Online Role-Playing Game (MMORPG) and demonstrated how these interactions promoted second language speaking abilities. These findings suggest that game-based technology may provide meaningful opportunities for language learners to practice speaking skills in supportive and engaging learning environments.

Despite these potential benefits, empirical research on the application of game-based technology specifically for spoken Chinese proficiency among international students remains limited. Most existing studies focus on vocabulary learning, grammar acquisition, reading comprehension, or general language achievement, while relatively few studies have examined the development of spoken Chinese skills, particularly pronunciation accuracy, tonal accuracy, and fluency in authentic communication contexts. Furthermore, limited evidence is available regarding how game-based technology influences learners' motivation and engagement while developing oral Chinese proficiency. Addressing this gap is important because speaking competence is one of the most essential outcomes of language learning and a key indicator of communicative success. Therefore, this study aims to explore how game-based technology can be utilized in Chinese speaking instruction to enhance learning outcomes and motivation among international students. The findings are expected to contribute to the growing body of knowledge on technology-enhanced language learning and provide practical implications for Chinese language educators seeking effective approaches to support speaking development.

In this study, spoken Chinese proficiency is conceptualized as the operational definition of learning achievement, as oral communication ability represents the primary learning outcome targeted by the intervention.

■ Research Questions

- 1) To what extent does game-based technology improve international students' overall spoken Chinese proficiency?
- 2) How does game-based technology influence international students' motivation and engagement in spoken Chinese learning activities?

■ Significance and Purposes

This study addresses the growing need for effective instructional approaches that support the development of spoken Chinese proficiency among international learners. As oral communication remains one of the most challenging aspects of Chinese language learning, identifying innovative teaching strategies that can improve both language performance and learner motivation is of considerable importance. This study contributes to the field of technology-enhanced language learning by providing empirical evidence on the use of game-based technology in Chinese language education and by expanding current understanding of how game-based learning environments can support oral language development and learner engagement. In addition, the findings may offer practical guidance for Chinese language teachers and educational institutions seeking effective ways to increase student participation, motivation, and speaking practice, while supporting the integration of digital technologies into Chinese language classrooms.

Accordingly, the purposes of this study are:

- 1) to examine the effects of game-based technology on international students' spoken Chinese proficiency.
- 2) to investigate the influence of game-based technology on international students' motivation and engagement in learning spoken Chinese.

■ Literature Reviews

Technology in Chinese Language Education

The integration of digital technology has significantly transformed language education by providing learners with greater access to interactive, flexible, and learner-centered learning environments (Gong et al., 2018; Gong et al., 2020). In Chinese language education, technology has been increasingly adopted to support language acquisition and improve learner engagement. Various digital tools, including multimedia resources, online communication platforms, mobile applications, and immersive technologies, have been used to facilitate language learning in different contexts (Chai & King, 2016).

Multimedia tools such as interactive videos, audio recordings, and animations can enhance students' understanding by presenting language content through multiple forms of representation (Chen & Zou, 2024). Online platforms including Hello Talk, Tandem, and WeChat enable learners to communicate with native speakers and participate in authentic language exchanges, thereby supporting both linguistic and cultural development (Li, 2022). Mobile learning applications such as Duolingo, Pleco, and Chinese Skill provide learners with opportunities for self-paced learning and continuous practice through interactive exercises and immediate feedback (Jiang & Xu, 2022). Furthermore, emerging technologies such as Augmented Reality (AR) and Virtual Reality (VR) have expanded opportunities for experiential learning by allowing students to practice language skills in simulated real-world environments (Peixoto & Bessa, 2021).

Recent studies have emphasized the growing role of artificial intelligence and adaptive learning systems in personalizing Chinese language instruction. For instance, (Frawley & Campbell, 2024) found that AI-driven speaking tutors significantly improved tonal accuracy among beginner learners by providing real-time visual feedback. Similarly, (Fithriani, 2021) reported that mobile-assisted language learning with gamified features enhanced vocabulary retention and speaking willingness among international students. These developments indicate that technology continues to evolve and offer new possibilities for Chinese language education.

Game-based Learning and Spoken Language Development

Game-based learning is an instructional approach that incorporates game elements and interactive activities into educational settings to support learning objectives. Unlike traditional teacher-centered approaches, game-based learning encourages active participation, problem-solving, collaboration, and continuous practice through engaging learning experiences (Acquah & Katz, 2020). The motivational characteristics of games, such as challenges, rewards, progression systems, and immediate feedback, have been identified as important factors that contribute to learner engagement and persistence.

In language education, game-based learning has been widely used to support vocabulary development, grammar learning, and communication skills. Language learning platforms such as Duolingo integrate game elements including points, levels, achievements, and personalized learning pathways to maintain learner motivation and encourage regular practice. Recent meta-analyses and empirical studies have provided robust evidence for the effectiveness of game-based learning in second language oral development. For example, (Godwin-Jones, 2019) conducted a meta-analysis of 32 studies and found that game-based interventions produced a moderate to large effect on speaking fluency and pronunciation accuracy. (Alexiou & Schippers, 2018) examined the use of a multiplayer role-playing game for Chinese oral practice and reported significant gains in tonal accuracy and spontaneous speech production. Although previous studies have demonstrated positive effects of game-based learning on language achievement and learner motivation, research focusing specifically on spoken Chinese development remains limited. Additional empirical evidence is therefore needed to better understand how game-based technology can support pronunciation accuracy, tonal accuracy, fluency, and learner engagement in Chinese language learning.

Theoretical Framework

This study is guided by the Technology Acceptance Model (TAM) and Self-Determination Theory (SDT). The Technology Acceptance Model explains how users' perceptions of usefulness and ease of use influence their attitudes toward adoption of technology and their intention to use technological systems (Lee et al., 2003). In educational settings, learners are more likely to engage with digital learning tools when they perceive them as useful, accessible, and supportive of their learning goals.

Self-Determination Theory focuses on the role of motivation in human behavior and learning (Ryan & Deci, 2021). The theory distinguishes between intrinsic motivation, which originates from personal interest and enjoyment, and extrinsic motivation, which is influenced by external rewards and recognition. These motivational dimensions are particularly relevant to game-based learning environments, where learners are encouraged through both enjoyable learning experiences and game-related incentives such as points, badges, and achievements.

Together, TAM and SDT provide a useful framework for understanding how game-based technology may influence learners' perceptions, motivation, engagement, and spoken Chinese proficiency. As illustrated in Figure 1, game-based technology is expected to enhance learning outcomes by increasing learners' motivation, promoting positive technology acceptance, and creating opportunities for active participation and speaking practice.

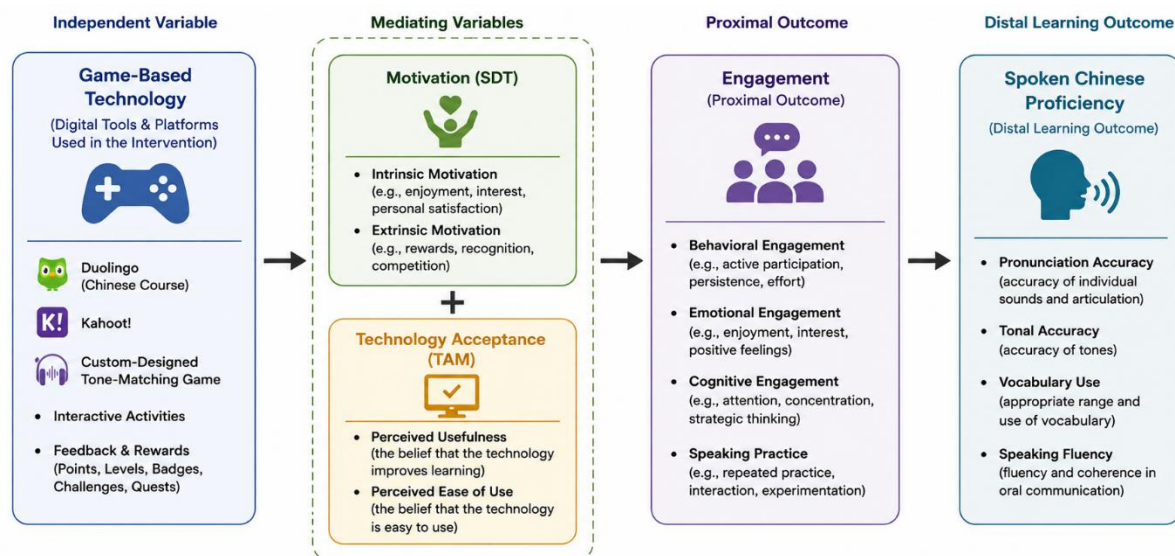


Figure 1. Theoretical Framework of Game-Based Technology for Spoken Chinese Learning

The framework consists of four interconnected components. First, game-based technology serves as the independent variable and encompasses the digital tools and platforms used in the intervention, including Duolingo, Kahoot! and a custom-designed tone-matching game. These technologies provide interactive learning activities, immediate feedback, rewards, challenges, and opportunities for repeated language practice. Second, learners' motivation and technology acceptance function as mediating variables. Motivation includes both intrinsic and extrinsic dimensions, while technology acceptance refers to learners' perceptions of usefulness and ease of use. Third, engagement is positioned as a proximal outcome, reflecting learners' behavioral, emotional, and cognitive involvement in learning activities through active participation, speaking practice, and peer interaction. Finally, spoken Chinese proficiency is conceptualized as the distal learning outcome and represents the primary goal of the intervention, reflected in improvements in pronunciation accuracy, tonal accuracy, vocabulary use, and speaking fluency. Game-based technology is expected to enhance spoken Chinese proficiency by increasing learners' motivation, strengthening technology acceptance, and promoting greater engagement in learning activities.

Methods

Research Design

This study employed a quasi-experimental pretest-posttest control group design to investigate the effects of game-based technology on spoken Chinese proficiency and learning motivation among international students. The study compared two instructional approaches: traditional classroom instruction and game-based technology instruction. Spoken Chinese proficiency and learning motivation were

examined as the primary outcome variables. The intervention was conducted over a six-week period, during which both groups studied the same learning content but experienced different instructional approaches.

Participants

The participants were 40 international students enrolled in Chinese language courses at a language school in Chiang Mai, Thailand. All participants were non-native Chinese speakers studying Chinese as a second or foreign language. Their language proficiency ranged from beginner to intermediate levels. Participants were selected using purposive sampling from two existing Chinese language classes and were assigned to either a control group ($n = 20$) or an experimental group ($n = 20$). The control group received traditional instruction, whereas the experimental group participated in game-based learning activities. All participants were adults aged 18 years or older and voluntarily agreed to participate in the study.

Instruments and Data Collection

Data was collected using four research instruments:

1) Spoken Chinese Proficiency Test: The first instrument was a spoken Chinese proficiency test administered before and after the intervention. The test was developed based on the HSKK Elementary Level and HSK Level 2 requirements and consisted of four sections: reading aloud, picture description, question answering, and short dialogue completion. The total score was 100 points, and all oral responses were audio-recorded and evaluated independently by two raters.

The scoring rubric is detailed in Table 1. Each of the four test sections contributed 25 points to the total score. For reading aloud, raters assessed pronunciation accuracy (10 points) and tonal accuracy (15 points). Picture description was evaluated based on vocabulary use (10 points), grammatical correctness (5 points), and fluency (10 points). Question answering assessed comprehension accuracy (10 points), response relevance (5 points), and fluency (10 points). Short dialogue completion was scored on interaction appropriateness (10 points), vocabulary use (5 points), and fluency (10 points).

Table 1

Scoring Rubric for Spoken Chinese Proficiency Test

Test Section	Criteria	Points
Reading Aloud	Pronunciation accuracy	10
Tonal accuracy	15	
Picture Description	Vocabulary use	10
Grammatical correctness	5	
Fluency	10	
Question Answering	Comprehension accuracy	10
Response relevance	5	
Fluency	10	
Short Dialogue Completion	Interaction appropriateness	10
Vocabulary use	5	
Fluency	10	
Total		100

2) Motivation and Engagement Questionnaire: The second instrument was a motivation and engagement questionnaire developed based on the Technology Acceptance Model (TAM) and Self-Determination Theory (SDT). The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and measured motivation, engagement, perceived usefulness, perceived ease of use, attitudes, and behavioral intentions toward game-based learning. Prior to the main study, the questionnaire was piloted with students who were not included in the final sample. The reliability analysis indicated acceptable internal consistency, with Cronbach's alpha exceeding 0.70.

3) Classroom Observation Checklist: The third instrument was a classroom observation checklist used to record students' participation, interaction, and engagement during the six-week intervention.

4) Semi-Structured Interview Protocol: The fourth instrument was a semi-structured interview protocol. Following the intervention, selected students from the experimental group participated in interviews to share their experiences and perceptions regarding the use of game-based technology in spoken Chinese learning.

Data collection was conducted in four stages, as illustrated in Figure 2. First, participants completed the spoken Chinese proficiency pre-test before the intervention. Second, the experimental group participated in game-based learning activities, while the control group received traditional instruction over a six-week period. Third, all participants completed the spoken Chinese proficiency post-test and the motivation questionnaire following the intervention. Finally, classroom observations and semi-structured interviews were conducted to obtain additional qualitative information regarding students' learning experiences and perceptions of game-based learning.

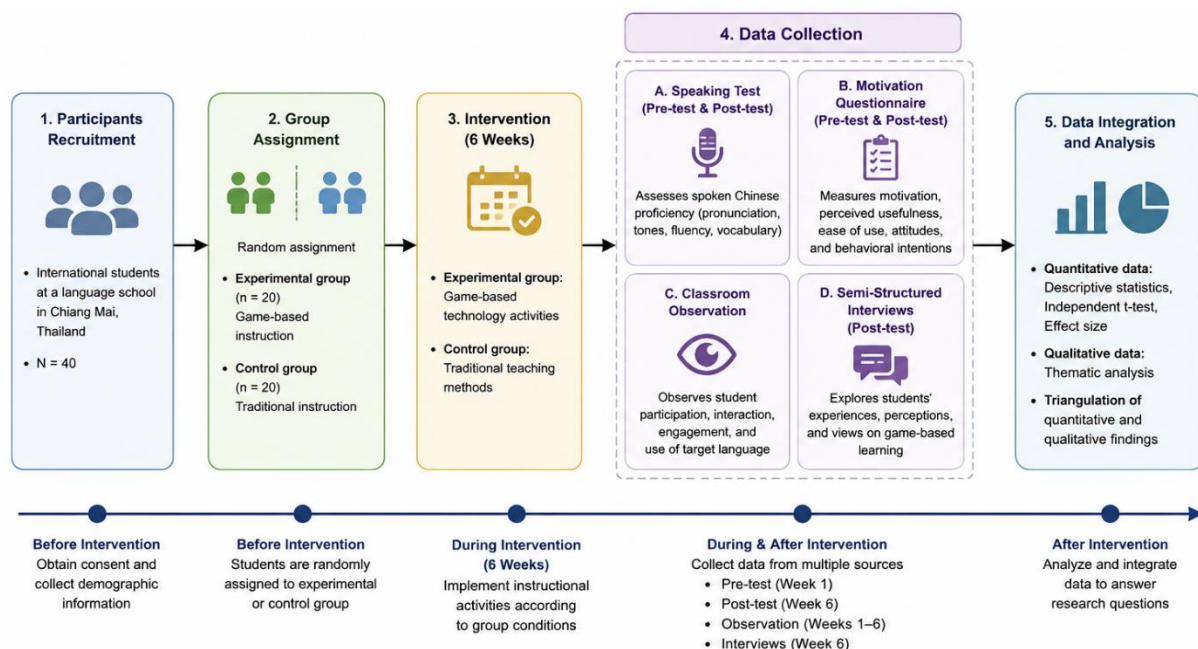


Figure 2. Data Collection Process

The data collection process consisted of four stages. Stage 1 (Pre-test, Week 1): All participants completed the spoken Chinese proficiency pre-test. Stage 2 (Intervention, Weeks 2–7): The experimental group received game-based instruction while the control group received traditional instruction, with both groups covering identical content and hours. Stage 3 (Post-test, Week 8): All participants completed the post-test and motivation questionnaire. Stage 4 (Qualitative Data, Weeks 6–8): Classroom observations were conducted weekly, and semi-structured interviews were conducted with nine experimental group students.

Game-based Technology Intervention

1) The game-based technology employed in this study consisted of a combination of existing commercial platforms and custom-designed digital activities. Three primary tools were utilized:

2) Duolingo (Chinese Course): A commercially available mobile application that incorporates gamified elements for language learning. Students used this app for pronunciation and tone practice, with features including voice recognition feedback, points, levels, and daily streak tracking.

3) Kahoot!: A web-based interactive quiz platform used for vocabulary review and class competitions. Students competed individually and in teams, earning points for correct answers and speed.

Custom-Designed Tone-Matching Game: A simple digital game developed by the research team using PowerPoint with embedded audio and interactive elements. Students matched spoken syllables to their correct tone contours, receiving immediate visual and auditory feedback.

Game Mechanics

The game-based learning environment incorporated several game mechanics. Points were awarded for correct responses, successful pronunciation attempts, and active participation. Levels and progress tracking were implemented through Duolingo's built-in progression system. Leaderboards were displayed during Kahoot! sessions to foster friendly competition. Badges and rewards were earned for completing daily practice streaks and achieving target scores. Challenges and quests included weekly missions such as completing a certain number of pronunciation practices or mastering a set of vocabulary items. Feedback mechanisms were embedded in all tools, providing immediate corrective feedback on pronunciation and tonal accuracy.

Student and Instructor Roles

During gameplay, students actively engaged with the applications and activities. In Duolingo sessions, they practiced pronunciation by speaking into their devices, completing interactive exercises, and monitoring their progress through the app's feedback system. In Kahoot! sessions, students answered questions on their devices, discussed answers with peers, and participated in class-wide competitions. In tone-matching sessions, they listened to audio prompts, selected corresponding tones, and repeated practice until mastery.

The instructor's role shifted from lecturer to facilitator. Before each game session, the instructor introduced the learning objectives and explained the game rules. During gameplay, the instructor monitored student progress, provided technical support, and offered individual guidance when needed. After gameplay, the instructor led debriefing discussions, reviewed common errors, and connected game activities to broader learning goals.

Typical Learning Session Flow

A typical 90-minute session for the experimental group is followed by the structure, as shown in Table 2.

Table 2
Learning Flow of the Experimental Group

Time	Activity	Description
0–10 min	Warm-up	Review previous vocabulary through a quick Kahoot! quiz
10–35 min	Duolingo Practice	Students complete pronunciation and tone exercises individually
35–55 min	Tone-Matching Game	Students practice tone identification and production with immediate feedback
55–75 min	Interactive Role-Play	Students apply vocabulary and structures in game-based conversational scenarios
75–90 min	Debrief & Summary	Instructor reviews common errors, highlights progress, and previews next session

Analysis of Data

Quantitative data obtained from the proficiency tests and questionnaires were analyzed using descriptive statistics, including means and standard deviations. Paired-sample t-tests were used to examine differences between pre-test and post-test scores within each group, while independent-sample t-tests were conducted to compare outcomes between the control and experimental groups. Effect sizes were calculated using Cohen’s d to determine the magnitude of the observed differences. Inter-rater reliability for the spoken Chinese proficiency test was assessed using Cohen’s kappa coefficient. Qualitative data obtained from classroom observations and interviews were analyzed using thematic analysis to identify common patterns related to learners’ engagement, motivation, and speaking development.

■ **Results**

Results of Spoken Chinese Proficiency

The first objective of this study was to examine the effects of game-based technology on international students’ spoken Chinese proficiency. Pre-test and post-test scores for both groups are presented in Table 3. The pre-test results showed no statistically significant difference between the control group and the experimental group ($t(38) = -0.32, p = 0.75$), indicating that the two groups had comparable levels of spoken Chinese proficiency before the intervention.

Table 3
Comparison of Pre-test and Post-test Scores Between Groups

Test	Group	N	Mean	SD	<i>t</i>	<i>p</i>
Pre-test	Control	20	52.35	6.42	-0.32	0.75
Pre-test	Experimental	20	53.10	7.18		
Post-test	Control	20	64.20	5.89	-4.62	< 0.001
Post-test	Experimental	20	78.65	6.21		

Following the six-week instructional period, both groups demonstrated improvements in their post-test performance. The control group improved from a mean score of 52.35 to 64.20, while the experimental group improved from 53.10 to 78.65. Paired-sample *t*-test results indicated significant improvement within both groups ($p < 0.001$). However, the magnitude of improvement was substantially greater in the experimental group, which achieved a mean gain of 25.55 points (48.1%), compared with 11.85 points (22.6%) in the control group.

An independent sample *t*-test comparing post-test scores revealed a statistically significant difference between the two groups ($t(38) = -4.62, p < 0.001$). The effect size was large (Cohen's $d = 1.48$), indicating that the use of game-based technology had a substantial positive effect on students' spoken Chinese proficiency. These findings suggest that integrating game-based learning activities into Chinese language instruction can provide more effective support for the development of speaking skills than traditional instructional approaches alone.

Sub-component Analysis of Spoken Chinese Proficiency

To examine whether improvements were observed across all speaking components, the post-test scores were further analyzed by sub-components. The experimental group demonstrated substantial improvement in tonal accuracy (mean score increase of 8.2 points out of 15), which represented the largest gain among all sub-components. This finding aligns with the interview data, where students frequently mentioned that game-based tools helped them perceive and correct tonal errors more effectively. Pronunciation accuracy also showed notable improvement (mean increase of 5.8 points out of 10), suggesting that the voice recognition feedback provided by Duolingo supported the development of clearer articulation. Fluency improved moderately (mean increase of 4.5 points out of 10), indicating that repeated practice through game activities contributed to more natural speech production. However, improvements in vocabulary use and grammatical correctness were relatively smaller (mean increases of 3.2 and 2.8 points, respectively), suggesting that while game-based activities effectively promoted oral production, their impact on lexical and grammatical accuracy may be more limited without explicit instruction. These findings suggest that game-based technology is particularly effective for developing tonal and phonological aspects of spoken Chinese, which are often the most challenging areas for international learners.

Results of Motivation and Engagement

The second objective of this study was to investigate the influence of game-based technology on students' motivation and engagement in spoken Chinese learning. The questionnaire results presented in Table 4 indicate that students in the experimental group reported consistently higher scores across all measured dimensions than those in the control group. In terms of motivation, students who participated in game-based learning activities demonstrated higher levels of both intrinsic and extrinsic motivation. The experimental group reported stronger enjoyment and interest in learning spoken Chinese ($M = 4.52, SD = 0.55$) than the control group ($M = 3.45, SD = 0.68$), while extrinsic motivation was also higher among students

in the experimental group ($M = 4.38$, $SD = 0.61$) compared with those receiving traditional instruction ($M = 3.62$, $SD = 0.72$). These findings suggest that game-based technology enhanced students' enjoyment of learning and encouraged greater participation through game-related incentives and rewards.

Table 4

Comparison of Motivation and Engagement Questionnaire Scores

Dimension	Control (n=20) Mean (SD)	Experimental (n=20) Mean (SD)	Mean Difference	<i>p</i>
Intrinsic Motivation	3.45 (0.68)	4.52 (0.55)	1.07	<0.01
Extrinsic Motivation	3.62 (0.72)	4.38 (0.61)	0.76	<0.01
Perceived Usefulness	3.50 (0.70)	4.45 (0.58)	0.95	<0.01
Perceived Ease of Use	3.55 (0.75)	4.30 (0.65)	0.75	<0.01
Attitude	3.48 (0.72)	4.55 (0.52)	1.07	<0.01
Behavioral Intention	3.40 (0.80)	4.48 (0.60)	1.08	<0.01

The results also revealed more positive perceptions of the learning technology among students in the experimental group. They reported higher levels of perceived usefulness ($M = 4.45$, $SD = 0.58$) and perceived ease of use ($M = 4.30$, $SD = 0.65$) than students in the control group, indicating that the game-based learning activities were viewed as both beneficial and user-friendly for supporting spoken Chinese development. In addition, students exposed to game-based technology demonstrated more positive attitudes toward learning spoken Chinese ($M = 4.55$, $SD = 0.52$) and stronger behavioral intentions to continue using similar learning approaches in the future ($M = 4.48$, $SD = 0.60$) than those in the control group.

Overall, the findings indicate that game-based technology positively influenced learners' motivation, engagement, and acceptance of technology-supported learning. All differences between groups were statistically significant ($p < 0.01$), suggesting that game-based learning can create a more engaging, motivating, and sustainable environment for spoken Chinese instruction.

Results of Classroom Observation

Classroom observations were conducted throughout the six-week intervention period to provide additional evidence regarding students' participation and engagement during learning activities. As shown in Table 5, students in the experimental group demonstrated higher levels of classroom participation than those in the control group. They produced more unprompted speaking turns, engaged in more frequent peer-to-peer interactions in Chinese, and used target vocabulary more actively during learning activities.

Table 5

Classroom Observation Results (Averaged Across Six Weeks)

Indicator	Control Group	Experimental Group
Unprompted speaking turns per session	2–3	10–14
On-task behavior (% of class time)	68%	91%
Peer-to-peer interaction in Chinese (occurrences per session)	0–1	6–9
Use of target vocabulary beyond drills	Rare	Frequent

The observation results also indicated higher levels of behavioral engagement among students in the experimental group. They remained on task for a greater proportion of class time and participated more consistently throughout the instructional sessions. In contrast, students in the control group were generally less active and relied more on teacher-directed interactions. These findings suggest that game-based learning activities created more opportunities for active participation and spoken language practice.

Overall, the observation data supports the quantitative findings reported in the achievement and questionnaire results. The higher levels of participation, interaction, and engagement observed in the experimental group suggest that game-based technology contributed to a more interactive and learner-centered environment for spoken Chinese learning.

Results of Semi-Structured Interviews

To gain a deeper understanding of students' experiences with game-based learning, semi-structured interviews were conducted with nine students from the experimental group following the intervention. Thematic analysis identified three major themes related to learners' experiences and perceptions of game-based technology in spoken Chinese learning.

Theme 1: Reduced Speaking Anxiety

Many participants reported feeling more comfortable speaking Chinese during game-based activities than in traditional classroom settings. Students explained that the interactive and low-pressure learning environment reduced their fear of making mistakes and increased their willingness to communicate in Chinese. One participant noted that the games allowed repeated practice without feeling embarrassed, which gradually increased confidence in speaking. These responses suggest that game-based learning created a supportive environment that encouraged oral participation.

Theme 2: Increased Motivation for Practice

Participants consistently reported that game elements such as points, rewards, levels, and progress tracking encouraged them to practice more frequently. Several students mentioned that they spent additional time practicing outside the classroom because they wanted to improve their scores or maintain their learning progress. One student commented, "The games made me want to practice more because I could see my progress every day." These findings support the questionnaire results, which showed higher levels of motivation and engagement among students in the experimental group.

Theme 3: Improved Awareness of Pronunciation and Tonal Accuracy

Another common theme was the role of immediate feedback in helping students identify and correct pronunciation and tonal errors. Participants reported that game-based tools enabled them to monitor their speaking performance more effectively than traditional repetition-based activities. One student stated, "I could hear and correct my mistakes immediately, which helped me remember the correct tones." This finding is consistent with the post-test results, which demonstrated substantial improvement in spoken Chinese proficiency among students who participated in game-based learning activities.

Overall, the interview findings indicate that game-based technology supported spoken Chinese learning by reducing anxiety, increasing motivation, and improving learners' awareness of pronunciation and

tones. These qualitative findings complement the quantitative results and help explain the superior performance of the experimental group in the post-test assessment.

■ Discussion

The findings indicate that game-based technology had a positive effect on students' spoken Chinese proficiency. Students in the experimental group achieved significantly higher post-test scores and demonstrated greater improvement than those in the control group. These findings are consistent with previous studies that reported positive effects of game-based learning on language development and communication skills (Peterson, 2011; Reinders & Wattana, 2015; Byun & Joung, 2024;). One possible explanation is that game-based activities provide learners with more opportunities for repeated practice, immediate feedback, and active participation, which support the development of pronunciation, tonal accuracy, and speaking fluency.

The study also found that students who participated in game-based learning reported higher levels of motivation, engagement, perceived usefulness, and positive attitudes toward learning spoken Chinese. These findings can be interpreted through the perspectives of the Technology Acceptance Model (TAM) and Self-Determination Theory (SDT). According to TAM, learners are more likely to adopt and engage with educational technologies when they perceive them as useful and easy to use. Similarly, SDT suggests that enjoyable and meaningful learning experiences can strengthen learners' intrinsic motivation. The game-based learning environment in this study appeared to support both motivational and technological factors that contributed to students' engagement in learning activities.

The qualitative findings further support the quantitative results. Classroom observations showed higher levels of participation and interaction among students in the experimental group, while interview data revealed reduced speaking anxiety, increased motivation for practice, and improved awareness of pronunciation and tonal accuracy. These findings suggest that the benefits of game-based learning extend beyond academic performance and may also influence learners' confidence and willingness to communicate. Together, the quantitative and qualitative findings highlight the potential of game-based technology as an effective approach for supporting spoken Chinese learning among international students.

A detailed comparison of the two groups reveals both strengths and limitations. The experimental group demonstrated clear advantages in post-test scores ($M = 78.65$ vs. 64.20), improvement rate (48.1% vs. 22.6%), spontaneous speaking ($10\text{--}14$ vs. $2\text{--}3$ unprompted turns), and motivation ($M = 4.52$ vs. 3.45). However, some students initially struggled with technical aspects, requiring additional support. The experimental group showed the greatest improvement in tonal accuracy (8.2 points) and pronunciation (5.8 points), but smaller gains in vocabulary (3.2 points) and grammar (2.8 points), suggesting game-based approaches are most effective for phonological development. The control group benefited from structured teacher-led grammar explanations. These findings suggest an integrated approach combining game-based activities with traditional instruction may yield optimal results.

■ Conclusion

This study examined the effects of game-based technology on spoken Chinese proficiency and learning motivation among international students. The findings showed that students who participated in

game-based learning activities achieved greater improvement in spoken Chinese proficiency than those who received traditional instruction. In addition, the experimental group reported higher levels of motivation, engagement, perceived usefulness, perceived ease of use, attitudes, and behavioral intentions toward learning spoken Chinese.

The classroom observation and interview findings further supported the quantitative results by showing that game-based learning encouraged active participation, increased speaking practice, reduced speaking anxiety, and improved learners' awareness of pronunciation and tonal accuracy. Together, these findings suggest that game-based technology can provide a supportive and engaging environment for spoken Chinese learning.

This study contributes to the growing body of research on technology-enhanced language learning and highlights the potential of game-based approaches for supporting spoken Chinese development among international learners. The findings may also provide useful insights for Chinese language educators seeking to increase student participation and motivation through technology-supported learning activities.

■ Limitations and Recommendations

This study has several limitations. First, the sample size was relatively small and was drawn from a single language school in Chiang Mai, Thailand, which may limit the generalizability of the findings. Second, the intervention was conducted over a six-week period and therefore did not examine the long-term effects of game-based learning on spoken Chinese development. Third, although the same instructor taught both groups, other classroom factors may have influenced students' learning experiences and outcomes. Finally, individual differences in students' familiarity with digital technologies and learning preferences were not examined in the present study.

Based on these limitations, future research should investigate the long-term impact of game-based learning on spoken Chinese proficiency using larger and more diverse samples. Studies conducted in different educational settings and cultural contexts would help improve the generalizability of the findings. Future research may also explore the effectiveness of specific game design features and different forms of game-based technology in supporting language learning outcomes. In educational practice, game-based learning should be used as a complement to traditional instruction to provide learners with additional opportunities for engagement, interaction, and spoken language practice.

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